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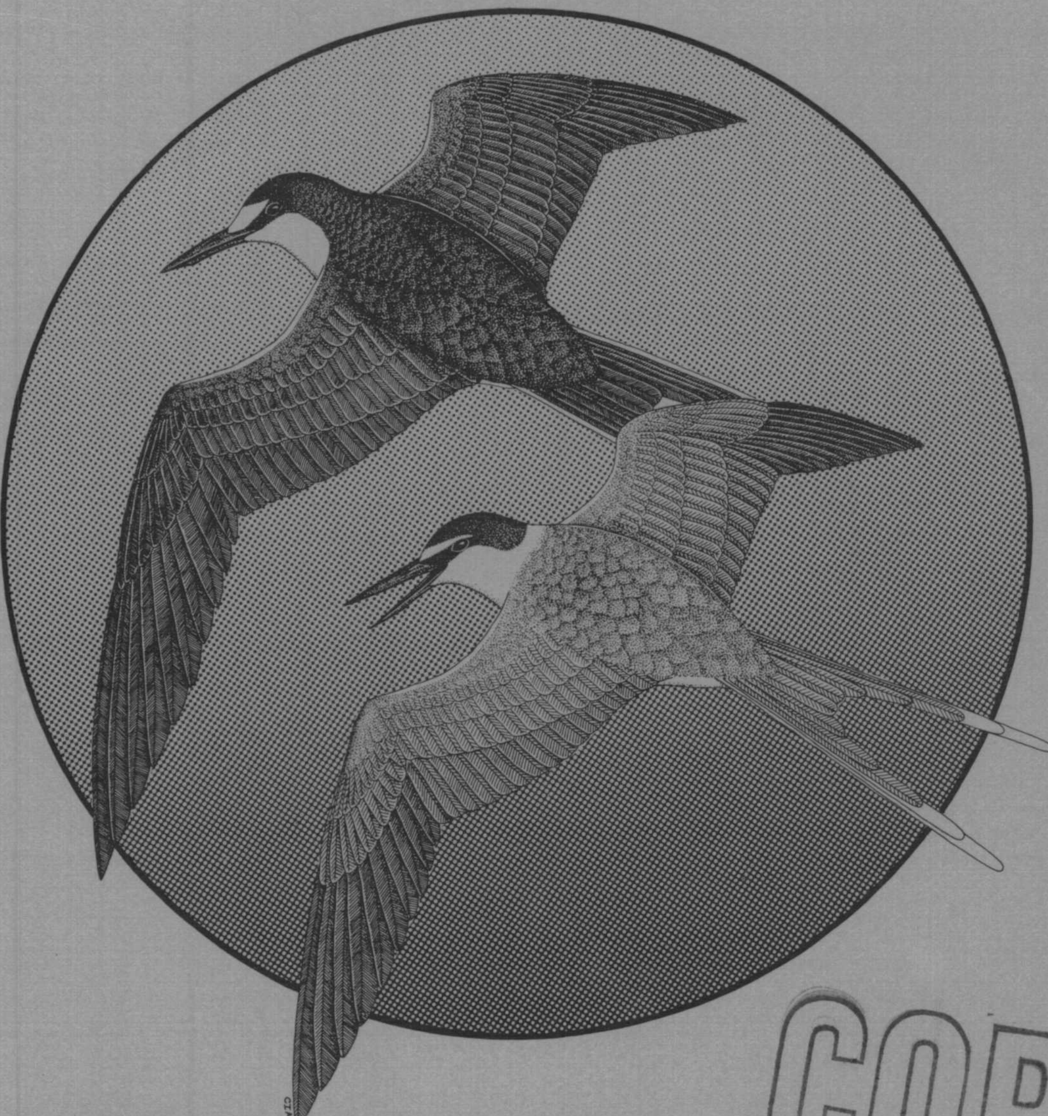
Part III
CHARADRIIFORMES



Minerals Management Service
Fish and Wildlife Service

U.S. Department of the Interior

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MARINE BIRDS OF THE SOUTHEASTERN UNITED STATES AND GULF OF MEXICO

PART III

CHARADRIIFORMES

by

Roger B. Clapp, Deborah Morgan-Jacobs, and Richard C. Banks

Museum Section
United States Fish and Wildlife Service
National Museum of Natural History
Washington, D.C. 20560

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Project Officers
Jeffrey A. Spendelow
Cherry Keller
National Coastal Ecosystems Team
United States Fish and Wildlife Service
NASA-Slidell Computer Complex
1010 Gause Boulevard
Slidell, Louisiana 70458

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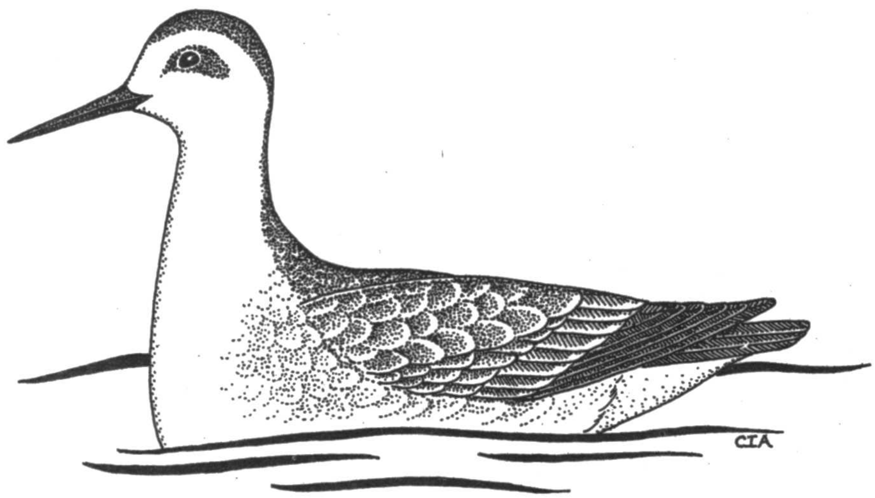

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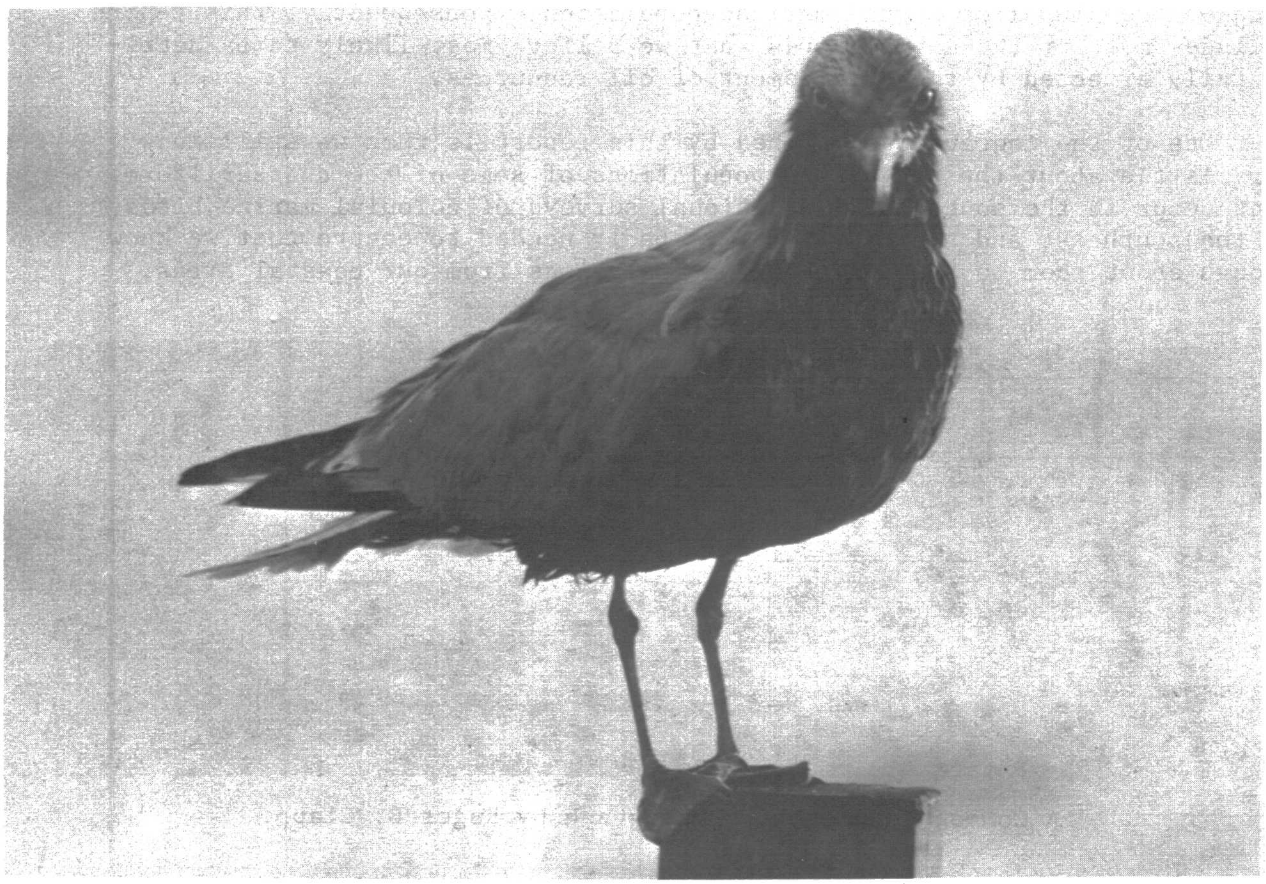
PREFACE

Part III of the volumes Marine Birds of the Southeastern United States and Gulf of Mexico, published by the National Coastal Ecosystems Team, provides a synthesis and analysis of information about the marine birds in this area. Accounts for 22 species include information on distribution, abundance, and susceptibility to oil pollution. Also included is information on the breeding biology of 16 species abundant in the southeast as breeding birds, winter residents, or migrants. Selected bibliographies follow each species account and include additional sources of information.

Any suggestions or questions regarding this report should be directed to:

Information Transfer Specialist
National Coastal Ecosystems Team
U.S. Fish and Wildlife Service
NASA-Slidell Computer Complex
1010 Gause Boulevard
Slidell, Louisiana 70458



A badly oiled gull (Larus sp.). Photograph by Roger B. Clapp.

ABSTRACT

Information on the seasonal distribution and abundance of 22 species of marine birds of the order Charadriiformes that occur in the coastal southeastern United States has been compiled and mapped from the literature. In many instances this provides the first synthesis of knowledge about a species for this region. We also provide information on global distribution, habitat and food for all species, and include information on various aspects of life history for the 16 species that we consider most important in coastal areas. This information was gathered in an attempt to assess the possible effects of offshore oil development on populations of marine birds in the southeast.

The susceptibility of birds to oil depends not only on their juxtaposition in time and space, but also on currents, climatic factors, the stage of the life or annual cycle, and the behavior of the species. Contamination by oil may result in matted feathers with death following from chilling, starvation, and ingestion of oil during preening. Few of the species covered in this report are at great hazard from the direct effects of oiling, but populations of most of these species are highly susceptible to environmental change. Large concentrations of wintering, breeding, and migrant gulls and terns occur in the southeast and in some instances make up a large proportion of the global or North American population. Consequently, this report includes most of the marine birds that we believe most likely to be detrimentally affected by the development of oil resources.

One of the conclusions reached by this report is that we still know very little about the status and populations of some of the charadriiforms that occur in the southeast. Additional surveys of colonial marine birds in the southeast and nearby waters are badly needed to ensure that we know enough about them to prevent their untimely loss from our coastal areas.

A Common Tern nest. Photograph by Roger B. Clapp.

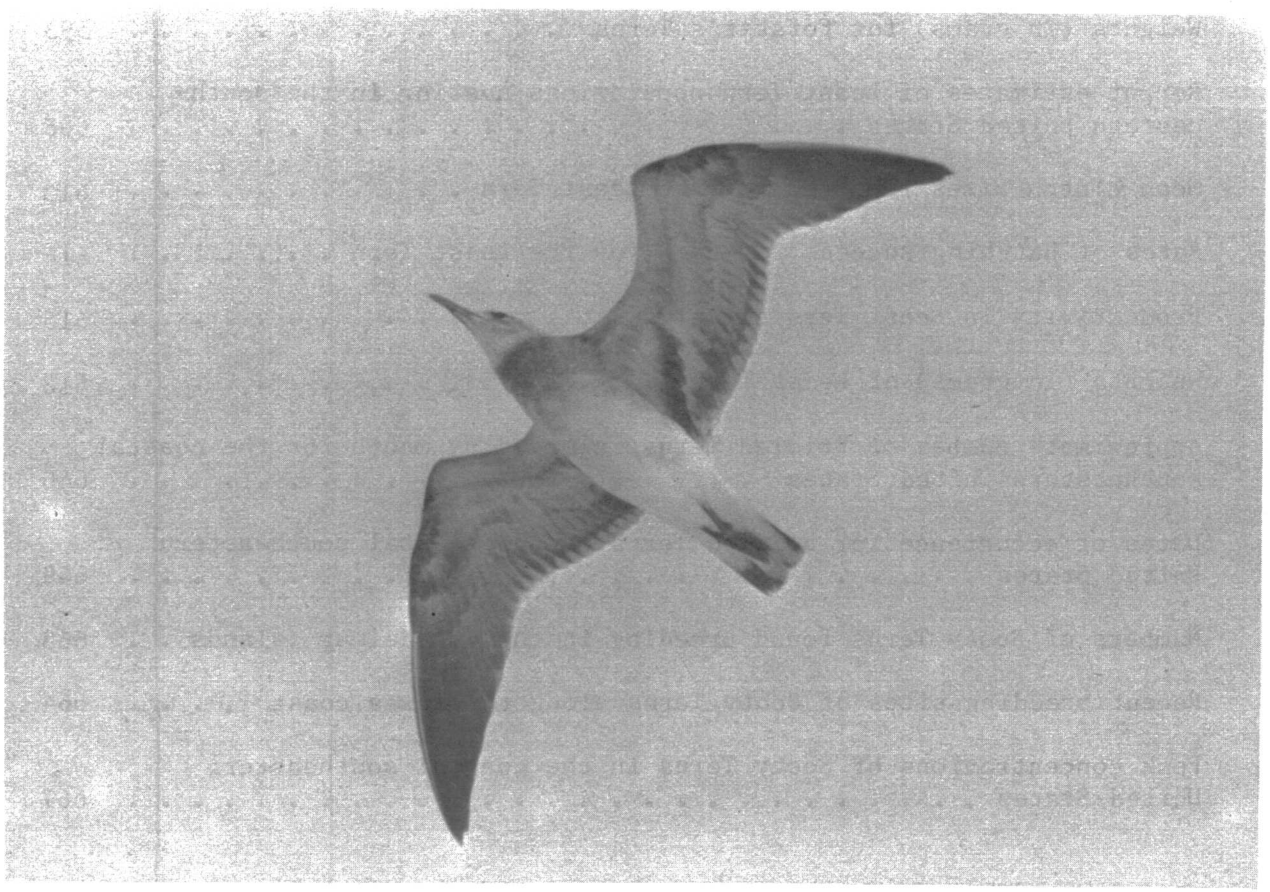
CONTENTS

MAPS

Adult Laughing Gull off Hatteras, North Carolina, in August 1981.
Photograph by Roger B. Clapp.

TABLES

Number		Page



An immature Laughing Gull. Photograph by Roger B. Clapp.

ABBREVIATIONS USED IN TEXT

Most of the abbreviations used in the text are in standard use and will be known to the reader; a few may be less familiar. These are listed below with a brief indication of their interpretation.

N, S, E, W, (capitalized without period)	compass directions
N., S., E., W. (captitalized with period)	geographic site designation (e.g., S. Padre Island

ac	acre
ad.	adult
AOU	American Ornithologists' Union
BOU	British Ornithologists' Union
BLM	Bureau of Land Management
ca.	(circa) about
CBC	Christmas Bird Count
cf.	(confer) compare/see
coll.	collected
comp.	compiler
Co.	County
CSLP	Center for Short-Lived Phenomena
EBBA	Eastern Bird Banding Association
ed./eds.	editor/editors
et. seq.	and the following
ha	hectare
IBBA	Inland Bird Banding Association
imm.	immature
in litt.	in the letters (of)
in prep.	in preparation
ms	manuscript
n	sample size
Natl. Park	National Park
Natl. Seashore	National Seashore
NERC	National Environmental Research Council
nonad.	nonadult
NWR	National Wildlife Refuge
OCS	Outer Continental Shelf
op. cit.	(opere citato) in the work cited
Par.	Parish
pers. comm.	personal communication
pers. observ.	personal observation
photogr.	photographed
prep.	preparer
SD	Standard Deviation
spec.	specimen
sp./spp.	species (singular/plural)
St. Park	State Park
subad.	subadult

subseq.	subsequent
unpubl.	unpublished
USFWS	United States Fish and Wildlife Service
USNFWL	United States National Fish and Wildlife Laboratory
WAGBI	Waterfowlers Association of Great Britain and Ireland
WMA	Wildlife Management Area

Units of measurement in the text are presented as they were in the source from which they were derived, and are followed in parentheses by conversion to the metric or English systems, as appropriate.

An adult Herring Gull. Photograph by J. A. Spendelow.

PURPOSE OF REPORT

The purpose of this report is to summarize the status of 22 coastal and marine charadriiform species in the southeastern United States and to explore the potential effects on these species of the development of petroleum resources on the Outer Continental Shelf (OCS). This entailed a review of available information in order to:

1) determine where and when coastal birds occur in marine areas that may be developed for oil and gas production;

2) ascertain which species would be most at risk from oil spills and the development of oil resources;

3) evaluate the importance of populations in the southeastern United States in relation to the global distribution and abundance of the species; and

4) summarize information on the life history of the species most likely to be adversely affected by the development of oil resources.

This material is presented in a form that enables the Bureau of Land Management (BLM) to identify aspects of OCS development that might threaten populations of marine birds. It provides information that will aid managers in making decisions that minimize damage to these populations during the development of energy resources. A corollary objective is to recommend topics for future research in areas where information is particularly scarce.

STUDY AREA

The study area encompasses the coastal and offshore waters of the southeastern United States, from the northern border of North Carolina to the Mexican border of Texas. Many coastal habitats occur within this area: sandy barrier islands; fresh, salt, and brackish marshes; open beaches; coastal bays; dredge-spoil islands; mudflats; and mangrove islands. The dominant habitats are discussed below.

HABITATS

North Carolina is dominated by a series of fringing barrier beaches behind which lie large estuaries with extensive areas of shallow water and salt marsh. These fringing islands (the Outer Banks) are farther (30-50 km or 20-30 mi) from the mainland than are such islands along other areas of the Atlantic coast (Warinner et al. 1976). Extensive stands of salt marsh with deep tidal channels are found south of Cape Lookout, North Carolina, through South Carolina and Georgia. Almost three-quarters of the salt-marsh acreage along the Atlantic seaboard is found in these three states. The largest areas of salt marsh on the Atlantic coast are in Georgia, which has 193,000 ha (477,000 ac), North

Carolina (64,000 ha or 158,000 ac), and South Carolina (176,000 ha or 435,000 ac) (West 1977).

Barrier islands are also very important coastal habitat in these three states. The land areas of the barrier islands for each state are 120,000 ac (49,000 ha) in North Carolina, 124,000 ac (50,000 ha) in South Carolina, and 153,000 ac (62,000 ha) in Georgia (Warner 1976), for a total of about 397,000 ac (161,000 ha). The area of water behind these islands becomes smaller to the south (Warinner et al. 1976). North Carolina, South Carolina and Georgia have about 266 mi (428 km), 199 mi (320 km), and 98 mi (158 km) of open beach, respectively, along their barrier islands. In other parts of the study area (e.g., parts of the Florida Gulf coast), beaches are few or nonexistent (Woolfenden and Schreiber 1973).

The east coast of Florida is dominated by a chain of barrier islands broken occasionally by tidal passes. Typically, these islands are sandy along their outer perimeters. Large areas of marsh and estuarine swamp lie landward of these islands (Warinner et al. 1976) and salt marshes gradually give way to mangrove swamp as one moves further landward (Reimold 1977). Much of the Gulf coast of Florida is dominated by salt marshes and mangrove swamps (Wariner et al. 1976). Extensive stretches of open beach are found from Naples on the Florida peninsula north along the panhandle to Alabama (Woolfenden and Schreiber 1973). In Alabama, tidal salt marshes, sandy beaches, and offshore islands are common coastal landforms. Mississippi's Gulf coast consists almost entirely of barrier islands that have salt marshes in their centers. The Mississippi shoreline is extensively developed but still contains fresh, salt, and brackish marshes (Warinner et al. 1976). Only a limited amount of salt marsh is found between northern Florida and Mississippi. Most marshes are small, disjunct, and in alluvial pockets protected by bay shores (West 1977).

Louisiana has more marsh and estuarine area than any of the other United States except Alaska (Warinner et al. 1976), and contains nearly half the total acreage of salt marsh in the contiguous United States. In some places the marshes extend inland as much as 40-50 km (25-30 mi) (West 1977). The coastline along the western third of the state is sandy, but the rest of the area is dominated by barrier islands and marsh that are strongly influenced by the enormous amounts of mud and silt deposited by the Mississippi River (Warinner et al. 1976). The Louisiana coast is one of the most productive areas for marine birds in the continental United States and supports enormous wintering populations of waterfowl.

The coast of Texas makes up a large portion of the western shore of the Gulf of Mexico. Sandy beaches and offshore barrier islands are abundant. Two semi-landlocked lagoons, the Upper and Lower Laguna Madre, and a large low-salinity estuary, Sabine Lake, are areas of great importance to wintering waterfowl. An estimated 78% of the world's population of Redhead (*Aythya americana*) ducks winters in the Laguna Madre, and 13% of the world's shrimp harvest comes from Texas waters (Warinner et al. 1976). A limited amount of salt marsh is present in Texas along bay shores enclosed by offshore bars (West 1977).

CLIMATES

The climatic regime, like the landform, differs widely from one part of the study area to another. The northeastern portion is the coldest. The lowest midwinter temperatures along the coast of North Carolina are on the order of 20°F (-7°C) and the average daily maximum during midsummer along the extreme southern coast is only 86°F (30°C), some 6°F less than is usually recorded in the interior. July is the wettest month and October the driest. Along the coast, snow and sleet usually fall only once or twice a year and are usually associated with northeasterly winds. Prevailing winds in North Carolina blow from the southwest most of the year and from the northeast in September and October (Hardy 1974). The weather along the coast of South Carolina is similar to that in North Carolina with some variation. Average annual temperatures along the South Carolina coast are about 68°F (20°C), with an average daily maximum in July of 88°F (31°C) and average daily minimums in January from 35° F (1.7°C) in the northeast to 42°F (6°C) in the southeast. March is particularly rainy along the coast, and October and November are the driest months. Prevailing winds in South Carolina are from the southwest and south in spring and summer, predominantly from the northeast in autumn, and from the northeast and southwest in winter (Landers 1974).

The climate in Georgia is characterized by short mild winters and warm humid summers. The coastal area becomes progressively drier and warmer from north to south. Peak periods of precipitation occur in winter and early spring; the average annual rainfall ranges from 75 in (190 cm) in the extreme northeastern part of the state to 53 in (135 cm) along the lower east coast. Average summer temperatures range from 73°F (23° C) in the extreme north to 82°F (28°C) in parts of south Georgia; average temperature for the three winter months ranges from 41°F (5°C) in the north to 56°F (13°C) on the lower east coast. Areas in northern Georgia have freezing temperatures during the day for almost a third of the year but the lower coast only has about ten days of freezing temperatures annually (Carter 1974).

Florida has a wider range of climate than any other state in the southeast. The climate ranges from temperate to subtropical in the north, to tropical in the Florida Keys. Summers are warm, humid, and long, and winters are mild and brief. Rainfall is abundant, especially from June to September. Mean annual temperatures range from the upper 60's (F) in northern Florida to the mid-70's in the south and reach nearly 78° F (26°C) at Key West. Rainfall varies widely from area to area and from year to year, with most areas usually receiving between 50 and 65 in (130-170 cm). The drier Keys have an average annual rainfall of only about 40 in (100 cm). On the southern part of the peninsula prevailing winds are from the southeast and east; elsewhere they are more erratic and tend to be from the north in winter and from the south in summer. Tropical storms frequently cause great damage; few years pass without a hurricane affecting part of the state (Bradley 1974).

The Gulf of Mexico has a maritime tropical climate with mean winter temperatures of about 70°F (21°C) and mean summer temperatures of 84°F (29°C). Relative to seasons in other parts of the study area, both summer and winter are hot and humid; humidity is greatest during spring and summer, and lowest during late fall and winter (BLM 1978a). Rain occurs fairly evenly throughout the year along the western and northern Gulf, with a peak from June through August (BLM 1978a). Further east in the Gulf the peak tends to be later and falls in August and September (BLM 1978b). The area becomes progressively wetter from the southwest to the north and central portions of the northern Gulf. The driest area of the Texas coast extends from Brownsville north to about Corpus Christi; the most humid area from Galveston to the Sabine River (Chaney et al. 1978). Average annual precipitation ranges from about 69 cm (27 in) at Brownsville to 137 cm (54 in) at New Orleans (BLM 1978a) and 170 cm (67 in) in Mobile (BLM 1978b).

Tropical storms and hurricanes regularly occur during late summer and fall and often ravage coastal habitats. Most of these storms enter the Gulf through the Yucatan Channel and Straits of Florida (BLM 1978a). Southeasterly winds predominate over the northern Gulf during the summer. Easterlies are more common during the winter, and prevailing winds from the west and southwest are rare at any time of year (BLM 1978a).

METHODS

Most of the information was obtained by a literature search. Additional information on oiling of individual species of birds and their distribution was obtained through examination of museum specimens and interviews, but these were not major sources. Several computerized information retrieval systems were investigated, but did not meet our needs. These sources were particularly weak on the local distribution of birds, much of which is to be found in regional journals not covered by computer services; the temporal coverage was also inadequate for this study. As Bartonek and Lensink (1978) pointed out, visual searches of periodicals "proved far more productive from the standpoint of both numbers of citations and thoroughness of the search."

We obtained literature citations primarily by scanning the literature and by consulting bibliographies in relevant papers. The primary sources for the journals, books, and papers were the libraries and reprint files of the Bird Divisions of the Smithsonian Institution, Washington, D.C. and the American Museum of Natural History, New York. Other major sources of information were the library of the Department of the Interior, the Library of Congress, and the Bird Library and reprint files of the Patuxent Wildlife Research Center, Laurel, Maryland. The Welder Wildlife Foundation, Sinton, Texas, and the library of government publications and reports maintained by the National Coastal Ecosystems Team, Slidell, Louisiana, were particularly rich sources of information otherwise difficult to obtain. Unpublished reports and papers were obtained from: The Florida Audubon Society, Vero Beach; the Florida Fish and Game Commission, Gainesville; Everglades National Park, Homestead; and individuals listed in the acknowledgments. Several dozen valuable but unpublished theses were obtained from educational institutions.

Searches were made of several secondary sources of literature citations. Literature review sections of major ornithological journals, particularly The Auk, The Ibis, and the Journal of Field Ornithology (Bird-Banding) were especially useful, as was Wildlife Review. We also made extensive use of Current Contents, Oil Pollution Abstracts, and Dissertation Abstracts. The Zoological Record, Biological Abstracts and Ecological Abstracts were also consulted but were less efficient sources of information. All state bird journals dealing with the southeastern United States (see list below) were scanned; these journals, along with American Birds (Audubon Field Notes in earlier volumes), provided much of the information on local distribution in each state.

We placed considerable emphasis on recentness of information in the literature search. A few journals (e.g., Wilson Bulletin, Bird-Banding) were examined for at least 30 years into the past, The Auk from 1930 to the present. Many others, depending on the degree to which they yielded useful information, were scanned for only a few recent years. We covered the foreign literature as thoroughly as possible. Most of the species treated in this report have a wide geographic distribution, and much of what is known of their breeding biology is to be found only in foreign periodicals. The linguistic limitations of the authors, as well as the temporal and fiscal limitations involved in the production of this report, precluded full use of this material.

Listed below are the serial publications covered extensively. Where appropriate, those areas of the world that these journals cover most thoroughly are listed in parentheses.

Acta Ornithologica (Poland, U.S.S.R.)
Alabama Birds
Alauda (France, French Africa)
American Birds [Audubon Field Notes] (United States, Canada)
Animal Behavior
Ardea (western Europe)
Atlantic Naturalist (Delaware to Virginia)
Atoll Research Bulletin
Auk (North America)
Australian Bird Watcher

Behaviour
Biologia (Bratislava) (Seria B) (Czechoslovakia)
Biotropica
Bird Study (Great Britain)
Blue Jay (central Canada)
British Birds
Bulletin of the British Ornithologists' Club (world)
Bulletin of the Kansas Ornithological Society
Bulletin of the Oklahoma Ornithological Society
Bulletin of the Texas Ornithological Society

California Fish and Game
Canadian Field-Naturalist
Canadian Journal of Zoology
Chat (North and South Carolina)
Colonial Waterbirds (eastern North America)
Condor (North America, neotropics)
Corella [Australian Bird-Bander]

Dansk Fugle (Denmark)
Dansk Ornithologisk Forenings Tidsskrift (Denmark)

Ecology
Ekologia Polska (Poland)
Elepaio (Hawaii)
Emu (Australia, New Guinea)
Estuaries [Chesapeake Science] (U.S. Atlantic Coast)

Florida Field Naturalist
Florida Naturalist
Florida Scientist

Gerfaut (western Europe, Africa)

Hornero (Argentina)

Ibis (Old World, Africa)
Irish Birds

Jack-Pine Warbler (Michigan)
Journal fur Ornithologie (Germany)
Journal of Animal Ecology
Journal of Applied Ecology
Journal of Ecology
Journal of Field Ornithology [Bird-Banding] (United States)
Journal of Wildlife Management (North America)

Kingbird (New York)

Larus (Yugoslavia, eastern Europe)
Limosa (Netherlands)
L' Oiseau et la Revue Francaise d'Ornithologie (France)
Loon [Flicker] (Minnesota)
Louisiana Ornithological Society News

Marine Pollution Bulletin
Maryland Birdlife
Mississippi Kite
Mississippi Ornithological Society Newsletter
Murrelet (Pacific northwest, Alaska, western Canada)

Nos Oiseaux (France, western Europe)
Notornis (New Zealand, Pacific islands)

Oikos (Denmark, Scandinavia)
Oriole (Georgia)
Ornis Fennica (Finland, Baltic area)
Ornis Scandinavica (Scandinavia)
Ornithologische Beobachter (Switzerland, middle Europe)
Ornithologische Mitteilungen (world)
Ostrich (South Africa)

Proceedings of the Annual Conference, Southeastern Association of Game and Fish Commissioners (southeastern U.S.)
Proceedings of the Louisiana Academy of Science

Revue Suisse de Zoologie (Switzerland, central Europe)
Ring (Europe)
Ringing & Migration (Great Britain)
Rivista Italiana de Ornitologia (Italy)

Scottish Birds
South Australian Ornithologist
Southwestern Naturalist (southwestern U.S.)
Soviet Journal of Ecology
Sterna (Norway)
Suomen Riista (Finland, Baltic area)

Texas Journal of Science
Tori (Japan)
Transactions of the North American Wildlife and Natural Resources Conference

Var Fagelvarld (Sweden)
Vestnik Zoologii (U.S.S.R.)
Vogelwarte (western and central Europe)

Western Birds (western U.S.)
Wildfowl
Wilson Bulletin (North America)

Zeitschrift fur Tierpsychologie
Zoologicheskii Zhurnal (U.S.S.R.)

The reprint files of several institutions supplied some less easily obtainable material. The most useful of these were files of the Museum Section of the Denver Wildlife Research Center (formerly the National Fish and Wildlife Laboratory), the Bird Division of the National Museum of Natural History, the American Museum of Natural History, and the Bird Library of the Gabrielson

Laboratory of the Patuxent Wildlife Research Center.

In all, about 10,000 citations dealing directly with the species treated are included in the three parts of this report. The more general articles found in the Literature Cited sections at the end of each volume will probably contain at least an additional 1,000 citatons.

Certain data (e.g., weights) reported in this study were obtained directly from data in the files and collections of museums, particularly those of the U. S. National Museum and Louisiana State University.

ARRANGEMENT AND CONTENTS OF SPECIES ACCOUNTS

Each volume of this series covers groups of birds for which the problems of preparing this report have been different, even though all species included share the characteristic of being at least occasionally found along the waters of the southeastern United States. Volume 1 (Clapp et al. 1982b) deals with pelagic seabirds whose status and occurrence in this area are only now being documented. These species, for the most part, do not breed commonly in southeastern waters, and have received little study.

Volume 2 (Clapp et al. 1982c) deals with ducks, geese, and swans, most of which are important in southeastern waters because large numbers winter or migrate through this area. Most of these species are covered extensively in the North American and foreign literature, and much is known about their breeding biology and distribution. Some of them, primarily species that are seldom hunted (e.g., mergansers, scoters), have been little studied and are among those species known to be most adversely affected by oil pollution in other areas. Information on distribution, status, and breeding biology of many species of waterfowl has been summarized in a number of recent handbooks (e.g., Bellrose 1976; Palmer 1976a, 1976b; Cramp et al. 1977).

The species accounts presented in volume 3 vary in length and detail with the quality and quantity of material examined and with the species abundance and vulnerability to oiling in southeastern waters. The accounts tend to be longer than those in the earlier volumes because most of the species included here have been studied more thoroughly and have a more extensive literature than the species included in Volume I, because few have received monographic treatment as have those in Volume II, and because most are regularly or seasonally abundant in the southeastern United States.

Much of the data on the status and biology in the southeast of the species included here is of recent origin. Much useful information was published while this report was being compiled (e.g., Duncan and Havard 1980, Rowlett 1980, Portnoy et al. 1981); still little is known about offshore distribution for many species. Although we have tried to make this report as timely and thorough as possible, further research probably will reveal the inadequacy of our present knowledge of the status of many species in southeastern waters.

SPECIES INCLUDED

This report covers 22 members of the order Charadriiformes: 2 phalaropes, 6 gulls, 13 terns, and the Black Skimmer. The birds dealt with here are species for which most of the North American (and sometimes world) population breeds, winters, or migrates through the southeastern United States. Several species (e.g., the phalaropes, Arctic and Bridled Terns) occur largely as offshore or pelagic migrants, others (e.g., Bonaparte's Gull, Common and Black Terns) occur largely as coastal migrants. Some species (e.g., Herring and Ring-billed Gulls) breed mostly or entirely north of the study area, but a large portion of their North American wintering population occurs in the southeastern United States. Large portions of the populations of several other species (e.g., Laughing Gull; Royal, Forster's and Least Terns) breed in the southeastern United States. Other species (Gull-billed, Caspian, Sandwich, and Sooty Terns; Brown Noddy; Black Skimmer) breed in the southeastern United States in such large numbers that their populations there make up a significant portion of the North American population.

Some of the species included (e.g., Laughing Gull; Caspian and Royal Terns; Black Skimmer) with important breeding populations in the southeast also use the area as a major wintering ground. The Roseate Tern, uncommon to rare in the southeast, was included because its populations are declining in many portions of its range and because it has been suggested as a candidate for listing as an endangered or threatened species.

We originally intended to include accounts for all species of several subfamilies (Stercorariinae, Larininae, Sterninae, Rynchopinae) of the family Laridae and for all species of murres, guillemots, and other alcids (Alcidae) that had been recorded at least once in coastal portions of the southeastern United States. We also intended to include an account for the American Coot (*Fulica americana*) [Rallidae], a species that is abundant in marshy coastal habitats in many of the southeastern United States. The loss of personnel, and the loss of use, increased cost of repair, and deterioration of word processing equipment and supplies made it necessary for us to delete many species from this volume and to complete this report at a scale less than originally envisoned.

The deleted species included the following: American Coot, Pomarine Jaeger (*Stercorarius pomarinus*), Parasitic Jaeger (*Stercorarius parasiticus*), Long-tailed Jaeger (*S. longicaudus*), Skua spp. (*Catharacta* spp.), Little Gull (*Larus minutus*), Common Black-headed Gull (*L. ridibundus*), Band-tailed Gull (*L. belcheri*), Mew Gull (*L. canus*), California Gull (*L. californicus*), Thayer's Gull (*L. thayeri*), Iceland Gull (*L. glaucoides*), Lesser Black-backed Gull (*L. fuscus*), Glaucous Gull (*L. hyperboreus*), Black-legged Kittiwake (*Rissa tridactyla*), Sabine's Gull (*Xema sabini*), Elegant Tern (*Sterna elegans*), White-winged Tern (*Chlidonias leucopterus*), Black Noddy (*Anous minutus*), Dovekie (*Alle alle*), Common Murre (*Uria aalge*), Thick-billed Murre (*U. lomvia*), Razorbill (*Alca torda*), and Black Guillemot (*Cepphus grylle*). The preliminary bibliographies for these species total about 170 pages and have been retained in the files of the Museum Section, Denver Wildlife Research Center.

SCIENTIFIC AND VERNACULAR NAMES

Each species account is headed by the common English and scientific name of the species, followed by vernacular names in other languages and alternative common English names used in the United States and in other English-speaking countries.

Scientific and vernacular names follow the 34th supplement (AOU 1982) to the AOU Checklist (AOU 1957), as does the sequence in which we list orders, families, and subfamilies. Widely used alternative scientific names are also noted. Explanation is made in footnotes where changes in scientific names have been adopted recently.

Scientific names of other organisms (e.g., plants, fish, crabs, molluscs) given in the text are either those used in the works cited or are from standard recent references or regional guides. Missing scientific names have been supplied only when we were certain what species was meant by the vernacular name used in the original text.

The primary source for most of the non-English vernacular names is the Nomina Avium Europaearum (Jorgensen 1958); other sources consulted include Dement'ev and Gladkov (1951), Austin and Kuroda (1953), Edwards (1972), and Cramp et al. (1977). The abbreviations for the languages and other geographical uses are as follows:

DA:	Danish	IC:	Icelandic	PR:	Portuguese
DU:	Dutch	IT:	Italian	RU:	Russian
EN:	English (Old World)	JA:	Japanese	SP:	Spanish
FI:	Finnish	NW:	Norwegian	SW:	Swedish
FR:	French	NZ:	New Zealand	US:	United States
GE:	German	PO:	Polish		

With few exceptions, the foreign common names given are those in widest use in the ornithological literature of the countries indicated. In several instances we include transliterated names from languages in which Roman characters are not used (Japanese, Russian). For Japanese names we relied upon Austin and Kuroda (1953) and for Russian names we used the names used in the translation of Dement'ev and Gladkov (1951). In some instances more than one foreign vernacular name for a species has been used. This is particularly true for Spanish, in which vernacular names may vary considerably from area to area.

The primary reason for supplying these alternative names is to assist future computer-based literature searches. Some of the English translations of foreign names (which are those entered on computers) imply a different species than the name would normally suggest to a reader of English or cannot be readily associated with an English name (e.g., the translation of the Russian common name for Larus ridibundus is Laughing Gull, a name that in English indicates the North American Larus atricilla). In addition, many of the more regionally-oriented foreign language journals, like those in the United States, fail to list the scientific names. As a result, searches of computer literature systems by scientific name alone may fail to indicate important notes or papers documenting recent changes in distribution.

Alternative scientific names widely or recently in use are supplied as another aid to literature searches. The Caspian Tern appears in recent literature as Sterna caspia, Sterna caspius, Sterna tschegrava, Hydroprogne tschegrava, and Hydroprogne caspia. One computer search we made revealed no less than four different lists of titles when each scientific name was used as a keyword.

GENERAL DISTRIBUTION

This section is divided into two parts, one giving occurrence in North America, the other giving occurrence elsewhere in the world. Most of this information has been taken from standard distributional works, but it has been supplemented, where possible, with more recent literature. Breeding and wintering ranges are emphasized in this section, with less information given about areas of occurrence during migration. Material relating to North America is more detailed and more complete than for other areas of the world.

DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

In this section we present more detailed remarks on distribution and abundance in the southeast. As much recent information through 1979 as possible has been incorporated. Some accounts provide even more recent information but the accounts were completed over a number of years and, as a result, the depth of coverage is not consistent. This section is based upon the most recent state ornithological handbooks and checklists; it also includes much information on seasonal observations published in American Birds and state journals, breeding data from the Colonial Bird Register at Cornell University, and data from unpublished manuscripts. This section also incorporates information on seasonal occurrence, breeding status and numbers, and habitats. Coastal areas are emphasized, but in some cases status elsewhere is also mentioned. Available data for many species are often unsatisfactory, incomplete, or extremely scanty. This is particularly true for transients and wintering populations.

Information is given sequentially by state from North Carolina to Texas. We have not listed states in which a species has not been recorded. Information from Florida is usually presented in two subsections, one dealing with the Atlantic coast, the other with the Gulf. This was done because the status of a species may vary considerably from coast to coast. In some instances a section dealing with the Keys is also included when a species' status there is different from that on either coast.

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

This section in the species accounts summarizes information given in the previous sections, often with additional data on world-wide population levels depending upon our present knowledge of the species. For some species tabular information is presented about seasonal occurrence, abundance, and areas of concentration in the southeast. Information on these topics is generally limited and shows where further data should be obtained.

Two types of maps indicate where concentrations of marine birds have been reported; one deals with breeding birds, the other with wintering populations. Breeding colony maps are based on highly diverse sources of information, including the Colonial Bird Register and a considerable number of published and unpublished censuses (e.g., Portnoy 1977, Parnell and Soots 1979 ms). Other data were found in recently published papers or were obtained from local ornithologists. These maps give an estimate of the number of breeding birds and indicate the year or period for which this estimate applies. The largest estimate available in the last few years is used instead of a range or mean because estimates are few and because we wish to emphasize areas known to contain large colonies or concentrations of colonies. Not all data were plotted because some species occur in so many colonies that it was not feasible to plot them on our maps. The maps may contain some inaccuracies. They are not intended as an atlas; their primary purpose is to provide an overview of where concentrations of breeding marine birds occur in the southeastern United States.

Most of the winter distribution maps are derived from Bystrak (1974), who based his maps on an analysis of National Audubon Society Christmas Bird Counts for one or more of the years from 1970-1972. We chose 45 of 58 coastal Christmas Bird Counts in the study area and compiled 5-year means for 1973-1977. In some instances fewer than 5 years of counts were available and the mean is for a shorter period. Localities were chosen to show geographic variation in numbers and to emphasize where the largest concentrations were found. The figures should not be construed to indicate the true size of local populations. The Christmas Bird Counts vary considerably in the amount of estuarine, coastal, and marine habitat covered, but we tried to allow for this by choosing counts that contained the most marine habitat. The numbers reported in any given year may not be precise because of the limitations of Christmas Bird Counts. These maps are intended to serve primarily as an index of where winter concentrations are most likely to be found and how this distribution varies throughout the southeast.

HABITAT

This section deals with the nesting, feeding and nonbreeding habitats and the offshore habitats used by the species. The extent and detail of information reported is usually greatest for nesting habitat, less for feeding habitat, and least for nonbreeding habitats such as those used by migrating or wintering birds. We often could give only sparse information for poorly studied species such as the Bonaparte's Gull, and found little adequate information about offshore occurrences for many common species. Habitats used in the southeastern United States have been emphasized when data were available; otherwise relevant information from other areas is used.

FOOD AND FEEDING BEHAVIOR

We give at least a brief general statement about foods eaten and the feeding methods. In some instances we include more detailed information on food habits, briefly abstracting recent studies and indicating proportions of different foods eaten. For most species few data on food habits in the southeastern United States are given, primarily because little is known about the birds' diet in this area. Consequently, data from other areas have been given on the assumption that similar foods are eaten in the southeast. Food habits have been summarized by geographic area for a few species for which much recent information is available. For species whose food habits are well documented, we pointed out differences in food habits of adults and young, and commented on seasonal variation and differences in foods eaten in different habitats.

IMPORTANT BIOLOGICAL PARAMETERS

This section presents basic information to allow biologists to predict the effects of development of oil resources on populations. The six species for which we do not give important biological parameters either occur largely as offshore migrants (Red and Red-necked Phalaropes, Arctic and Roseate Terns) or are much more abundant outside the southeastern United States (Great Black-backed Gull and Brown Noddy). Much of the information compiled in this section is derived from research conducted elsewhere because few adequate studies of the breeding biology of coastal seabirds have been made in the southeast. For one species, the Herring Gull, for which there are many data from both the Old and New Worlds, we have included only information from North American studies.

The data in this section consist of brief summaries of the egg-laying period, mean clutch size, incubation period, hatching success, age at fledging, fledging success, mortality of eggs and young, renesting, age at first breeding, maximum natural longevity, and weight. Data on egg laying, incubation period, and age at fledging allow one to estimate periods when birds breeding within the study area are most vulnerable to disturbance. Clutch size and hatching and fledging success are good indicators of productivity. Information on mortality and renesting indicate the potential for recovery following a large nesting failure. Figures for known maximum natural longevity allow a crude comparison between species of their total reproductive potential. The maximum natural longevity is given in terms of "estimated minimum age" in years and months following Kennard (1975) and Clapp et al. (1982a), and may list information based on banding records from the United States, Canada and the Old World. Finally, information on weights is included because this, and population data given elsewhere in the report, will allow planners to compare species in terms of biomass affected by any given oil-related activity.

SUSCEPTIBILITY TO OIL POLLUTION

We emphasize oiling records from southeastern waters but may have missed reports of oiling for some species. Much of the Old World literature reports oiled birds only by species groups (e.g., gulls, ducks) and combines information on individual species in these totals. Some information may be found in Old World regional periodicals unavailable in the United States and not covered by computer-based literature retrieval systems. For each species we also provide an estimate of the potential effect of oil pollution and the development of oil resources in the southeast, taking into account the known or suspected vulnerability of the species, its abundance in the southeast, and its abundance elsewhere.

SPECIES BIBLIOGRAPHY

At the end of each species account is a species bibliography which includes citations that provide additional data on the topics briefly covered in the text, as well as on various other aspects of the biology of the species. All citations in the text appear in the Literature Cited at the end of this report.

The bibliographies in this volume are not exhaustive, but cover the world literature because little is known of the biology of marine birds in the coastal southeastern United States and because more extensive bibliographies should be helpful in planning future research on these birds. As in the preceding volumes in this series (Clapp et al. 1982b, 1982c), the bibliographies stress distribution, ecology, and behavior of the species but provide more information on topics such as identification, hybrids, diseases, and the effects of pesticides.

Our search of the literature stressed recentness of information. Each species bibliography should be relatively complete through 1981 and mid 1982. Some references published more recently may be included, but these and other references from 1981 and 1982 may not have been used in writing the account. We also listed other important papers dealing with the biology of the species through the early part of the century, and included older references that are still the major sources of information on the species. We were more complete with papers written in English.

The species bibliographies are arranged from present to past with authors listed alphabetically under each year, rather than in the more conventional alphabetical and chronological listing used in the Literature Cited. We arranged them this way to make it easier for the reader to find the most recent information. We checked all references used in the text of the accounts as well as most of the remaining references. Some citations from secondary sources remain unchecked. We estimate that the three volumes in this series contain on the order of 10,000 references, and our temporal and fiscal limitations were too great to allow complete verification of all references.

OIL POLLUTION AND MARINE BIRDS OF THE SOUTHEASTERN UNITED STATES

With the possible exception of marine turtles, marine birds are the vertebrates most severely threatened by oil pollution and the development of oil resources. The work of Old World biologists presents clear evidence of substantial damage to several populations of marine birds. Specific information on the effects of oiling and oil spills on avian populations in the New World is very limited, especially so for populations in the southeastern United States. Systematic surveys of beached birds and seabird kills have begun only recently in the United States. Further, data on oiling of marine birds are scattered through a diverse body of literature. Many distributional notes reporting the first specimen of a species from a geographic locality parenthetically note that the specimen was oiled. Other information is scattered through regional distributional works and yet more data lie in the banding and recovery files of the Bird Banding Laboratory of the U.S. Fish and Wildlife Service.

Oil pollution kills many thousands of marine birds each year in Denmark (Riisgard 1979) and elsewhere. During the winter of 1980-1981, five oiling incidents in northwest Europe (Mead 1981) led to an estimated 60,000 oiled birds on the beaches (Mead and Baillie 1981). Most of these birds were various species of auks, but many Black Scoters (*Melanitta nigra*) were killed in Western Denmark and many live, oiled Black-legged Kittiwakes (*Rissa tridactyla*) were seen in Holland and Belgium (Mead and Baillie 1981). These spills probably killed more marine birds in western Europe than had any incidents during the previous 12 years (Anon. 1982a). Another recent spill that washed ashore on the Magdalen Islands in the Gulf of St. Lawrence off eastern Canada killed more than 1,500 seabirds, most of them evidently Dovekies (*Alle alle*) and murres (*Uria* spp.) (Anon. 1982b).

Oiling has been a major factor in reducing populations of Common Eiders (*Somateria mollissima*) in the Danish Waddensea (Joensen 1973), Common Eiders and Black Scoters in Holland (Swennen and Spaans 1970), and Atlantic Puffins (*Fratercula arctica*) in France (Bourne 1976). Other examples of significant reductions in avian populations due to oil pollution are given in reviews by Bourne (1968a, 1976), Croxall (1975), Vermeer and Vermeer (1975), and the Food and Agricultural Organization of the United Nations (1977).

Smaller but significant losses have also been recorded in localized populations. An estimated 25-50% of the Common Loons (*Gavia immer*) wintering in Shetland, off Scotland, died following the ESSO BERNICLA oil spill (Stowe and Morgan 1979). All local Mallards (*Anas platyrhynchos*), European Coots (*Fulica atra*), and Moorhens (= Common Gallinule, *Gallinula chloropus*) died following an oiling of the Amer River in the Netherlands; it was estimated that approximately 88% of the Greylag Geese (*Anser anser*) and 71% of the Bewick's Swans (*Cygnus columbianus bewickii*) also were lost (Belterman 1972). During the winter of 1981-82 an oil spill in Belgium killed about 300 birds and affected as many as 3,000, mostly gulls and the entire local population of Little Grebes (*Tachybaptus ruficollis*) (Anon. 1982c).

Despite continuing reports of high seabird mortality from oil pollution, particularly in the colder waters of the North Atlantic, current opinion is that the long-term effects of oil spills on the environment may be scant. The Royal Commission on Environmental Pollution (1981 in Bourne 1982) stated that "We have concluded that oil spills are unlikely to cause long-lasting damage; the environment has a remarkable capacity for recovering from even the largest oil spillages. We have found no clear evidence that oil spills have significantly affected populations of sea birds or other marine species . . . The short term consequences of oil pollution are serious . . . and are typified by the pollution of beaches on the one hand, and damage to seabirds on the other . . ." Clark (1982) pointed out that although tens of thousands of marine birds die annually from oil pollution in western Europe, natural mortality accounts for hundreds of thousands per year. Nonetheless, Nettleship (1977) believed that oil pollution of the sea still constitutes the single largest threat to seabirds.

VARIABILITY AMONG SPECIES IN SUSCEPTIBILITY TO OIL POLLUTION

Surveys of beached birds are biased indicators of the proportion of a population affected by oiling (Bourne 1976, Powers and Rummage 1978). Recent studies by Manomet Bird Observatory (Powers and Rumage 1978, Powers et al. 1980) documented differences between the species composition of birds found oiled on beaches and birds found oiled at sea. In December 1976 and in January 1977, 181 oiled birds were found on the beaches of Nantucket Island and Martha's Vineyard, Massachusetts, following the spill of the ARGO MERCHANT. Most of these birds were alcids (48.1%), gulls (27.1%) and loons (18.2%), but 7 sea ducks, 2 Northern Gannets (_Sula bassanus_), 2 cormorants, and 1 grebe were also found. Most (92% of 1120) of the birds seen offshore were gulls; of these, 59%, 41% and 9%, respectively, of the Herring Gulls, Great Black-backed Gulls, and Black-legged Kittiwakes (_Rissa tridactyla_) were oiled. Both Northern Gannets and Northern Fulmars (_Fulmarus glacialis_) were seen offshore more frequently than observed on the beaches, making up 6% and 1%, respectively, of the birds seen offshore. Twelve percent of the gannets seen and at least some of the fulmars were oiled. Alcids made up only 12% of the birds seen, but only 12 oiled Dovekies (_Alle alle_) were observed. Powers and Rumage (1978) pointed out, however, that oil on the larger alcids could have been overlooked easily.

Although beached bird surveys (Table 1) give some idea of differences in susceptibility to oiling between groups of birds, the recent work by Powers et al. (1980) suggests how different the situation may be offshore. Offshore surveys may be more reliable for indicating the magnitude of the oil pollution problem in a given area and for providing useful data on the incidence and extent of oil pollution. Species such as loons, grebes, auks, and sea ducks are frequently killed by oil. Others, such as gulls, are frequently oiled but die much less often from the direct effects of oiling (Table 2). Terns (Table 1, Bourne in litt.) are seldom found on beached bird surveys, and if they do die are perhaps less likely to be found. They evidently seldom die from the direct effects of oiling (Table 2). Black Skimmers are probably intermediate between

Table 1. Number and percentage of beached birds examined that were oiled (a).

Kinds of birds	Great Britain		South Atlantic Coast United States		Oregon-Washington Coast (b)		California Coast	
	Total found	% oiled	Total found	% oiled	Total found	% oiled	Total found	% oiled
Loons (Divers)	152	94	114	4	3	33	175	10
Grebes	54	59	14	64	14	36	798	5
Albatross	--	--	0	--	0	--	8	0
Petrels (c)	337	17	0	--	2	50	0?	-
Northern Fulmar	--	--	0	--	570	28	301	4
Shearwaters	--	--	14	0	0	--	623	22
Storm-petrels	--	--	0	--	4	25	40	0
Gannets	182	50	6	17	--	--	--	--
Cormorants	218	45	6	0	0	--	13	0.5
Brown Pelican	--	--	17	0	--	--	38	0
Wildfowl	1137	76	51	4	26	92	296	7
Phalaropes	--	--	0	--	--	--	119	3
Jaegers	--	--	1	0	0	--	8	0
Kittiwakes	--	--	0	--	105	21	33	24
Gulls	2448	30	131	0	16	31	1197	2
Terns	--	--	37	0	0	--	--	--
Skimmer	--	--	1	0	--	--	--	--
Auks	6171	80	0	--	104	94	2848	19

(a) Data for Great Britain, the south Atlantic coast of the United States, the Oregon-Washington coast, and the California coast are from Bourne (1976), Malcolm Simons (in litt.), Harrington-Tweit (1979), and Ainley (1976), respectively; the periods covered are 1968-1970, December 1977-August 1978, mid-winter 1976, and 1971-1975, respectively. Data for the southeastern coast through 1 December 1977 are based on surveys from Cape Hatteras, North Carolina, to Cape Canaveral, Florida, thereafter south to Jensen Beach, Florida.

(b) Most mortality of fulmars and Black-legged Kittiwakes following this incident was not believed to be due to oil; most wildfowl and alcid mortality was attributed to oiling (Harrington-Tweit 1979).

(c) Although Bourne (1976) did not specify, his term 'petrels' probably included all Procellariidae (e.g., petrels, shearwaters, fulmars) and may have included Hydrobatidae (storm-petrels). His term 'gulls' probably included all Laridae (gulls and terns). For other material summarized here, 'petrels' refers to *Pterodroma*, 'shearwaters' to *Puffinus*, 'gulls' to *Larus*, and 'terns' to Sterninae.

Table 2. Susceptibility of various larids to oiling as indicated by banding recoveries (a).

Species	Number recov- ered	Number dead from oiling	Percent dead from oiling	Areas from which dead oiled larids were reported (b)
Laughing Gull (*Larus atricilla*)	2,269	4	0.18	New Jersey, Louisiana, Texas, Panama
Ring-billed Gull (*Larus delawarensis*)	23,531	19	0.08	Ontario (4), New York (3), Florida, North Carolina, Michigan (2)
California Gull (*Larus californicus*)	2,658	6	0.23	California (4), Washington (2)
Herring Gull (*Larus argentatus*)	34,713	58	0.17	New York (10), Massachusetts (8), Ontario (5), Newfoundland, Texas (4)
Western Gull (*Larus occidentalis*)	2,916	8	0.27	California (6), Washington, Oregon
Glaucous-winged Gull (*Larus glaucescens*)	18,979	23	0.12	British Columbia (9), Washington (7), Oregon (4)
Great Black-backed Gull (*Larus marinus*)	1,426	3	0.21	New York (2), Quebec
Caspian Tern (*Sterna caspia*)	2,390	3	0.13	California (2), Michigan
Royal Tern (*Sterna maxima*)	4,230	5	0.12	Virginia, North Carolina, South Carolina, Florida
Common Tern (*Sterna hirundo*)	56,067	14	0.03	Caribbean (5), Brazil (2), Venezuela (2), New Jersey (2)
Sooty Tern (*Sterna fuscata*)	30,461	1	0.003	Florida
Brown Noddy (*Anous stolidus*)	942	1	0.11	Caribbean
Black Skimmer (*Rynchops niger*)	927	2	0.22	Florida

a) This table is derived from a printout produced by the Bird Banding Laboratory that listed all birds whose recovery through 11 April 1978 was believed due to oiling, and from Clapp et al. (1982a) which gives the number of recoveries for each species processed by the BBL through December 1981. The percentages may underestimate the numbers recovered due to oiling, but suggest the degree to which oiling causes direct mortality. No Franklin's Gulls (250 recoveries), Roseate Terns (1,286), Arctic Terns (291), or White Terns (*Gygis alba*) (376) were reported dead from oiling.

b) For species recovered in large numbers we only list areas from which the most oiled birds were reported.

these two groups in their susceptibility to oiling.

REGIONAL AND SEASONAL DIFFERENCES IN OILING AND MORTALITY OF BEACHED BIRDS

Although beached bird surveys in the eastern United States have been conducted for only a short time, the extent of oiling among birds found dead along the southern Atlantic coast appears low compared with other areas in the United States and Europe. Only 4% of 400 birds found dead along the southeastern Atlantic coast from January 1976 through August 1978 were oiled. In contrast, oiling occurred on 82% of 667 birds found along the Polish Baltic coast from November 1974 to August 1975 (Gorski et al. 1977), on 26% of 162 found along Irish coasts from December 1977 to March 1978 (O'Keeffe 1978), on 79% of 3,431 found on the international beached bird surveys in Northwest Europe in January-March 1975 (Lloyd 1976), and on 18% of 2,420 found along the California coast in 1975 (Ainley 1976).

Bird mortality per mile of beach also tends to be less in the southeastern United States than in other areas (Table 3). Mortality figures for a heavily polluted area, the Polish Baltic coast (3.2 birds/km or 5.1 birds/mi; Gorski et al. 1977), are considerably higher than for anywhere in the southeast. Other areas in northwestern Europe vary considerably in mortality recorded during beached bird surveys; these mortalities are usually greater than those found in the southeastern United States, but resemble those found along the North Atlantic coast of the United States. Lloyd (1976) reported a range in the number of dead birds found of 0.17 birds/km (0.3 birds/mi) in part of France to 4.06 birds/km (6.5 birds/mi) in West Germany during the winter of 1975. For Great Britain, 1968-70, the average was 1.3 birds/km (2.1 birds/mi) (Bourne 1976), similar to mortality in the southeastern United States. Mortality during 1976-1980 along the southeastern Atlantic coast and Florida Gulf averaged 1.3 birds/mi (0.79 birds/km) and 1.2 birds/mi (0.77 birds/km), respectively (Simons 1981 ms). Mortality along the California coast is also greater than in the southeast; surveys there reported an average of 3.5 birds/mi (2.2 birds/km) from 1971 to 1975 (Ainley 1976). The disparity between beached bird mortality rates in California and Europe and the southeast may arise partly from differences in prevailing winds and currents. In parts of North America where prevailing winds blow offshore, most mortality is found around enclosed inlets. On islands offshore in western North America and in northwest Europe, where prevailing winds carry dying birds (and oil) to shore, both chronic oil pollution and the recorded mortality of marine birds is greater (Bourne 1976).

The colder winter climates in these areas are also almost certainly a factor in the increased mortality. Both oil pollution and bird mortality are greatest in northwest Europe during the coldest part of the year (Bourne 1968a). Oiling (and presumably mortality) of marine birds off the north Atlantic coast of the United States is greatest during winter and spring (Powers et al. 1980); mortality is also greater during winter and spring along the south Atlantic and Gulf coasts (Tables 3, 4).

Table 3. Comparison of regional and seasonal variation of beached bird mortality and incidence of oiling in the eastern United States (a).

Period		Atlantic Coast N of Cape Hatteras		Atlantic Coast S of Cape Hatteras		Florida Gulf Coast		Texas Gulf Coast	
		Dead birds/ mile	% oiled	Dead birds/ mile	% oiled	Dead birds/ mile	% oiled	Dead birds/ mile	% oiled
SPRING									
Mar.-May	1982	2.19	6	1.32	0.0	2.14	----	3.33	0.0
Mar.-May	1981	1.48	34.3	.57	7.7	1.00	0.0	2.95	11.1
Mar.-May	1980	1.52	0.0	0.55	----	2.75	----	----	----
Mar.-May	1979	----	51.4	0.92	20.0	.82	0.0	----	----
Mar.-May	1978	----	66.8 (b)	1.58	0.0	1.77	----	2.00	0.0
Mar.-May	1977	2.50	5.5	0.95	0.0	.75	0.0	----	----
SUMMER									
June-Aug.	1981	2.10	0.0	.15	0.0	0.27	0.0	----	----
June-Aug.	1980	4.27	0.0	.39	0.0	.39	0.0	2.80	0.0
June-Aug.	1979	4.40	1.2	0.38	5.6	0.53	0.0	3.00	100.0 (c)
June-Aug.	1978	6.37	0.0	1.43	0.0	1.30	0.0	----	----
June-Aug.	1977	6.81	0.9	0.14	0.0	0.50	----	----	----
FALL									
Sep.-Nov.	1981	2.17	4	1.07	2	1.47	0.0	0.40	0.0
Sep.-Nov.	1980	1.48	----	1.04	----	1.00	----	----	---
Sep.-Nov.	1979	0.98	13.4	1.43	0.0	0.59	0.0	0.36	0.0
Sep.-Nov.	1978	1.05	0.0	1.49	0.0	1.00	5.6	4.00	0.0
Sep.-Nov.	1977	0.24	0.0	0.60	0.0	1.25	0.0	0.75	0.0
WINTER									
Dec.-Feb.	81-82	2.51	3.9	1.54	0.9	----	0.0	----	----
Dec.-Feb.	80-81	1.76	12.5	.29	0.0	1.39	0.0	----	----
Dec.-Feb.	79-80	----	----	.57	----	1.56	----	----	----
Dec.-Feb.	78-79	2.19	2.3	1.84	1.1	1.74	0.0	1.00	0.0
Dec.-Feb.	77-78	2.70	6.5	2.87	1.4	3.40	----	1.00	0.0
Dec.-Feb.	76-77	9.33	5.5	1.75	0.0	2.88	0.0	----	----

Table 3. Concluded.

(a) This comparison is based on Bulletins of the Atlantic and Gulf Coast Beached Bird Survey Project and Simons (1981 ms, in litt.). These data, while useful, are incomplete and have sometimes (particularly in Texas) been based on surveys of so few miles of beach that the results obtained are probably not comparable from region to region. Dashes indicate lacking data. Several figures from the first two volumes of this series have been corrected and some additional information is given.
(b) This high figure is the result of an oil spill in the Chesapeake Bay in February 1978.
(c) This high figure is presumably the result of the IXTOC oil spill in the southern Gulf of Mexico.

Table 4. Comparison of five-year averages of beached bird mortality for different areas in the eastern United States (a).

		Dead birds found per mile on the:			
Season	Five-year period ending	Atlantic Coast N of Cape Hatteras	Atlantic Coast S of Cape Hatteras	Florida Gulf Coast	Average for entire area
Spring (Mar.-May)	1982	2.79	1.38	1.12	2.08
Summer (June-Aug.)	1980	6.31	0.61	0.83	----
Fall (Sep.-Nov.)	1980	0.80	1.22	0.93	1.00
Winter (Dec.-Feb.)	1981	3.70	2.57	2.25	3.04

(a) These figures are compiled from Bulletins produced by the Atlantic and Gulf Coast Beached Bird Survey Project. Too few data are available for the Texas Gulf coast for these to be meaningful. The high average mortality in summer in the northeastern United States is partly the result of disturbance of nesting colonies.

Data on occurrence and seasonal variation of oiled birds at sea are largely unavailable, but a preliminary report by Powers et al. (1980) of at-sea observations from February 1976 to December 1979 in the Georges Bank area off Massachusetts provides some useful information. The majority of oiled birds seen were gulls. In some months (January and February) gulls made up nearly all oiled birds seen, but very few oiled gulls were seen during the summer (June-August). Oiled Northern Fulmars were regularly seen in spring and summer. Oiled Greater Shearwaters (Puffinus gravis) were seen in June and October. Oiled sea ducks (Common Eider [Somateria mollissima], Red-breasted Mergansers [Mergus serrator], White-winged Scoters [Melanitta fusca] and Oldsquaws [Clangula hyemalis]) were seen in December and March. Northern Gannets and Pomarine Jaegers (Stercorarius pomarinus) were rarely oiled.

BIRD KILLS FOLLOWING OIL SPILLS IN THE SOUTHEASTERN UNITED STATES

The few reports of large bird kills following oil spills in southeastern waters are usually inadequate. A typical example occurred in late December 1968, when a barge spilled crude oil along the coast of Wakulla County, Florida. This resulted in "many ducks snipe and other birds so covered with oil that they were unable to fly. Smaller birds were unable to walk in the heavy oil" (Center for Short-Lived Phenomena 1969). Reports of more recent spills are no better. During the spring of 1981, 39 oiled Common Loons (Gavia immer) were picked up on the beaches of Pea Island NWR, North Carolina. Despite treatment, only 2 survived (Simons 1981). How many more died at sea or what other species were affected is unknown. A "large toll" of wintering Common Loons and Red-throated Loons (Gavia stellata) was taken by an oil spill near Myrtle Beach, South Carolina (Anon. 1981). In yet another incident, more than 175,000 gallons of heavy fuel oil spilled into a marsh on the Cape Fear River in South Carolina. This spill was followed by the indirect oiling of Brown Pelican (Pelecanus occidentalis) eggs when oiled adults returned to incubate their eggs. Whether this oiling affected the colony or other waterbirds nesting nearby is not known (Anon. 1982d).

We know of only two instances of major oil spills in or near the southeastern United States for which there is even fair information about the number and species of birds killed. The first of these occurred in early February 1976 in the lower Chesapeake Bay. Following the sinking of a barge near the mouth of the Potomac River, spilled fuel oil resulted in the widespread contamination of marshes and beaches, and the death of an estimated 20,000 to 50,000 birds (Roland et al. 1977). Perry et al. (1979) made estimates for each species that died during this spill, five spills that occurred in the Delaware River, and another large spill in Chesapeake Bay. Most of the victims of the seven spills were ducks (69.02% of ca. 52,500 birds), Horned Grebes (Podiceps auritus) (27.75%), and Common Loons (1.30%). Few charadriiforms died (315 Herring Gulls, 30 Great Black-backed Gulls, 10 Ring-billed Gulls, and one American Oystercatcher (Haematopus palliatus).

The second major mortality followed the spill in Tampa Bay of some 80-100 tons of oil when the Greek tanker DELIAN APOLLON ran aground in mid-February 1970 and ruptured its hull (Wallace 1970, Clark 1973). Oil spreading over the bay resulted in at least 4,500 birds being brought to cleaning and rehabilitation stations (Sims 1970). As many as 9,000 birds may have died (Clark 1973). The birds brought to cleansing stations were largely ducks, Common Loons, and Horned Grebes (Sims 1970).

Several of the southeastern states are among those with the greatest number of oil spills and amount of oil entering the ecosystem yearly (Table 5). However, so little information on the effects of oiling on seabirds of this area is being recorded and reported that it is impossible to assess adequately the overall effect of oil pollution in the southeast.

SOURCES OF VARIATION IN MORTALITY FROM OIL POLLUTION

A large number of factors are involved in determining the magnitude of detrimental effects of oil pollution on marine birds. Birds oiled in cold weather or cold water have a much higher fatality rate than do those in warm weather and warm water. Even small amounts of oil may lead quickly to death under the stress of cold (Levy 1980), but birds in warmer areas may survive the same degree of oiling (R. Clapp, pers. observ.; C. Harrison, pers. comm.). Reports from Europe (Bourne and Bibby 1975, Riisgard 1979) indicate that mortality from oiling is greater in winter than in summer.

Oil spilled in cold water remains liquid longer than in warm water and is likely to cause more damage as a result. It first forms a "chocolate mousse" water-in-oil emulsion and then it forms tar balls. Although these forms of oil may present some hazard to birds (Bourne and Bibby 1975), the hazard is apparently much less than with fresh oil.

Bourne (1976) summarized some of the changes in daily, annual, and life cycles of marine birds that may increase their vulnerability to oil pollution. Local currents and winds may bring drifting slicks into rafts of birds roosting on the water. Bourne and Devlin (1969) suggested that most mortality from oiling occurs when roosting or feeding birds are trapped by drifting slicks. Birds that concentrate in flocks of 1,000 or more to scavenge behind fishing trawlers (e.g., gannets and gulls [Powers et al. 1980]), may be drawn into the area of an oil spill, causing disproportionately large numbers to be oiled. Conversely, oiled birds may follow trawlers away from the site of a spill and thus be underrepresented among the sick and dying coming ashore (Powers and Rumage 1978).

Bourne (1976) pointed out that marine birds are particularly susceptible to damage from oil when they are molting. When birds lack their usual insulation, smaller than usual amounts of oil may lead to death from chilling, shock, and starvation.

Table 5. Oil spills in the southeastern United States 1978-1980 compared with other states (a).

State	Number of oil spills 1978-80	Percent of spills occurring in the southeast	Percent of all U.S. oil spills	Volume spilled (gallons) 1978-80	Percent of oil spilled in the south-east	Percent of oil spilled in U.S. waters
Southeastern states						
North Carolina	297	2.4	1.0	139,165	1.3	0.4
South Carolina	282	2.3	0.9	105,791	1.0	0.3
Georgia	259	2.1	0.8	474,206	4.4	1.5
Florida	2,018	16.2	6.6	507,693	4.7	1.6
Alabama	434	3.5	1.4	518,829	4.8	1.6
Mississippi	151	1.2	0.5	65,750	0.6	0.2
Louisiana	5,664	45.5	18.4	5,325,747	49.3	16.5
Texas	3,350	26.9	10.9	3,662,896	33.9	11.3
Total-Southeast	12,455	100.1	40.5	10,800,077	100.0	33.4
Other heavily polluted states						
New Jersey	1,052	---	3.4	3,921,308	---	12.2
Massachusetts	792	---	2.6	1,992,655	---	6.2
New York	1,081	---	3.5	1,334,970	---	4.2
California	2,249	---	7.3	1,083,129	---	3.4
Kansas	120	---	3.9	901,096	---	2.8
Kentucky	508	---	1.7	861,329	---	2.7
Missouri	292	---	0.9	809,987	---	2.5
Rhode Island	253	---	0.8	700,105	---	2.2
Alaska	798	---	2.6	639,860	---	2.0
Pennsylvania	800	---	2.6	614,129	---	1.9
Total-U.S. Waters	30,777	---	---	32,207,039	---	---

(a) This table is compiled from U. S. Coast Guard (1980, 1981) data. Other heavily polluted states chosen for comparison were those that had the greatest amount of oil spilled from 1978 through 1980. The figures for 1980 were preliminary figures only. The figure for Texas probably is somewhat inflated due to the IXTOC blowout.

Breeding birds are particularly susceptible to oil. The loss of one member of a pair may mean complete loss of their reproductive potential for that year. Although this loss may be recouped in future generations, most marine birds have low productivity and populations take years to recover from a single oiling incident. Oil in the vicinity of breeding colonies also may diminish reproductive success by decreasing the hatching success of contaminated eggs, by disturbance to the colony from attempts to control pollution (Bourne 1976), and by debilitating oiled birds so much that they may not attempt to breed (Stowe 1982).

Ford et al. (1982) recently developed a mathematical model that dealt with the effects of oil spills on breeding populations of seabirds, using guillemot and kittiwake populations in the Bering Sea as paradigms. Their model suggests that a catastropic mortality of adults requires a longer recovery time for a population than does a similar mortality of young. A complete breeding failure by guillemots in one year would have a smaller effect on recovery time than would a 5% mortality of adults. Although these remarks are based on alcids, a group highly susceptible to oil pollution, the authors pointed out that their results probably are applicable to other species with high adult survival rates. High adult survival rates have been shown for several species that occur in the southeast, Northern Fulmar, Manx Shearwater (Puffinus puffinus), Herring Gull (Dunnet 1982), and Common Tern (DiCostanzo 1980), and are likely to occur in species of gulls and terns breeding in the southeast.

Ford et al. (1982) also modeled the effects of chronic low-level pollution following a one-time adult mortality (as might be caused by an oil spill). Their results indicated that small decreases in adult survival or fecundity greatly increased the amount of time required for the affected population to recover. They also pointed out that "Chronic low-level pollution may produce permanent changes in the survivorship and fecundity schedules of a population, which can alter the recovery time and extinction point for one-time perturbations." Ford et al. (1982) concluded by stating that their model should be regarded as no more than a preliminary estimate that predicts only the magnitude of a population's response to an oil spill. They indicated that more precise predictions are not possible without adequate data.

Few observations of the behavior of birds encountering oil have been reported. Available information indicates that differences in behavior between species affect their level of vulnerability to oil. According to the Internation Council for Bird Protection (1960), Long-tailed Ducks (= Oldsquaw, Clangula hyemalis) choose to land on oil slicks. If true, this may account for some of the very high oil-related mortalities reported for this diving duck. Guillemots (= Common Murres, Uria algae) dive to escape floating oil but suffer the risk of surfacing into it and thus becoming severely contaminated (Bourne 1968b). Hainard (1959) reported that some diving ducks (Tufted Duck [Aythya fuligula] and Pochard [A. ferina]) avoided patches of oil floating down a river. Gulls (Bourne 1968b) and Manx Shearwaters (Puffinus puffinus) (Casement 1966) also actively avoid thicker, more noticeable oil slicks when flying. Some of these birds also avoid oil when swimming; a Herring Gull and a Black-legged Kittiwake (Rissa tridactyla) that swam into a patch of floating oil immediately took flight (Bourne 1968b, Bourne and Devlin 1969). Sanderlings (Calidris alba) and Willets (Catoptrophorus semipalmatus) oiled on the Texas coast spent less time feeding and more time roosting and making comfort movements than did unoiled birds (Chapman 1981).

The number of birds that die following an oil spill is also related to the type of petroleum spilled and how long it remains in the environment. Crude oil is less toxic than refined oils (diesel oil, No. 2 fuel oil, Bunker "C") (Hay 1979), and fresh oil causes more damage than older, weathered oils (Bourne and Bibby 1975). Some oils may be innocuous enough that oiled birds are not killed and are even capable of cleaning their plumage (Birkhead et al. 1973, Phillips 1974).

The number of deaths from oiling following a spill is not necessarily related to the amount of oil spilled; large spills may result in few deaths, while smaller spills may cause large losses, particularly when substantial numbers of birds are concentrated in small areas (Croxall 1975, Salomonsen 1979). In addition, large oil spills may cause no greater loss of marine birds than does chronic oil pollution of the environment (Nelson-Smith 1973, Croxall 1975, Holmes and Cronshaw 1977).

EFFECTS OF OIL ON CONTAMINATED BIRDS AND THEIR EGGS

The primary effect of oil on birds is a loss of buoyancy and insulation when the plumage becomes matted. Oiled birds then may quickly chill and die from exhaustion and exposure. Ingestion of oil by birds also leads to a variety of physical and physiological disorders that make death more likely (Clapp et al. 1982c, Eastin and Murray 1981). Experimental studies also have dealt with the secondary effects of oiling on reproduction of marine birds. Small amounts of oil will reduce the hatching success of duck, heron, gull, tern, and auklet eggs (Eastin and Hoffman 1978, Stickel and Dieter 1979, Ainley et al. 1981, Hoffman and Eastin 1981).

Toxicity of oils is greater for new eggs than for those further along in incubation, and older weathered oils are less toxic than fresh ones. Oiling of incubating gulls causes significant egg mortality when the oiled feathers come in contact with the eggs. Oiling of eggs also may result in deformed chicks. Deformed bills, incompletely ossified wing or foot bones, abnormally small liver lobes and stunting were the most common abnormalities found in experimental studies (Stickel and Dieter 1979).

Other studies have shown that the number of eggs laid by Mallards (Anas platyrhynchos) decreases when they are fed diets containing 2.5% South Louisiana crude oil (Eastin and Hoffman 1978, Stickel and Dieter 1979). Ducklings fed diets containing 5% of this crude oil grow more slowly than usual and may develop a number of internal disorders (Eastin and Hoffman 1978). These amounts of oil seem large, but other work has shown that smaller doses, similar to what might be encountered in nature, may also have adverse affects on health and reproductive biology.

Herring Gull chicks at Little Duck Island, Maine were fed 1 ml doses of a crude oil/corn oil mixture. Chicks fed 0.2 and 0.5 ml of weathered South Louisiana crude oil grew more slowly for 7-9 days after treatment than did controls fed only 1 ml of corn oil (Butler et al. 1978). Chicks fed 0.2 ml of crude oil recovered within two weeks, but those fed 0.5 ml showed a reduced gain in weight for about three weeks after the initial dosing. Both groups fed crude oil also exhibited decreased culmen growth. No differences in behavior were noted.

Peakall et al. (1978) tried to determine which compounds in crude oil inhibited growth. Herring Gull chicks were fed 1 ml of two South Louisiana crude oils, or the aliphatic or aromatic fractions contained within 1 ml of each. One crude oil caused no significant reduction in weight gain, but both the crude oil and aromatic fractions of the other caused significant decreases in the growth rate. Hallett (in Peakall et al. 1978) found that polynuclear aromatics with 3 or more rings were present in the oil that caused reduced growth, but not in the other. This variation in the adverse effects caused by two presumably similar crude oils suggests that the effects on local breeding populations encountering oil spills may be highly variable and not predictable by the degree to which the birds become contaminated. Additional information on experimental work showing the effects of oil on marine birds of the southeast is given in the species accounts for Great Black-backed Gull, Laughing Gull, and Sandwich Tern.

POTENTIAL HAZARDS TO MARINE BIRDS FROM OFFSHORE OIL PRODUCTION

About two-thirds of the oil in coastal waters comes from runoff and effluent from terrestrial sources. Tanker operations account for about 26 times more oil in marine waters of the United States as do offshore operations (Ohlendorf et al. 1978), but may cause a disproportionately large share of avian mortality. Ohlendorf et al. (1978) suggested that, for the marine environment, it may be safer to produce oil offshore than to import it. Widespread, severe effects of chronic small spills at producing offshore oil fields have not yet been found (Dicks and Hartley 1982) and these fields may cause relatively few long-term biological problems (Dicks 1982, Dicks and Hartley 1982). The same may not be true for chronic discharges in coastal waters, particularly at specific sites where oil is produced, handled, and refined. There the effects may be local and subtle or severe and long-lasting (Dicks and Hartley 1982).

Longley and Jackson (1980) reviewed the problems caused by the development of petroleum resources in brackish marshes and suggested alleviative measures that could be taken. Effects include direct loss of vegetation and animals (e.g., by dredging construction of pipelines and roads); addition of dissolved, particulate and toxic materials to the environment; and changes in water flows. Changes in water flow were considered the most damaging hazard because they may result in the complete loss of a marsh ecosystem. Such an event could be accompanied by a reduction or an elimination of the populations of marine birds that use the habitat for nesting or feeding.

Similar effects are likely when onshore areas and offshore barrier islands are affected by development of oil and gas resources. Changes in water flow due to dredging could easily change tidal and current patterns, resulting in the elimination of islands used for nesting. Terrestrial access to larger islands may result in the introduction of predators (e.g., foxes, raccoons) that could eliminate an entire bird colony in a season or two. Disturbance engendered by construction could result in the mass desertion of a traditional breeding area by some species.

Geological characterizations of the sensitivity of shorelines to oil spills are not sufficient to determine the overall sensitivity of these areas (Owens and Robilliard 1981). Owens and Robilliard pointed out that some time- and site-specific features (e.g., presence of endangered species, migrations of fish, seabirds, waterfowl, and shorebirds) are largely overlooked in such considerations and may make a site highly sensitive for only short periods of time. They stated that "the vulnerability of mobile (whether resident or migratory) marine bird species is probably more significant than the impact of oil on the nearby intertidal habitats." They further pointed out that the threat that the IXTOC I blowout presented to the egg laying of the endangered Kemp's Ridley sea turtle along an isolated Texas beach would not have been identified by the usual processes of determining sensitive areas.

Several recent reports reviewed human activities relevant to development of onshore oil facilities. These reports include Mulvihill et al.'s (1980) detailed review of the effects of shoreline structures on the coastal environment, Morton's (1976) review of the ecological effects of dredging, and Buckley and Buckley's (1976a, 1977a) and Burger's (1981a) reviews of the effects of human disturbance on colonially nesting birds.

Onshore habitat change or loss resulting from the development of facilities related to offshore oil production in the long run, probably will more adversely affect waterbirds in the southeastern United States than will the production of oil itself. The species treated in this volume compose the group most vulnerable to petroleum development in the southeast. Development of onshore facilities to produce, transport, and hold oil will probably be a major source of environmental disruption and disturbance for these birds. Other forms of coastal development (e.g., recreation and real estate) also may cause serious declines in populations of the species included here, and may have more serious consequences than development of petroleum resources. Further research into the flexibility in the use of breeding habitat is needed to determine the extent to which development may damage populations but, as Buckley and Buckley (1980a) pointed out, such efforts will have little value unless management efforts include massive habitat protection.

A secondary hazard to breeding seabirds of the southeast is the ingestion of oil-contaminated food. The impact may not be immediate, but deleterious effects on the health of adult marine birds and on the production of young can be severe.

RECOMMENDATIONS FOR FUTURE RESEARCH

This report reveals large gaps in the body of knowledge necessary to deal effectively with problems relating to marine birds and OCS development. Below are some of the problems that we believe need most attention.

STATUS AND BIOLOGY OF BREEDING SPECIES

The sizes of breeding populations of marine birds in the southeast are still poorly known, yet limited data suggest that this area contains significant numbers of some species (Table 6). Recent surveys (Soots and Parnell 1975a; Portnoy 1977, 1978 ms; Blacklock et al. 1978, 1978 ms; Parnell and Soots 1979 ms; Portnoy et al. 1981) provide valuable information on the sizes of populations, but surveys are incomplete for many areas and have been taken over too short a period to allow for the annual variation usually found in populations of marine birds. Information from coastal areas of Georgia and South Carolina is inadequate, and information from Florida is available only for portions of the state. In addition, the locations and sizes of breeding colonies of conspicuous breeders (e.g., Sandwich and Royal Terns) that occupy relatively few nesting sites are better known than those of other species (e.g., Laughing Gulls, Forster's Terns) whose colonies are more numerous and widely dispersed, but are found in less easily surveyed habitats. Species that tend to nest in association with other species (e.g., Gull-billed and Caspian Terns) are often overlooked on surveys and the actual numbers breeding in the southeast are not well known.

Many recent papers have dealt with the difficulties of censusing waterbirds (Nettleship 1976; Harris and Lloyd 1977; Buckley et al. 1978b; Birkhead and Nettleship 1980; Drury 1980; Erwin 1980a, 1981; Erwin and Ogden 1980; Hutchinson 1980; Portnoy 1980). Perhaps too much emphasis has been placed on obtaining highly accurate censuses when obtaining consistent results over time is more important. Erwin (1980a) pointed out that "the most important factor in obtaining systematic sampling results is probably observer consistency" and that using the same observers over a period of years allows a comparison that emphazizes relative rather than absolute changes in numbers. In commenting on censuses conducted in Alaska and New England, Drury (1980) stated that "one should not draw conclusions based on data gathered in the course of scattered surveys made over a few years, no matter how precise and thorough the counting of each sample," a point with which we agree thoroughly. Drury also remarked that useful conclusions can be drawn from varied surveys if (a) estimates were made systematically, (b) if the overall change in numbers has been considerable, and (c) if the biological reasons for periodic changes are known and understood. He pointed out that variations in numbers between surveys can be dealt with by calibrating for differences between observers, counting techniques, and counts taken at different times of day and in different parts of the breeding season.

Table 6. Estimated populations of charadriiform marine birds breeding in the southeastern United States compared with their status in other areas administered by the U.S.

Species	Number breeding in the southeast	World breeding range	Significance of populations in the southeastern U.S. compared with other areas under U.S. jurisdiction
Laughing Gull	ca. 263,000	Mostly North America	A majority (ca. 65%) of the U.S. population and probably most of the world population breeds in the southeast; most of the remainder breed along the North Atlantic coast. They also breed in the Caribbean, includ- the Virgin Islands, but the size of populations breeding there is poorly known.
Herring Gull	ca. 500	Widespread in the Holarctic regions	Negligible. Well over 100,000 birds breed along the North Atlantic coast of North America and in the Great Lakes region.
Great Black-backed Gull	ca. 20	Atlantic, North America and eastern Eurasia	Negligible. Most of the North American population breeds along the North Atlantic coast with the majority breeding in Maine and Massachusetts
Gull-billed Tern	ca. 3,000	Nearly cosmopolitan	The southeast contains about 95% of all Gull-billed Terns breeding in the U.S. More than half of the southeastern birds are found in Texas. Others breed in the Caribbean but whether any breed in areas administered by the U.S. is not known.
Caspian Tern	ca. 3,000	Widespread but patchy	The southeast holds over a fifth of the U.S. population. Most of the southeastern birds breed in Texas.
Royal Tern	ca. 99,000	Mostly North America	Over 90% of the U.S. population breeds in the southeast.

Table 6. Continued.

Species	Number breeding in the southeast	World breeding range	Significance of populations in the southeastern U.S. compared with other areas under U.S. jurisdiction
Sandwich Tern	ca. 75,000	Mostly North America and Europe	Over 95% of the U.S. population breeds in the southeast. Some colonies in Louisiana are among the largest known. An unknown number also breeds in the U.S. Virgin Islands.
Roseate Tern	ca. 400 (a)	Warm and temperate waters of the world	Negligible. Most of the Roseate Terns breeding in areas administered by the U.S. are in the Atlantic northeast and in the U.S. Virgin Islands.
Common Tern	ca. 9,000	Mostly in eastern North America and the palearctic of the Old World	Slight. The only signficant population breeds in North Carolina and represents perhaps about 10% of the birds breeding in the eastern U.S. Breeding status along the Gulf coast and in the Caribbean is uncertain. Most of the U.S. population breeds around the Great Lakes and in the Atlantic northeast.
Forster's Tern	ca. 24,000	North America	Nearly 70% of the U.S. population and probably more than half the world population breeds in the southeast. About 80% of the southeastern population breeds in Louisiana.
Least Tern	ca. 26,000	Largely in the western and eastern U.S.	About 60% of the U.S. population occurs in the southeast where the largest known colonies of the species are found. Considerable numbers also nest along the U.S. North Atlantic coast. Others breed in the Caribbean and in the U.S. Virgin Islands, but populations there are poorly known.

Table 6. Concluded.

Species	Number breeding in the southeast	World breeding range	Significance of populations in the southeastern U.S. compared with other areas under U.S. jurisdiction
Bridled Tern	None	Pantropical except much of Pacific	Breeds in the U.S. Virgin Islands and elsewhere in the Caribbean but little is known of their populations
Sooty Tern	ca. 80,000	Pantropical	Florida holds the only sizeable population breeding in the contiguous United States. Thousands breed in the Caribbean, including the U.S. Virgin Islands, and in the Mariana Islands. Hundreds of thousands breed in Hawaii and American Samoa.
Brown Noddy	ca. 3,000	Pantropical	The only sizeable population breeding in the contiguous United States is in Florida. Unknown numbers also breed in the U.S. Virgin Islands and many thousands breed in Hawaii, American Samoa, and the Mariana Islands.
Black Skimmer	ca. 59,000	North and South America	Over 85% of the skimmers breeding in the U.S. are found in the southeast and this area undoubtedly contains a majority of the North American population. About 70% of the population in the eastern U.S. breeds in Louisiana and Texas.

(a) Recent comments by W. B. Robertson, Jr. (pers. comm.) suggest that the number now breeding in Florida is even less than the figure given in the species account.

The data currently available, while providing some idea of breeding populations of southeastern marine birds, do not adequately assess the total number of birds using the area nor do they provide adequate information about the size of nonbreeding populations, the seasonal and annual variations in populations, or the habitats they use. Management decisions based on present information may err because available data do not reflect conditions applicable when the decisions need to be made. A continuing commitment to the monitoring of marine bird populations in the southeast (and elsewhere) is needed. Nothing less will provide the information necessary to make judicious decisions that will benefit both the marine bird and human populations that compete for the resources of the coastal zone.

Data on regional differences in nesting chronology, degree of annual variation in reproductive success, factors influencing nest-site selection, determinants of colony location (particularly in relation to food resources), and other demographic parameters, are necessary for satisfactory evaluation of the effects of managerial decisions on the well-being of populations. Studies should be undertaken over a period of several years; those conducted during a single season do not provide enough information for most managerial purposes. As the National Environment Research Council (NERC) (1977) pointed out, "... such [long-term studies are] essential as a baseline against which the results of future studies or environmental impacts can be measured."

The breeding biology of some of the species in this report has been studied in North America (e.g., Ring-billed Gull), in the Old World (e.g., Gull-billed and Black Terns), or in both (e.g., Herring Gull, Common and Roseate Terns), but few of the charadriiforms breeding in the southeast have been studied there. Only the Sooty Tern and the Laughing Gull have been relatively well studied in the southeast, and much remains to be learned of the biology and numbers of the latter. Some information is available on the breeding biology of Least Terns and Black Skimmers in the southeast. Royal, Sandwich, Forster's, and Gull-billed Terns are largely unstudied in the southeast and the latter three have been little studied anywhere in the United States. Virtually nothing is known about the breeding biology of Caspian Terns in the southeast or of the status and reproductive biology of the Common and Roseate Terns. The latter is declining in many portions of its range and has been recommended for endangered species status (Buckley and Buckley 1981).

One way of predicting the effects of oil spills on local populations is to develop mathematical models that take into account various biological parameters that determine the response of populations to spills. A recent attempt to do this by Ford et al. (1982) indicated that the following parameters are those most needed for such models:

1) the size of the nonbreeding population,
2) the movement patterns of foraging individuals,
3) the spatial and temporal distribution and availability of food near breeding colonies,
4) the relationship between feeding rates and the age of young in relation to growth rates and survival probabilities,

5) the degree of density dependence in various population parameters,
6) the probability that a given bird will die as the direct result of an oil spill,
7) the age-specific mortality schedules of local populations under normal conditions,
8) the rate at which populations respond to perturbations and regain an equilibrium distribution at sea, and
9) the effect of an oil spill on the short-term availability of food.

Ford et al. (1982) thought that the last four parameters are the most important for developing the model, but none are easy to measure and some require massive logistical support. Future research on species breeding in the southeast should be directed towards answering some of these questions.

DISTRIBUTION AND BIOLOGY OF TRANSIENT, WINTERING, AND PELAGIC POPULATIONS

Our knowledge of the distribution, numbers, and biology of charadriiform marine birds occurring offshore or during nonbreeding periods is even more limited than our knowledge of the status of breeding species. The Bridled Tern is one of the commonest of offshore species, but little is known of its areas of origin or biology. Large portions of the North American populations of Black Terns and Franklin's Gulls migrate through the study area. The area is also a major wintering ground for Laughing, Bonaparte's, Ring-billed, and Herring Gulls; Caspian, Royal, and Forster's Terns; and Black Skimmers. We know little about habitat use by these wintering populations, nor do we know much about total populations.

With the exception of the Sooty Tern, very little banding has been done in the enormous marine bird colonies of the southeast; in consequence scientists usually have no idea of the routes by which they disperse from these breeding colonies. A mass banding program, judiciously undertaken, should add greatly to our knowledge of their dispersal. Such work should be conducted over a period of years and be integrated with a marking program that would allow the recognition of individuals. Such a program could also provide useful data on timing of migration through the area, as well as provide insight into foraging ranges, local movements, and various aspects of breeding biology. Among the charadriiform species nesting in the southeast, Laughing Gulls; Caspian, Royal, Sandwich, and Forster's Terns; and Black Skimmers would probably be the species most easily treated by this approach.

Present knowledge of pelagic birds in the southeast is poor. Only a few pelagic surveys have been conducted in this area with any thoroughness and regularity. Studies by David Lee in North Carolina, Charles Duncan and Ralph Havard in Alabama, and by John Johnson in Florida, have been only partially reported and tend to concentrate on rare birds and those seen well offshore. Duncan and Havard's recent (1980) study revealed that species like the Blue-faced Booby (Sula dactylatra) and Bridled Tern, formerly thought rare in the northern Gulf, are in fact major components of the pelagic avifauna.

Comprehensive and detailed offshore surveys of marine birds, conducted by boat at least monthly and over a carefully chosen grid, would help immensely in planning contingencies to be taken following oil spills. Such surveys should last at least 2 years because data from any given year may not represent typical conditions. Recent aerial studies of this nature (e.g., Fritts et al. 1982 ms) help delineate the extent to which offshore areas are used by marine birds and at least should result in useful information about the amount of biomass in a given area at a given time. One limitation of this approach is the low reliability of identification to species. Fritts et al. (1982 ms) were not able to distinguish from the air between four species of Sterna (Forster's, Common, Arctic, and Roseate Terns), nor could they usually distinguish between species of storm-petrels, tropicbirds, jaegers, or phalaropes. Their report mentions neither Caspian nor Gull-billed Terns although both must have been present in inshore areas.

An inexpensive way to determine the potential effect of oil development would be to make observations from oil rigs on species composition and behavior of passing transients. Some species, such as the boobies, are probably attracted to these platforms, because the rigs may concentrate local food resources.

International borders are biologically imaginary lines that tend to distort our knowledge of the distribution of birds. "Foreign" birds may form a large proportion of the biomass of marine birds in southeastern waters for part of the year. One of the largest oil spills in history followed the blowout on 3 June 1979 of the IXTOC I well of Petroleos Mexicanos in the southern Gulf of Mexico. Eventually over 3 million barrels of petroleum were lost and an oil slick that spread across the southern gulf by August washed ashore along 80 km (50 mi) of the Texas coast (Waldichuk 1980). Although only about 20 birds were found dead from oiling in this area (Garmon 1980), several of these were pelagic species seldom seen along the Texas coast but common in the waters of the U.S. Gulf of Mexico (Clapp et al. 1982b). These dead birds included five Blue-faced Boobies and one Brown Noddy (B. Chapman, pers. comm.), neither of which is common off the Texas coast. The low toll of marine seabirds, one of the groups known to be most severely affected by oiling, is not surprising since the Texas coast is some 800 km (ca. 500 mi) north of the blowout site in the Bay of Campeche (at ca. 19°20'N, 92°25'W). What is surprising, however, is that none of the follow-up reports addressed the problem of what happened to seabird colonies nearer the blowout. Three areas near the IXTOC blowout (Cayos Arcas [20°13'N, 91°58'W], Cayos Arenas [22°07'N, 91°24'W] and Arrecifes Alacran [Alacran Reef] [22°23'N, 89°40'W]), presently or formerly supported populations of breeding or roosting seabirds. The closest of these, Cayos Arcas, is only some 45 mi (75 km) from the wellhead of the IXTOC I spill. It held some 5,000 Blue-faced Boobies in late 1952. Another 400 were seen on Cayo Arenas. This species, the Magnificent Frigatebird (Fregata magnificens) and the Royal Tern are all known to breed on Cayo Arcas (Paynter 1955). Alacran Reef supports breeding populations of Blue-faced Boobies, Brown Boobies (Sula leucogaster), and Magnificent Frigatebirds. Alacran Reef may also support nesting populations of Royal and Sandwich Terns (Boswall 1978). Boswall (1978) reported about 2,000 Blue-faced Boobies and 2,000 Brown Noddies in

September 1975. He noted that thousands of Sooty Terns apparently nest on the reef. In the early 1950's some 800 Brown Boobies were present and as many as 5,000 Magnificent Frigatebirds bred there (Paynter 1955). The numbers suggest this area is an important source for the pelagic avifauna of the Gulf of Mexico.

Several of the marine birds treated here and in Clapp et al. (1982b) breed in the Caribbean. Audubon's Shearwater (Puffinus lherminieri) and the Bridled Tern, periodically common to abundant off our southeastern coasts, breed in the U.S. Virgin Islands and elsewhere in the Caribbean. The Caribbean may be an important source for these as well as for other species (e.g., Blue-faced Booby, Magnificent Frigatebird, Sooty Tern) common in the offshore waters of the southeast. Species of marine birds that breed or have bred in the U.S. Virgin Islands include Blue-faced Boobies; Brown Boobies; Red-footed Boobies (Sula sula); Magnificent Frigatebirds; White-tailed Tropicbirds (Phaethon lepturus); Red-billed Tropicbirds (Phaethon aethereus); Sandwich, Sooty, and Bridled Terns; and Laughing Gulls (Dewey and Nellis 1980). The Roseate Tern population is one of the largest remaining in the Caribbean. The U.S. Virgin Islands are one of the few (perhaps the only) areas under U.S. jurisdiction where breeding Audubon's Shearwaters, Red-billed Tropicbirds, and Bridled Terns may be found. Colonies of marine birds in the Virgin Islands are much in danger from introduced and feral animals and from poachers (Dewey and Nellis 1980). What information is available makes clear that the unoccupied islands of the Caribbean are one of the main refugia for marine birds in the warmer waters of the world.

We recommend that efforts be made to initiate cooperative international surveys of marine bird populations in the southern Gulf of Mexico and in the Caribbean. International surveys would supply not only a much better understanding of the overall status of the species involved, but also would permit far better insight into the consequences of local managerial decisions on a species throughout its range. Previous efforts along these lines, particularly with regard to waterfowl, have been highly effective in producing the information needed to manage populations.

EFFECTS OF OIL ON SOUTHEASTERN MARINE BIRDS

We believe that attempted rehabilitation of oiled birds following a major oil spill is largely a waste of time, money, and other resources. A group of marine bird experts (NERC 1977) stated that "since the results of attempts to rehabilitate oiled birds are so poor, it may be more profitable to expend efforts at preventing birds from becoming polluted." It is desirable, however, to salvage oiled birds to find out what species were affected and to obtain information that will allow for more prudent responses to future spills. Satisfactory efforts to adequately document losses to oil spills in the United States are almost nil. This information is often difficult to obtain because counts of dead or contaminated birds may not indicate the numbers that were affected or will die. Seldom is there information on the number of birds present in an area before, during, and after contamination. While it may be next to impossible to do more than estimate numbers present before a spill, rapid responses to oiling incidents should allow some idea of the numbers present during and after a spill. Detailed observations made during and after the spill may allow better estimates of the severity of the spill.

Other factors make estimation of the damage caused by spills more difficult. For example, the time of an oil slick's passage through an area may be crucial in determining the degree of contamination and mortality experienced by each species. During the contamination of the Firth of Forth in February 1978, oil passed near the main feeding area for waterbirds at night; consequently, there was a proportionately greater loss of night-feeding Greater Scaup (Aythya marila) and Pochards (Aythya ferina) than there was of Common Goldeneye (Bucephala clangula) and Common Eiders (Somateria mollissima), most of which had moved elsewhere to roost (Campbell et al. 1978).

The proportion of birds oiled following a pollution incident may vary widely between species, depending on the habitats used and the habits of the birds. The probability of finding most oiled birds that roost or loaf onshore near their offshore feeding areas is greater than it is for finding birds that spend all or most of their time offshore and that, following oiling, sink from sight never to be seen again.

Further, wind, offshore currents, and movements by the birds themselves may take most of the victims of an oil spill far from where they were oiled before anyone notices their plight. In some parts of Europe and on the west coast of the United States, prevailing winds bring victims of oiling to shore. In contrast, on the Atlantic seaboard winds take oiled birds out to sea. Consequently, comparisons of damage from oil pollution incidents between these areas are not valid. Likewise, we cannot use estimates of mortality from beached bird surveys in Europe to predict the incidence of mortality in the western Atlantic. At best, the European reports suggest that damage to wild birds from oil on the U.S. east coast may be greatly underestimated.

Powers and Rumage (1978) documented one spill off Massachusetts well enough to demonstate differences between onshore and offshore observations. Following the ARGO MERCHANT spill, prevailing winds and tides made it unlikely that oiled birds would wash ashore and led Powers and Rumage to suspect that the few birds (181) found oiled on the beaches of Nantucket Island and Martha's Vineyard had made an active effort to get ashore. Hundreds of oiled Great Black-backed and Herring Gulls were seen offshore during at-sea surveys following this spill (Powers, pers. comm.). Oiled Northern Fulmars, a species not found along the beaches, were also seen. Most oiled birds were seen near the tanker or oil slick, but oiled gulls and Black-legged Kittiwakes were widely dispersed due to their penchant for following fishing trawlers. Levy (1980) analyzed the oil found on dead or moribund birds in Atlantic Canada and suggested that Herring and Great Black-backed Gulls obtained near Sable Island, Nova Scotia, had been contaminated by oil from the ARGO MERCHANT spill that had occurred some 840 km (520 mi) away.

Despite the difficulties in obtaining unbiased data on the effects of oil spills, we still recommend that better efforts be made to monitor and publish reports of the effects of these spills on marine birds. Much of the information needed to answer questions relating to oil pollution and marine birds in the southeastern United States would be available if such efforts had been made in the past.

We also recommend that more attention be paid to monitoring long-term effects of oil pollution in the southeast. One of the better and less expensive ways in which this may be accomplished is a periodic census of birds found dead along the beaches. This lends some objective basis to speculations about the effects of oil pollution, and also provides information about unusual or increasing mortality from other causes (e.g., pesticides). Over time, this may serve as an early warning indicator of serious problems. Such surveys are conducted in the eastern United States by the Atlantic and Gulf Coast Beached Bird Survey Project, but the area covered in some regions is very small (e.g., 2 mi of the Texas coast [M. Simons, pers. comm.]).

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An oiled adult Laughing Gull at Flamingo, Florida. Photograph by Roger B. Clapp.

RED-NECKED PHALAROPE

(*Phalaropus lobatus*)

[DA: Odinshane, DU: Grauwe franjepoot, EN: Red-necked Phalarope, FI: Isovesipaasky, FR: Phalarope a bec etroit, Phalarope hyperbore, GE: Odinshuhnchen, Odinswassertreter, Schmalschnabliger Wassertreter, IC: Odinshani, IT: Falaropo beccosottile, JA: Aka-eri hire-ashi, NW: Svommesnipe, PO: Platkonog rdzawoszyi, PR: Falarodo, RU: (Round-nosed Phalarope), SP: Falaropo picofino, Chorlillo norteno, SW: Smalnabbad simsnappa, US: Northern Phalarope]

GENERAL DISTRIBUTION

North America Red-necked Phalaropes breed in low Arctic and Subarctic North America from the Pribilof and Aleutian islands east and north through northern Alaska, thence east along the northern part of the continent through southern Victoria Island and central Keewatin to southern Baffin Island. They breed south to southern Alaska, southwestern Yukon, and northwestern British Columbia, and from northwestern Mackenzie southeast to northern Saskatchewan, Manitoba, and Ontario. They also breed east on islands and the coast of James Bay through northern Quebec to the east coast of Labrador (AOU 1957, Godfrey 1966).

Red-necked Phalaropes migrate in considerable numbers along and off the coasts of North America (AOU 1957, Godfrey 1966) and are widespread migrants in tropical Atlantic waters (Watson 1966). They also migrate through the interior of western North America (AOU 1957) and regularly, but in much smaller numbers, through the interior farther east. Transients have been recorded in Central America in Guatemala, Honduras, Costa Rica, and Panama (Blake 1977).

World Distribution Red-necked Phalaropes breed in the Old World in southern Greenland, Iceland (Hohn 1965), the Faeroes, Scotland and Ireland (rarely) (BOU 1971), in Norway and Sweden south to about 62° N, and in Spitsbergen and Finland, locally south in the latter to about 64° N. This species also breeds in the U.S.S.R. in northern Estonia and in northern Russia on the northern Kola Peninsula and Kandalaksha Bay east to the Taimyr Peninsula (to about 72° N) and east along the coast to the Chukotski Peninsula. From northern Siberia it breeds as far south as about 64°-66° N, and east to the Commander Islands (Vaurie 1965). European populations from southeastern Scandinavia and northern Russia migrate southeast to the Persian Gulf; birds from Old World populations farther west migrate south along the west coast of Europe to winter off Africa (Hohn 1966, Hilden and Vuolanto 1972).

Taxonomic note: This species has often been placed in the genus *Lobipes*. "Northern Phalarope" is the common name used in most of the recent North American literature, but we prefer to use the name "Red-necked Phalarope", following the usage adopted by the forthcoming AOU checklist.

Both Old and New World populations winter at sea, largely in tropical and subtropical waters. In the New World, the species winters in large numbers off the Peruvian coast (Murphy 1936), where it occurs chiefly on the outer fringes of the Humboldt Current (Blake 1977). Blake (1977) considered it casual in the coastal waters of Chile south to Santiago, but others (AOU 1957, Vaurie 1965) thought the wintering range off Pacific South America was from the Galapagos and Ecuador south to Chile and southern Argentina. These phalaropes also winter commonly off the south Atlantic coast of South America (Hohn 1965, 1969).

Red-necked Phalaropes winter in the Old World off west Africa, Arabia, and in the waters of southeast Asia (BOU 1971); in the western Pacific they occur in large numbers off Japan (OSJ 1974), and winter from the Ryukyus south and east to northern New Guinea (Vaurie 1965), where they are not uncommon (Condon 1975).

DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

North Carolina Pearson et al. (1942) considered Red-necked Phalaropes rare transients along the coast, but recent observations show they are actually numerous offshore during migration. This species has been recorded more than 70 times in North Carolina (Lee and Booth 1979) with most sightings from 10 August through 25 October and from 3 May through 10 June. We know of approximately 50 published records of the Red-necked Phalarope from North Carolina, but we list below only those that involve four or more birds.

1909	23 Sep.	5	seen (3 coll.) at White Lake, Bladen County	Pearson et al. 1942
1962	13 Sep.	30	seen 22-25 mi E Hatteras Inlet	Grant 1963
1966	4 Sep.	5	seen off Hatteras Inlet	Parnell 1967a
1972	27 May	30	seen at Pea Island	Teulings 1972c
1972	8 Oct.	45	seen off Hatteras	Teulings 1973a
1973	26 May	30	seen off Morehead City	Teulings 1973e
1973	2 Sep.	4	seen off Hatteras	Teulings 1974d
1973	16 Sep.	15	seen off Hatteras	Teulings 1974d
1974	1 Sep.	6	seen off Hatteras	Teulings 1975a
1975	12 Oct.	70	seen off Cape Hatteras	Teulings 1976a
1976	18 May	4	seen feeding at sandflats, Oregon Inlet	Teulings 1976d

1976	11 Aug.	4	seen off Oregon Inlet	Teulings 1977a
1976	5 Sep.	26	seen off Oregon Inlet	Teulings 1977a
1976	6 Sep.	27	seen off Hatteras	Teulings 1977a
1976	21 Sep.	20	seen off Oregon Inlet	Teulings 1977a
1977	9 June	3-6	seen off Oregon Inlet	LeGrand 1977b
1978	10 Oct.	13	seen off Oregon Inlet	LeGrand 1979a
1979	10 May	91	seen off Oregon Inlet	LeGrand 1979d

South Carolina The status of the Red-necked Phalarope in South Carolina is probably the same as in North Carolina. Although regarded by Sprunt and Chamberlain (1949) as a rare transient, mostly along the coast, they are almost certainly common migrants offshore. Wayne (1910) and Sprunt and Chamberlain (1949) agreed that the species was abundant offshore despite the paucity of records. We found only 11 records for the state, the majority (7) from the spring migration. Spring records extend from 17 May through 3 June, and fall records from 11 September through 25 October.

1880	17 May	1	coll. in Chester Co., 150 mi inland	Loomis 1880
1885	25 Sep.	seen	at Frogmore, Beaufort Co.	Sprunt and Chamberlain 1949
1885?	25 Oct.	seen	at "Sea Islands"	Sprunt and Chamberlain 1949
1903	3 June	1	captured at Charleston	Wayne 1905
1913	28 May	1	seen off Mt. Pleasant	Sprunt and Chamberlain 1949
1933	30 May	1	female seen at Cape Romain	Sprunt 1933
1934	29 May	1	ad. female coll. at Bull's Island	Chamberlain 1934
1950	11 Sep.	1	seen inland in Columbia area	Burton 1970
1956	2 May	2	seen inland at Aiken	Burton 1970
1961	22 May	1	female seen inland at Lake Murray	Smith 1961
1972	27 May	1	seen at Huntington Beach	Teulings 1972c

Georgia Red-necked Phalaropes are thought to be rare inshore and offshore migrants in Georgia and accidental inland (Denton et al. 1977). We know of only about 18 records for the state. Records from the spring migration extend from 5 May through early June; records from the fall migration from 24 July through 3 October. There is one winter record.

1933	24 May	1	female coll. at mouth of Savannah River	Burleigh 1958
1937	3 Oct.	1	male coll. in Grady County	Burleigh 1958
1950	9 May	1	male coll. inland near Augusta	Denton and Chamberlain 1950b
1950	9 Sep.	1	seen at Savannah	Tomkins 1958
1951	25 Sep.	2	seen on pond 3 mi E Savannah	Chamberlain 1952a
1958	5 May	1	coll. at Hutchinson's Island, Savannah	Tomkins 1958
1958	16 Aug.	seen	at Savannah	Denton et al. 1977
1958	13 Aug.- 13 Sep.	4-11	seen at Hutchinson's Island	Chamberlain 1959a, Tomkins 1958
1959	19 Sep.	2	seen at Hutchinson's Island	Chamberlain 1960a
1959	23, 24 Sep.	4,1	seen at Hutchinson's Island	Chamberlain 1960a
1964	10 Sep.	1	seen at Tybee Island	Parnell 1965a
1968	12 Sep.	2+	seen at Jekyll Island	Masters 1968
1972	27 May	1	seen at St. Simons Island	Teulings 1972c
1976	23 May	2	seen (1) inland near Gainesville	Teulings 1976c
1976	23 May	2(?)	seen (1) inland at Pendergrass	Denton et al. 1977
1976	early June	2	seen (1) near Pendergrass	LeGrand 1976
1977	24-26 July	2	seen inland at Eufaula NWR	LeGrand 1977b
1979	11 Feb.	3	seen off Jekyll Island	LeGrand 1979b

Florida - Atlantic Coast The Red-necked Phalarope is a rare migrant along the coast and is occasionally found inland (Kale 1979 ms a). There are few early reports of this species from the Atlantic coast of Florida; Howell (1932)

(1) These three 1976 records may be of the same birds.

listed one record, and another five were summarized by Sprunt (1954). Since then there have been at least another 22 records from the coast, as well as seven from inland localities. We list below only coastal records since Sprunt's (1954) publication, but include all coastal observations in Table 7. Numbers of Red-necked Phalaropes seen in recent years clearly indicate that the species is much more abundant offshore than previous records suggested, and is most abundant as a transient in April-May, and in September-October (Table 7). Numbers seen in December and January also suggest that some may winter in offshore waters.

1958	8-10 May	1	seen at Canaveral	Stevenson 1958c
1962	24 Apr.	1	seen at Fort Pierce	Paulson and Stevenson 1962
1962	6, 8 May	at least 32	seen (some coll.) in small flocks E of Palm Beach	Paulson and Stevenson 1962
1962	16 Dec.	16	counted 40 yds offshore between Juno Beach and Jupiter	Stevenson 1962b
1963	24 Sep.	2	seen at Playalinda Beach	Cunningham 1964a
1965	10-11 Sep.	1	seen at Guano Lake	Stevenson 1966a
1967	21 Oct.	1	seen at Sawpit Sanctuary, Duval County	Robertson and Ogden 1968
1969	9 Oct.	22	seen at Port Canaveral	Robertson 1970
1972	21 Mar.	12	seen in Indian River at Rockledge	Stevenson 1972a
1972	28 May	6	seen at Little Talbot Island	Ogden 1972
1972	26 Aug	seen	off Cocoa	Stevenson 1973
1972	28 Oct.	4	seen off Boynton Inlet	Stevenson 1973
1972	16 Dec.	1	seen in Indian River near Sebastion	Woolfenden 1973
1973	4 May	65+	seen 18 mi E Cape Canaveral	Kale 1973
1973	9 Sep.	8	seen 24 mi off Mayport	Edscorn 1974
1973	13-29 Oct.	1-2	seen daily at Port Canaveral	Edscorn 1974
1974	29 June	2	seen 20 mi off Cocoa	Ogden 1974
1974	25 Sep.	1	found dead near Stuart	Edscorn 1975

1975	7 Sep.	19	seen off Mayport	Edscorn 1976
1977	23 Jan.	36	seen 10-15 mi off Canaveral	Stevenson 1977
1978	29 Apr.	up to 30	seen off Ponce Inlet	Kale 1978a
1978	30 Dec.	1	seen at Port Canaveral	Stevenson 1979a

Florida - Keys We know of only five records from the Keys; all but one are of either fall migrants or wintering birds.

1954	15 Aug.	1	seen at Key West	Stimson 1955
1954	14-15 Nov.	1	seen at Little Duck Key	Stevenson 1955a
1954	23 Nov.	1	seen at Key Vaca	Stevenson 1955a
1967	15 Oct.	1	found dead at Norris Cut, Virginia Key	Robertson and Ogden 1968
1972	20 May	1	male seen off Duck Key, Florida Straits	Kale 1972

Florida - Gulf Coast Red-necked Phalaropes occur over the open waters of the Gulf of Mexico but are seldom recorded from the Florida Gulf coast (Kale 1979 ms b). We found only 16 records for this area, predominantly of spring migrants (14 March-25 May). More than half of all Red-necked Phalaropes reported along the Florida Gulf coast have been seen between 13 and 25 May. Two summer records could have been either of early fall migrants or of birds that had lingered in the south during the breeding season. Few Red-necked Phalaropes have been recorded along this coast in fall and winter.

1918	14 Mar.	1	seen 175 mi W of Tampa	Howell 1932
1929	14 May	1	coll. near Plant City	Howell 1932
1954	29 Apr.	1	seen, coll. at Snake Bight (Cape Sable area)	Stevenson 1954a
1956	25 May	1	coll. at Lake Jackson	Stevenson 1956c
1959	22 Nov.	2	seen at Cape San Blas	Newman 1960a
1963	14 May	4	seen ca. 1 mi off Alligator Point	Stevenson 1963b
1963	6 July	1	coll. near Tampa	Stevenson 1963c
1965	27 June	1	seen at Sanibel Island	Ogden and Stevenson 1965

1969	19-20 May	1	seen on upper St. Marks River, Wakulla County	Pantelidis and Stevenson 1969
1970	12, 16 May	1,2	seen on freshwater pond, Tampa	Edscorn 1971
1972	11-15 May	1	seen at McKay Bay	Kale 1972
1972	13 May	1	seen at Navarre Beach	Imhof 1972
1973	12 Oct.	1	seen at Tampa	Edscorn 1974
1975	27 Nov.	1	found at Navarre	Purrington 1976
1976	21 Jan.	1	seen at Sanibel Island	Stevenson 1976
1977	25 May	1	ad. female seen at Toytown Dump	Kale 1977

Alabama Red-necked Phalaropes occur only occasionally in Alabama, predominantly during the fall migration (Imhof 1976b). We know of only 12 records for the state; eight are from inland localities, the rest from the coast. Spring records are from 29 April to 17 May. Fall records occur from 6 August to 13 November, and there is one winter record. Imhof (1976b) listed nine of the records; we list below those from the coast and those published subsequent to Imhof (1976b).

1964	27 Aug.	seen	at Dauphin Island	Imhof 1976b
1973	10 Sep.	6	seen 9 mi S of Dauphin Island	Imhof 1976b
1973	13-14 Oct.	seen	at Blakely Island, Mobile	Imhof 1976b
1975	6 Aug.	1	seen at Wheeler NWR	Purrington 1976
1977	29 Apr.	1	seen at Blakely Island, Mobile	Imhof 1977
1977	27-29 Aug.	1(?)	seen in Limestone Co.	Purrington 1978

Mississippi Red-necked Phalaropes are rarely seen in Mississippi. There are only three records, all of fall migrants. The first two phalaropes were recorded inland at sewage lagoons in 1976. One was seen 11 September at Kosciusko, Attala County (Sanders 1976) and another was seen 21 September at Hattiesburg (Gates 1976). The third sighting was made along the coast at Pascagoula on 10 September 1977 (Purrington 1978).

Louisiana Red-necked Phalaropes are rarely seen in Louisiana. We know of only six records for the state, five of them listed by Lowery (1974). As on the Texas coast, this species is evidently more frequent during spring migration than in the fall.

1966	8 May	1	ad. female coll. 10 mi W of Johnson's Bayou, near Sabine Pass	Lowery 1974
1970	1 May	6	seen at Cameron	Lowery 1974
1971	30 Apr.- 1 May	4,3	seen at Cameron	Lowery 1974
1971	12 Sep.	1	seen 10 mi W Johnson's Bayou	Lowery 1974
1978	14 May	1	seen at Holly Beach Oil Field, Cameron	Imhof 1978

Texas Oberholser (1974) reported that Red-necked Phalaropes are regular but scarce in the interior during fall migration; they are rare during spring migration. Along the coast they are rare to casual in fall and (along the central coast) casual in spring. Spring migration occurs mainly from late April to late May, and most fall migration occurs from mid-August to mid-October. Extreme dates of occurrence range from 4 April to 6 June, and from 12 July to 22 December (Oberholser 1974).

We know of approximately 55 records of Red-necked Phalaropes from Texas. About three-quarters of these records are from inland localities; nearly two-fifths of them were made at Austin, where the species is regularly recorded during the fall migration. September is the month of peak occurrence in the interior but along the coast most Red-necked Phalaropes have been seen from the latter half of April through early May. We list below 13 records obtained on or near the coast.

1938	12 July	1	seen at Jones Lake, Aransas NWR	Oberholser 1963 ms
1940	4 Apr.	2	seen at Aransas NWR	Oberholser 1963 ms
1940	25-29 Apr.	7	seen on flats W of Mullet Bay, Aransas NWR	Oberholser 1963 ms
1952	26 Apr.	1	seen at Rockport	Watson and Goldman 1952, Oberholser 1963 ms
1959	4 Oct.	1	seen at Baytown Tunnel	Webster 1960a, Oberholser 1963 ms
1959	15 Sep.	1	seen at Laguna Atascosa	Webster 1960a
1961	18 July	2	seen at Aransas NWR	Webster 1962a, Oberholser 1963 ms

1962	17 Apr.	ca. 35	seen eating insects on seaweed, Mustang Island beach	Webster 1962b
1963	9-10 May	2	seen on Oso Creek, W of Corpus Christi	Webster 1963
1968	18 Oct.	1	seen 10 mi E of Brownsville	Webster 1969a
1973	9-10 May	2	seen at Corpus Christi	Blacklock 1978 ms
1975	31 Oct.	1	photogr. at Padre Island Natl. Seashore	Blacklock 1978 ms
1979	29 Apr.	1	photogr. in Brazoria County	Webster 1979c

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

Breeding Red-necked Phalaropes breed circumpolarly in the northern Holarctic, largely between 52° and 74° N. They are found mostly in the tundra, but may also breed in the boreal zone.

Winter Red-necked Phalaropes winter at sea, primarily in tropical and subtropical oceans. They may be found off the coasts of South America, northwest Africa, Arabia, and southeast Asia.

Migration The Red-necked Phalarope occurs in the southeastern United States primarily as a transient in spring and fall (Tables 7, 8). Most occur offshore, and their status off many states is largely unknown because these waters have been poorly investigated. In North Carolina and Florida where offshore surveys have been conducted most frequently, these phalaropes are common migrants. Although considerably less information is available for the northern Gulf of Mexico, it seems evident that Red-necked Phalaropes are less abundant there than off the Atlantic coast and are apparently relatively more common during spring migration. Peak periods of occurrence in both the Gulf and Atlantic areas are April-May and September-October (Table 7).

On the basis of ringing recoveries obtained in the Old World, Hohn (1966) thought that the birds of Sweden, Finland, the Baltic area, and adjacent northern Russia migrate overland toward the Caspian Sea and probably from there to the Persian Gulf. Hohn also suggested that migrants off western Europe probably come from the east coast of Greenland, Iceland, the Faeroes, the northern British Isles, and Norway. Hilden and Voulanto (1972), after a more recent examination of Finnish ringing recoveries, agreed with Hohn; they believed that the migration from Finland takes place to the southeast over the European continent. Additional information on migration in other areas is given by Meinertzhagen (1925), Bent (1927), Hohn (1965), Schiemann (1972), and Glutz von Blotzheim et al. (1977).

Table 7. Approximate number of Red-necked Phalaropes recorded by month for the coastal southeastern United States (a).

State/region	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
North Carolina	-	1	-	-	171	7	4	7	144	130	-	-
South Carolina	-	-	-	-	8	1	-	-	2	1	-	-
Georgia	-	3	-	-	6	2	2	5	16	1	-	-
Florida-Atlantic Coast	36	-	12	31	104	2	-	2	83	44	2	32
Subtotal-ATLANTIC COAST	36	4	12	31	289	12	6	14	245	176	2	32
Florida-Keys	-	-	-	-	1	-	-	1	-	1	2	-
Florida-Gulf Coast	1	-	1	1	12	1	1	-	-	1	3	-
Alabama	-	-	-	1	1	-	-	3	6	4	2	1
Mississippi	-	-	-	-	-	-	-	-	3	-	-	-
Louisiana	-	-	-	4	11	-	-	-	1	-	-	-
Texas-Coast	-	-	-	46	4	-	4	-	1	3	-	-
Subtotal-GULF COAST	1	-	1	52	28	1	5	3	11	8	5	1
TOTAL-ALL AREAS	37	4	13	83	318	13	11	18	256	185	9	33

(a) If the source did not make it clear whether one or more birds were seen, we assumed that only one was seen. When birds were seen in more than one month we counted them separately in each month.

HABITAT

Nesting Bent (1927) described the preferred nesting habitat of Red-necked Phalaropes in the western Aleutian Islands as the wetter portions of flat alluvial plains. Nests were placed in small hollows in mounds or tussocks in wet meadows near the edges of marshy ponds or near the mouths of small streams. At Scammon Bay, Alaska, these phalaropes nested on sedge-grass marshlands, in clearings in alder and willow scrub-covered slopes, and on heath-covered slopes just above these slopes (Hohn 1968). Preferred nesting habitat was the lower edge of the alder/willow scrub area. Kistchinski (1975) noted that Red-necked Phalaropes in eastern Siberia nested more frequently along permanent bodies of water than did the closely-related Red Phalarope.

In most Arctic areas these phalaropes have been reported to nest in marshes with small ponds (Hilden and Vuolanto 1972 and authors cited therein). Nests are made on moss in wet places or among sedges near the edge of the water; these nests are often placed on small hummocks surrounded by water. Hilden and Vuolanto (1972) found nest sites at the southernmost permanent breeding area in Finland to be in considerably different habitat. Almost half (47.3%, n = 74)

Table 8. Dates of occurrence for Red-necked Phalaropes in the coastal southeastern United States (a).

State	Number of occurrences	Dates of occurrence: Spring		Fall	
North Carolina	70+	3 May-10 June	(10 July-4 Aug.)	10 Aug.-25 Oct.	(5 Feb.)
South Carolina	11	17 May-3 June		11 Sep.-25 Oct.	
Georgia	18	5 May-early June		24 July-3 Oct.	
Florida -Atlantic coast	28	21 Mar.-28 May	(29 June)	23 Aug.-2 Nov.	(20 Nov.-23 Jan.)
Florida-Keys	5	20 May		15 Aug.-15 Oct.	(14 Nov.-23 Nov.)
Florida -Gulf coast	16	14 Mar.-25 May	(27 June-6 July)	12 Oct.	(22 Nov.-21 Jan.)
Alabama	12	29 Apr.-17 May		6 Aug.-14 Oct.	(13 Nov.-6 Dec.)
Mississippi	3	-----		10 Sep.-21 Sep.	
Louisiana	5	30 Apr.-14 May		12 Sep.	
Texas-coast	13	4 Apr.-10 May	(2 July-18 July)	15 Sep.-31 Oct.	

(a) Records in parentheses may represent summering birds or early fall migrants, or late fall migrants or wintering birds.

of the nests were 20 m (66 ft) or more from water, and most (78.6%, n = 70) were on dry sites (sand, gravel, dry meadow) rather than on wet ones. All nests found were in patches of low or sparse vegetation, usually grasses (*Festuca*, *Deschampsia*, *Puccinellia*; 41.9%, n = 74), spike rushes (*Eleocharis*; 28.4%), or sedges (*Carex*; 21.6%). Hohn (1969) noted that this species tends to nest farther inland than the Red Phalarope. Kistchinski (1975) reported a density in eastern Siberia of 0.3-0.5 pairs/ha (0.7-1.2/ac) for birds nesting in the Indigirka Delta, compared to 1-2 pairs/ha (2.5-4.9/ac) for the Red Phalarope. In an area south of the Kolymskaya Channel that Kitchinski regarded as less desirable nesting habitat for Red Phalaropes, comparable figures were 0.5 pairs/ha (1.2/ac) for the Red-necked Phalarope and 0.9 pairs/ha (2.2/ac) for the Red Phalarope.

All nests observed by Hilden and Voulanto (1972) were found in or near colonies of Arctic Terns. These authors suggested that this association was chosen by the phalaropes, pointing out that the phalaropes react to tern alarm calls as do other species showing strong association with larids, and that the highest nesting densities of these phalaropes in Finnish Lapland always occur where there are nesting Arctic Terns.

Feeding Bianki (1967) remarked that Red-necked Phalaropes usually feed in open water where bits of detritus collect. They are found less commonly near the shoreline at high tide. Bent (1927) commented that both this species and the Red Phalarope, when at sea, preferred to feed in tide rips, on or near floating seaweed, and often near whales or schools of fish. Scott (1959) noted migrant Red-necked Phalaropes feeding among rows of drifting seaweed off southwestern Nova Scotia. During fall migration along the Yukon coast, these phalaropes feed along beaches, in the lee of ice flows, and on the open ocean; they preferred to feed in sheltered waters on windy days (Vermeer and Anweiler 1975).

Migrants inland are frequently seen on sewage ponds, rain pools, impoundments, and lakes. Cox (1973) suggested that Red-necked Phalaropes away from pelagic habitats prefer shallow pools, in contrast to Red Phalaropes, which apparently prefer deeper water.

Nonbreeding and Offshore During migration in the northern Chesapeake Bight, just north of North Carolina, Red-necked Phalaropes occur somewhat closer inshore than do Red Phalaropes; the former usually occur 20 km (12 mi) or more offshore, the latter 70 km (44 mi) or more (Rowlett 1980). Migrants arriving in Greenland and Iceland in the spring remain in large flocks in coastal bays and deltas until inland nesting ponds are free of ice (authors cited by Hilden and Voulanto 1972).

FOOD AND FEEDING BEHAVIOR

Red-necked Phalaropes feed primarily by surface-seizing (Ainley and Sanger 1979), i.e., sitting on the water and picking their prey from the surface with their bills. Phalaropes may also turn rapidly in circles, a behavior referred to as "spinning". This may stir up edible particles from the bottom in shallow water, but it also may serve to activate chilled invertebrates in deeper water (Hohn 1971). Hohn suggested that this behavior occurs where there is a dense concentration of food items, because the spinning motion allows the birds to feed rapidly. Spinning may also play a role in courtship display (Hohn 1971, Everett 1976).

Phalaropes occasionally "tip-up" like dabbling ducks, immerse their heads and necks, and seize prey underwater (Hohn 1971). Diving has been recorded once for this species (Selous 1915 in Hohn 1971), and some feed by using side-to-side sweeps of the bill in shallow water (Hohn 1968). Benning (1971) noted an instance in which this species hawked insects up to a foot or so above the water.

Red-necked Phalaropes are gregarious and often form feeding flocks, particularly at the conclusion of spring migration when weather prevents entry to the breeding grounds. This gregariousness extends into the breeding season. During this period at Scammon Bay, Alaska, they often congregate into flocks of about 20 birds (Hohn 1968).

The only comprehensive study of the food habits of the Red-necked Phalarope in North America was conducted by Wetmore (1925), who examined 155 stomachs collected from May to October. He found that these shorebirds were almost entirely carnivorous, with animal matter forming 97.2% by volume. Small insects were the most important items of diet; flies (Diptera) constituted 32.8% of the bulk, but true bugs (Hemiptera - 31.8%) and beetles (Coleoptera - 16.5%) were also important. Of the flies, early developmental and adult stages of mosquitoes (Culicidae) and gnats (Chironomidae) were especially important; the larvae of mosquitoes made up 6.3% of the sample. Most of the stomachs in which the mosquito larvae were found evidently were collected on the breeding grounds in Alaska. Among the other insect groups forming most of the diet a few taxa predominated. Water-boatmen (Corixidae) were the most significant food among the Hemiptera eaten, and diving-beetles (Dytiscidae) and water-scavenger beetles (Hydrophilidae) were most important among the coleopterids.

Crustaceans were eaten throughout the year but made up only a small proportion (9.3%) of the diet; amphipods were frequently taken, and brine shrimps (Artemia) were eaten extensively at Great Salt Lake, Utah, during migration. Wetmore (1925) suggested that crustaceans probably form a considerably higher proportion of the diet when these birds are at sea.

Other kinds of food that Wetmore (1925) recorded as occasionally or rarely eaten by Red-necked Phalaropes included molluscs (snails or other gastropods), other insects (largely those found in aquatic habitats), marine worms, spiders, mites, and an unidentified fish. Plants comprised only a small portion of the food (2.8%) but were regularly found in the stomachs; this material consisted mostly of the seeds of plants characteristic of wet areas (e.g., Ruppia, Potamogeton, Scirpus).

Baker (1977) examined the contents of 24 stomachs collected at Churchill, Manitoba, but did not report specific items of diet in detail, noting only that these phalaropes preyed heavily upon adult chironomids. Stomachs of birds collected on Kandalaksha Bay, U.S.S.R., contained only terrestrial insects (Bianki 1967) that evidently had been gleaned from the surface of the water. Dement'ev and Gladkov (1951), in an earlier summary of food habits of Red-necked Phalaropes in the U.S.S.R., found that terrestrial insects were eaten only casually. On the whole, prey taken in the U.S.S.R. was similar to that taken in North America, i.e., aquatic insects and their larvae. Birds along the Caspian Sea in fall mainly fed on amphipods, while those from the Murman Coast had eaten molluscs, insects, vegetable matter, and pebbles (Dement'ev and Gladkov 1951).

Phalaropes on coastal islands in the Gulf of Bothnia fed primarily on larval and adult Chironomidae in saline situations, but ate mostly Trichoptera larvae, water fleas, tadpoles, water spiders, and collembolans in freshwater ponds (Hilden and Vuolanto 1972).

SUSCEPTIBILITY TO OIL POLLUTION

We found no reports of oiled Red-necked Phalaropes. Although they feed on the surface in flocks, their offshore distribution, their short stay in most southeastern waters, and their scarcity in parts of the southeast make them of relatively low concern with regard to the development of petroleum resources. This is probably not true in other areas. Their feeding habits and flocking behavior on fall migration along the Yukon coast led Vermeer and Anweiler (1975) to consider them perhaps the most vulnerable to oil pollution of all shorebirds occurring there. King and Sanger (1979) agreed by giving the Red-necked Phalarope one of the highest ratings for vulnerability for any shorebird occurring in the northeastern Pacific. They indicated that this species should be of special concern vis a vis the potential effects of oil pollution.

BIBLIOGRAPHY

1982

Orr, C. D., R. M. P. Ward, N. A. Williams and R. G. B. Brown. 1982. Migration patterns of Red and Northern Phalaropes in southwest Davis Strait and in the northern Labrador Sea. Wilson Bull. 94: 303-312.

Ruttledge, R. F. 1982. Red-necked Phalarope--a hitherto unrecorded case of breeding in Co. Mayo. Irish Birds 2: 196-197.

1981

Hohn, E. O. 1981. Northern Phalarope flocks at Miquelon Lake, Alberta. Blue Jay 39: 41-43.

Pigeon, P. 1981. Observation d'un Phalarope a bec etroit *Phalaropus lobatus* et d'un Phalarope a bec large *Phalaropus fulicarius* a Aulnois-sous-Laon (Aisne). Alauda 49: 232.

1980

Becker, P. 1980. Zum Vorkommen des Odinswassertreters (*Phalaropus lobatus*) an den Kuste Sudwestafrikas und zur feldornithologischen Unterscheidung der Wassertreter. Ornithol. Mitt. 32: 40-44.

Guex, C. 1980. Observation hivernale d'un Phalarope a bec etroit *Phalaropus lobatus* sur le Leman. [Winter observations of the Red-necked Phalarope *Phalaropus lobatus* on Lake Geneva.] Nos Oiseaux 35: 372. [In French.]

Hohn, E. and D. J. Mussell. 1980. Northern Phalarope breeding in Alberta. Can. Field-Nat. 94: 189-190.

King, F. 1980. Red-necked Phalaropes breeding at Akeragh Lough in County Kerry. Irish Birds 1: 540-541.

Orsini, P. 1980. Premiere observation hivernale du Phalarope a bec etroit Phalaropus lobatus dans le Moyen-Atlas (Maroc). [First winter observation of Red-necked Phalarope Phalaropus lobatus in the Middle Atlas (Morocco).] Alauda 48: 258-259.

1979

Holmes, G. 1979. First record of Red-necked Phalarope in New South Wales. Austr. Birds 13: 75-76.

Roudybush, T. E., C. R. Grau, M. R. Petersen, D. G. Ainley, K. V. Hirsch, A. P. Gilman and S. M. Patten. 1979. Yolk formation in some charadriiform birds. Condor 81: 293-298.

Toups, J. A., M. B. Hodges and P. V. Donaldson. 1979. Northern Phalarope at Pascagoula--first photographic record for Mississippi. Mississippi Kite 9: 9-10.

1978

Dunnett, G. M. and S. W. Kotogama. 1978. Red-necked Phalarope in Sri Lanka. J. Bombay Nat. Hist. Soc. 75: 215-216.

Ruttledge, R. F. 1978. Red-necked Phalaropes breeding south of latitude 53° 37' in Ireland. Irish Birds 1: 229-231.

Taylor, W. B. 1978. Seasonal status, population size, and habitat utilization of Red and Northern Phalaropes in the Southern California Bight. (Abstract only.) Pac. Seabird Group Bull. 5: 74.

1977

Ash, J. S. and O. M. Ashford. 1977. Great Black-headed Gulls Larus ichthyaetus and Red-necked Phalaropes Phalaropus lobatus inland in Ethiopia. J. East Afr. Nat. Hist. Soc. 31: 1-3.

Baker, M. C. 1977. Shorebird food habits in the eastern Canadian Arctic. Condor 79: 56-62.

Brichetti, P. 1977. Il falaropo becco sottile, Phalaropus lobatus (L.) in Italia. Uccelli d'Italia 2: 129-131.

Gianella, C. 1977. Observazione di un falaropo becco sottile-Phalaropus lobatus (L.)-nella Laguna di Ponente di Orbetello. Riv. Ital. Ornitol. 47: 293-294.

Muller, G. and H.-P. Keller. 1977. Beobachtungen von Weissflugelseeschwalben (Chlidonias leucopterus), steinwalzer (Arenaria interpres) und Odinswassertreter (Phalaropus lobatus) in der Oberlausitz. Beitr. Vogelkd. 23: 60-61.

Ruthke, P. 1977. Futtertragen und Dunenkleid des Odins-wassertreters (Phalaropus lobatus). [Food carrying and juvenile plumage of the Red-necked Phalarope Phalaropus lobatus.] Vogelwelt 98: 229-231. [In German with English summary.]

Schiemann, H. 1977a. Uber das Vorkommen der Wassertreter (Phalaropodidae) in den brandenburgischen sachsischen und thuringischen Bezirken, souie in Berlin. Beitr. Vogelkd. 23: 49-56.

_____. 1977b. Beringungsergebnisse Nordeuropaischer Odinshunchen. [Banding results of North European Red-necked Phalaropes.] Sterna 16: 73-80. [In German with Norwegian summary.]

Sinclair, J. C. 1977. The phalaropes. Bokmakierie 29: 90-91.

1976

Crawford, P. and D. Crawford. 1976. Second record of Northern Phalarope in Nashville area. Migrant 47: 94.

Everett, J. J. 1976. Mutual spinning by Red-necked Phalaropes. Brit. Birds 69: 219-220.

Gates, L. J. 1976. Northern Phalarope in Hattiesburg, Mississippi. Mississippi Kite 6: 37.

McNamara, J. A. 1976. Two further records of the Red-necked Phalarope. S. Austr. Ornithol. 27: 142.

Sanders, J. A. 1976. A Northern Phalarope in Attala County, Mississippi. Mississippi Kite 6: 36.

Vanhercke, L. 1976. De grauwe franjepoot (Phalaropus lobatus). Wielewaal 42: 342-343.

1975

Dontschev, S. 1975. Neue Angaben uber das Auffinden von Phalaropus lobatus (L.), Glareola nordmanni Fisch.-Waldh. und Arenaria interpres (L.) am der bulgarischen Schwarzmeerkuste. Larus 26-28: 183-187.

Kistchinski, A. A. 1975. Breeding biology and behaviour of the Grey Phalarope Phalaropus fulicarius in East Siberia. Ibis 117: 285-301.

Menon, S. S. 1975. Occurrence of the Red-necked Phalarope (Phalaropus lobatus) on inland waters in Bangalore. J. Bombay Nat. Hist. Soc. 72: 846-847.

Nakamura, K. 1975. [On a Red-necked Phalarope encountered [in a] typhoon during migration.] Tori 23: 95-96. [In Japanese with English summary.]

Schmidt, G. 1975. Beobachtungen uber den Wegzug des Odinswassertreters aus nordnorwegischen Brutgebieten an der Barents-See. Beitr. Vogelkd. 21: 233-244. [In German.]

Vermeer, K. and G. G. Anweiler. 1975. Oil threat to aquatic birds along the Yukon coast. Wilson Bull. 87: 467-480.

1974

Eller, G. D. 1974. Northern Phalarope in upper east Tennessee. Migrant 45: 96.

Kopke, G. 1974. Odinswassertreter (Phalaropus lobatus) im Juni auf Baltrum. Vogelkd. Ber. Nieders. 6: 18.

Seeger, J.-J. 1974. Odinswassertreter am Gulper See. Falke 21: 284.

Steinbach, R. 1974. Vorkommer der wassertreter Phalaropus lobatus (L.) und Phalaropus fulicarius (L.) im Gebiet der Haselbachar und Eschefelder Teiche sowie am Speicherbechten Windischleuba. Abh. Ber. Naturkundemus. 'Mauritanium' 8: 333-338.

1973

Cox, J. B. 1973. A further occurrence of the Red-necked Phalarope in South Australia. S. Austr. Ornithol. 26: 116-117.

Fevold, H. R., E. W. Pfeiffer and J. S. Rice. 1973. Steroid biosynthesis by phalarope (Steganopus tricolor and Lobipes lobatus) adrenal tissue. Gen. Comp. Endocrinol. 21: 353-357.

Smith, F. T. H. 1973a. Red-necked Phalarope at Altona saltworks (Phalaropus lobatus). Bird Obs. 473: 12.

_____. 1973b. Further to the Altona Red-necked Phalarope. Bird Obs. 477: 4-5.

Stelzer, M. 1973. Uber das Vorkommen der Wassertreter (Phalaropodidae) in der Schweij und ihren Randgebieten. Ornithol. Beob. 70: 157-170. [In German with French summary.]

van Avermaet, G. 1973. Franjepoten. Wielewaal 39: 216-220.

1972

Hilden, O. and S. Vuolanto. 1972. Breeding biology of the Red-necked Phalarope Phalaropus lobatus in Finland. Ornis Fenn. 49: 57-85.

Jovanovic, V. 1972. Novi podaci o seobi liskonoge tankokljune, Phalaropus lobatus, u Vojvodini. Larus 24: 164.

Raner, L. 1972. Forekommer polyandri hos smalnabod simsnappa och svartsnappa? [Polyandry in the Northern Phalarope and the Spotted Redshank.] Fauna Flora 67: 135-138. [In Swedish.]

Schiemann, H. 1972. Uber Winterquartiere nordeuropaischer Odinshuhnchen. [On wintering areas of northern Red-necked Phalaropes (Phalaropus lobatus).] Vogelwarte 26: 329-336. [In German with English summary.]

Vaisanen, R. A., O. Hilden, M. Soikkeli and S. Vuolanto. 1972. Egg dimension variation in five wader species: the role of heredity. Ornis Fenn. 49: 25-44.

1971

Benning, W. E. 1971. Phalaropes hawking insects over the water at Montezuma. Kingbird 21: 11.

Edscorn, J. B. 1971. Northern Phalarope (Lobipes lobatus) occurrences in central Florida. Fla. Nat. 44: 94.

Everett, M. J. 1971. Breeding status of Red-necked Phalaropes in Britain and Ireland. Brit. Birds 64: 293-302.

Hohn, E. O. 1971. Observations on the breeding behaviour of Grey and Red-necked phalaropes. Ibis 113: 335-348.

McGregor, A. 1971. Rare birds: Red-necked Phalaropes. Bird Life 7: 2-5.

Pringle, J. S. and W. S. Pringle. 1971. Red-necked Phalarope Phalaropus lobatus at Strandfontein. Ostrich 42: 228-229.

Scholz, J. 1971. Odinswassertreter (Phalaropus lobatus) am Schlammteich bei Artern. Beitr. Vogelkd. 17: 174-175.

Verheyen, J. A. 1971. Red-necked Phalarope Phalaropus lobatus in the Island of Flores, Indonesia. Ardea 59: 64.

1970

Alsop, F. G., III. 1970. Northern Phalarope in the Great Smoky Mountains National Park. Migrant 41: 39-40.

Coffey, J. W. 1970. Northern Phalarope in Washington County. Migrant 41: 66-67.

Haight, T. 1970. Northern Phalarope in Dutchess County. Kingbird 20: 179-180.

Hohn, E. O. 1970. Gonadal hormone concentrations in Northern Phalaropes in relation to nuptial plumage. Can. J. Zool. 48: 400-401.

Lowery, G. H., Jr. 1970. The Louisiana state list. La. Ornithol. Soc. News 56: 1-7.

1969

Bates, A. K. and M. L. Bierly. 1969. White-rumped Sandpipers, Northern Phalaropes, Ruddy Turnstones, Gull-billed Terns and Stilt Sandpipers at Marion Fish Hatchery. Ala. Birdlife 17: 52-54.

Eckert, J. 1969. Red-necked Phalarope in south Australia. Emu 69: 184-186.

Eriksson, K. 1969. Weibchenschwarme des Odinswassertreters (*Phalaropus lobatus*) und die Datierung ihrer Gelege in Finnisch Lappland. [On the flocking of female Red-necked Phalaropes (*Phalaropus lobatus*) during the breeding season and on the time of egg-laying in Finnish Lappland.] Ornithol. Mitt. 21: 157-160. [In German with English summary.]

Hohn, E. O. 1969. The Phalarope. Sci. Am. 220: 104-111.

Schoennagel, E. 1969. Gehauftes Auftreten des Odinswassertreters (*Phalaropus lobatus*) auf der Insel Borkum (Nordsee). Ornithol. Mitt. 21: 18.

Smith, F. T. H. 1969. The Red-necked Phalarope near Melbourne. Austr. Bird Watcher 3: 166-167.

1968

Gerasimov, N. N. 1968. [Breeding of the Red-necked Phalarope in Kamchatka.] Ornitologiya 9: 344-345. [In Russian.]

Glayre, D. 1968. Un Phalarope a bec etroit sejourne dix jours a Chavornay. Nos Oiseaux 29: 275-276.

Hohn, E. O. 1968. Some observations on the breeding of Northern Phalaropes at Scammon Bay, Alaska. Auk 85: 316-317.

Masters, G. 1968. Black-necked Stilts and Northern Phalaropes at Jekyll Island, Ga. Oriole 33: 50-51.

Plucinski, A. 1968. Odinswassertreter (*Phalaropus lobatus*) bei Goslar. Ornithol. Mitt. 20: 239.

1967

Kumerloeve, H. and P. A. D. Hollum. 1967. Zum durchzug von *Phalaropus lobatus* (L.) in Kleinasien. Vogelwarte 24: 64-65.

1966

Hohn, E. O. 1966. Ringing (banding) and recoveries of phalaropes--a summary of presently available information. Bird-Banding 37: 197-200.

Warfield, R. W. 1966. Vagrant Northern Phalarope at Lilypons. Md. Birdlife 22: 14-15.

1965

Dittberner, H. and W. Dittberner. 1965. Sturmmowe, Larus canus, brutend und Odinswassertreter, Phalaropus lobatus rastend am Grossen Schwerin (Muritz). Beitr. Vogelkd. 11: 103-105.

Hohn, E. O. 1965. Die Wassertreter. Neue Brehn-Bucheri 359. Ziemsen Verlag, Wittenberg. 60 pp.

Turk, M. 1965. Northern Phalarope at Dauphin Island. Ala. Birdlife 13: 42.

1964

Clark, W. S. 1964. An unusual visitor (Northern Phalarope). Ala. Birdlife 12: 12.

Rittinghaus, H. 1964. Phalaropus lobatus (Phalaropodidae) Nahrungserwerb. Pp. 309-311 in G. Wolf (Ed.) Encyclopedia Cinematographica, Inst. fur den Wissenschaftlichen Film, Gottingen. [In German.]

1963

Smith, F. T. H. 1963. An Australian sight record of the Red-necked Phalarope (Phalaropus lobatus). Austr. Bird Watcher 2: 1-4.

1962

Longstreet, R. J. 1962. Northern Phalarope (Lobipes lobatus) on Lake Monroe. Fla. Nat. 35: 92.

Pocock, T. N. 1962. Red-necked Phalarope Phalaropus lobatus and other birds at Iscor Dams, Vanderbijl Park. Ostrich 33: 41-44.

1961

Smith, E. D. 1961. Northern Phalarope on Lake Murray, South Carolina. Chat 25: 68.

1959

Hall, G. A. 1959. A late record for Northern Phalarope in West Virginia. Wilson Bull. 71: 194.

Ogden, J. 1959. Northern Phalaropes at Nashville. Migrant 30: 55.

1958

Bellier, L. and R. Leveque. 1958. Phalarope a bec etroit en Camargue. Alauda 26: 230. [In French.]

1957

Haftorn, S. 1957. Om foreldrenes omsorg for egg og unger hos svommesnipe, _Phalaropus lobatus_ (L.) and temmincksnipe, _Calidris temminckii_ (Leisl.). [On parental care in _Phalaropus lobatus_ (L.) and _Calidris temminckii_ (Leisl.).] K. Nor. Vidensk. Selsk. Mus. Arbok 1957: 12-144.

Harrisson, T. 1957. Red-necked Phalarope, _Lobipes lobatus_ (Linnaeus) in south-east Asia. J. Bombay Nat. Hist. Soc. 54: 947.

Morzer Bruijns, W. F. J. and M. F. Morzer Bruijns. 1957. Waarnemingen van de Grauwe Franjepoot, _Phalaropus lobatus_ (L.), in de Indischm Oceaan. [Observations of the Red-necked Phalarope, _Phalaropus lobatus_ (L.), in the Indian Ocean.] Ardea 45: 72-84. [In Dutch with English summary.]

1956

Christensen, N. H. 1956. Odinshanens (_Phalaropus lobatus_ L.) og Thorshanens (_Phalaropus fulicarius_ L.) forekomst i Danmark. [The occurrence in Denmark of the Red-necked Phalarope (_Phalaropus lobatus_ L.) and the Grey Phalarope (_Phalaropus fulicarius_ L.] Dan. Ornithol. Foren. Tidsskr. 50: 191-206. [In Danish with English summary.]

Mester, H. 1956. Odinshuhnchen (_Phalaropus lobatus_) bei Frondenberg/Ruhr. Ornithol. Mitt. 8: 53.

1955

Geroudet, P. 1955. Le passage des phalaropes en Suisse romande. Nos Oiseaux 23: 42-47. [In French.]

Stimson, L. A. 1955. Northern Phalarope. Fla. Nat. 28: 29.

1954

Maluquer, S. M. 1954. _Phalaropus lobatus_ en Espana. Ardeola 1: 121-122

1953

Alexander, H. G. 1953. Rednecked Phalarope near Delhi. J. Bombay Nat. Hist. Soc. 51: 507.

Berndt, R. and R. Reinecke. 1953. Erstnachweis des Odinswassertreters, *Phalaropus lobatus* (L.) fur das Braunschweiger Hugelland. Ornithol. Mitt. 5: 6.

Meier, H. 1953. Schmalschnabliger Wassertreter im Urner Reussdelta. Ornithol. Beob. 50: 32.

Mouchet, E. 1953. Le Phalarope a bec etroit aux Grangettes. Nos Oiseaux 22: 72.

1952

Eberhardt, R. L. 1952. Northern Phalaropes and Xanthus Murrelet associated with fishes. Condor 54: 314.

Simon, H. 1952. Observation d'un Phalarope hyperbore dans le Calvados. Oiseau Rev. Fr. Ornithol. 22: 322.

1951

Hanstrom, R. 1951. Den smalnabbade simsnappen, en originell svensk smavadare. Fauna Flora 1/2: 57-66.

[Wood, J. D.]. 1951. Studies of some species rarely photographed XXXI. The Grey [and] Red-necked Phalarope. Brit. Birds 44: 235-236.

1950

Nevin, W. S. 1950. Red-necked Phalarope on the Kent-Susses border. Brit. Birds 43: 191-192.

1949

Longstreet, R. J. 1949. Flock of Northern Phalaropes at Daytona Beach, Florida. Auk 66: 204.

van Ijzendoorn, A. L. J. 1949. A preening phalarope (*Lobipes lobatus*). Auk 66: 89-90.

1948

Walkinshaw, L. H. 1948. Nestings of some shorebirds in western Alaska. Condor 50: 220-223.

1945

Vaughan, R. 1945. A rare visitor. Country Life 97: 1001.

1943

Cole, L. J. 1943. Behavior of Northern Phalarope with young. Condor 45: 39.

1938

Michael, C. W. 1938. Behavior of Northern Phalaropes. Condor 40: 85.

1937

Low, G. C. 1937. Grey and Red-necked Phalaropes in the Arabian Sea. Ibis (14th Ser.) 1: 866.

Meinertzhagen, R. 1937. Grey and Red-necked Phalaropes in Arabian Sea. Ibis (14th Ser.) 1: 667.

Sits, E. 1937. Beobachtungen uber *Phalaropus lobatus* an der Matsulu Bucht. Ann. Soc. Nat. Univ. Tartu 43: 16-24.

Wust, W. 1937. Schmalschnabliger Wassertreter, *Phalaropus lobatus* (L.) bei Ismaning erlegt. Anz. Ornithol. Ges. Bayern 2: 449-450.

1935

Tinbergen, N. 1935. Field observations of East Greenland birds. I. The behaviour of the Red-necked Phalarope (*Phalaropus lobatus* L.) in spring. Ardea 24: 1-42.

1934

Bonami, L. 1934. Cattura di un Falaropo a becco sottile (*Phalaropus lobatus* [L.]). Studi Trentini 15: 196-197.

Chamberlain, E. B. 1934. Northern Phalarope in South Carolina. Auk 51: 519-520.

1933

Sprunt, A., Jr. 1933. Second occurrence of Northern Phalarope in South Carolina. Auk 50: 358-359.

Stone, W. 1933. Northern Phalaropes on the New Jersey coast. Auk 50: 475-476.

Taning, A. V. 1933. The winter quarters of the phalaropes. Ibis (13th Ser.) 3: 132-133.

Young, C. G. 1933. The winter quarters of the phalaropes. Ibis (13th Ser.) 3: 548.

1932

Urner, C. A. 1932. Phalaropes in New Jersey in spring. Auk 49: 475-476.

1931

Glegg, W. E. 1931. On the nesting of the Red-necked Phalarope in Shetland. Oologists' Rec. 9: 10-14.

1929

Poole, E. L. 1929. Northern Phalarope (_Lobipes lobatus_) in Pennsylvania. Auk 46: 108.

Townsend, C. W. 1929. Breeding range of the Northern Phalarope (_Lobipes lobatus_). Auk 46: 108-109.

1928

Schorger, A. W. 1928. The wintering area of the Red and Northern Phalaropes. Auk 45: 206.

1927

Momiyama, T. 1927. [On the specimens of _Lobipes lobatus_ obtained at Prefect. Saiitama, Hondo.] Tori 5: 267-271. [In Japanese.]

1926

Grote, H. 1926. Zur Verbreitung von _Phalaropus lobatus_ (L.) und _Phalaropus fulicarius_ (L.). Ornithol. Monatsber. 34: 122.

Spingarn, E. D. W. 1926. Northern Phalarope in Dutchess County, N.Y. Auk 43: 90-91.

1925

Meinertzhagen, R. 1925. The distribution of the phalaropes. Ibis (12th Ser.) 1: 325-344.

Rapine, J. 1925. Les Phalaropes. Rev. Fr. Ornithol. 17: 54-56.

Wetmore, A. 1925. Food of American phalaropes, avocets, and stilts. U.S. Dep. Agric. Bull. 1359. 20 pp.

1923

Tschusi zu Schmidhoffen, V. 1923. _Phalaropus fulicarius_, _P. lobatus_ und _Acanthis flavirostris_ in Oberosterreich. Ornithol. Monatsber. 31: 62.

1921

Gordon, A. 1921. A note on the nesting of the Red-necked Phalarope. Brit. Birds 15: 90-91.

1915

Selous, E. 1915. A diary of ornithological observations made in Iceland during June and July, 1912. Zoologist 19 (Ser. 4): 54-56, 169-174, 303-307, 20: 54-68, 139-152, 267-272.

1914

Best, M. G. S. and M. D. Haviland. 1914. Notes on the Red-necked Phalarope in the Outer Hebrides. Brit. Birds 8: 9-12.

1910

Brimley, H. H. 1910. Northern Phalarope in Bladen County, North Carolina. Auk 27: 206.

Morris, R. O. 1910. Capture of the Northern Phalarope near Springfield, Mass. Auk 27: 79.

1909

Smith, C. B. 1909. "Sundhani". Avic. Mag. 7: 309-311.

1908

Bahr, P. H. 1908. Some observations on the breeding habits of the Red-necked Phalarope. Brit. Birds 1: 202-207.

Service, R. 1908. Red-necked Phalarope in Solway Area. Ann. Scott. Nat. Hist. 1908: 253.

1907

Gladstone, H. S. 1907. The Red-necked Phalarope in Ireland. Brit. Birds 1: 174-177.

1905

Wayne, A. T. 1905. Notes on certain birds taken or seen near Charleston, South Carolina. Auk 22: 395-400.

1903

Williams, E. 1903. Breeding of the Red-necked Phalarope in Ireland. Irish Nat. 12: 41-45.

1901

Forrest, J. 1901. Red-necked Phalarope (*Phalaropus hyperboreus*) in North Wales. Zoologist 1901: 428.

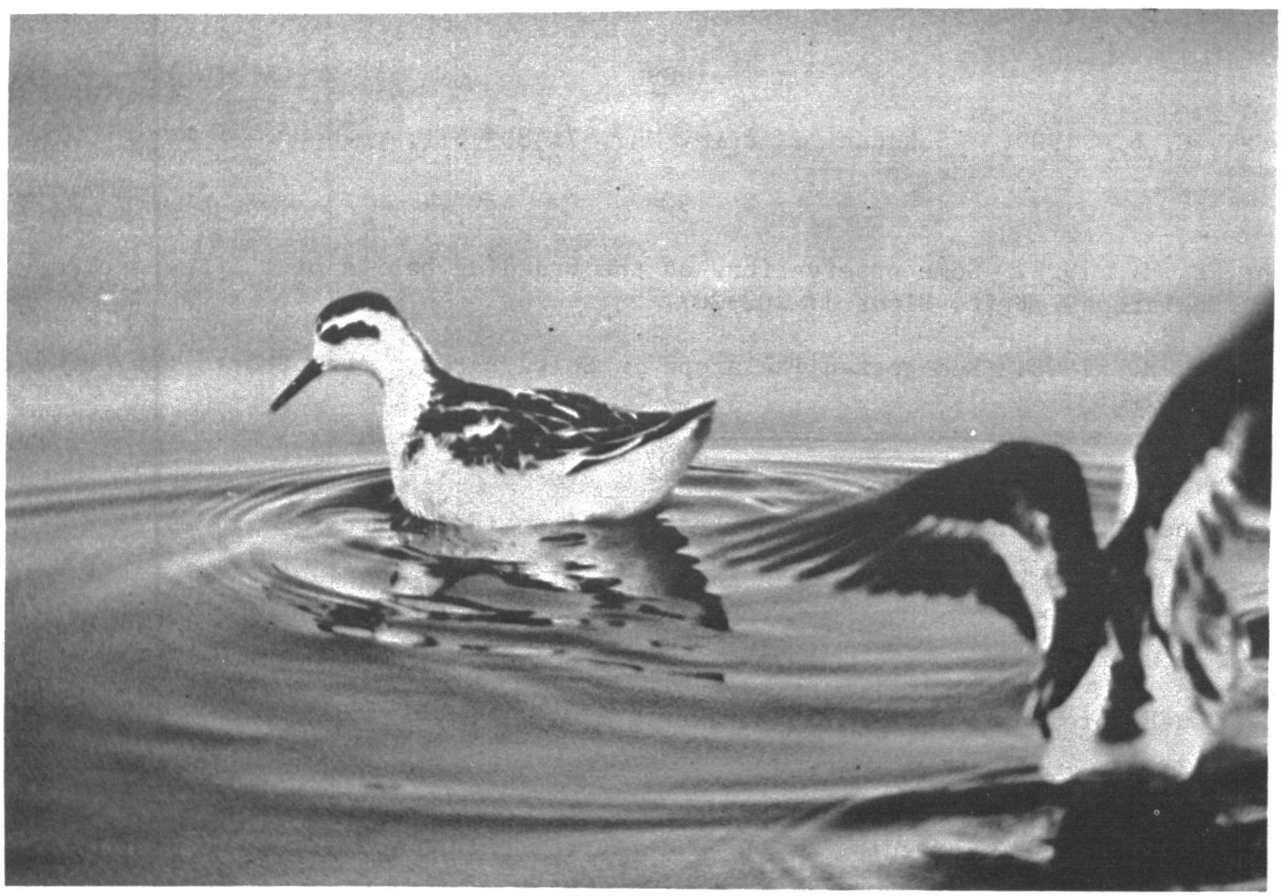
Gaal de Gyula, G. 1901. Der *Phalaropus lobatus* (L.) in der Vogelfauna des Balaton-See. Aquila 8: 295-296.

1880

Loomis, L. M. 1880. The Northern Phalarope in Chester County, South Carolina. Bull. Nuttall Ornithol. Club 5: 242.

1878

Coues, E. 1878. The Northern Phalarope in North Carolina. Bull. Nuttall Ornithol. Club 3: 40-41.



Red-necked Phalarope in winter plumage. Photograph by Clayton Taylor.

RED PHALAROPE

(*Phalaropus fulicaria*)

[DA: Thorshane, DU: Rosse franjepoot, EN: Grey Phalarope, FI: Vesipaasky, FR: Phalarope a bec large, GE: Thorshuhnchen, Thorswassertreter; IC: Thorshani, IT: Falaropo a becco largo, JA: Hai-iro hire-ashi shigi, NW: Polarsvommesnipe, PO: Platkonog plaskodzioby, PR: Falarodo, RU: (Flat-nosed Phalarope), SP: Falaropo picogrueso, Chorlillo norteno; SW: Brednabbad simsnappa]

GENERAL DISTRIBUTION

North America The breeding range of the Red Phalarope in North America overlaps that of the Red-necked Phalarope but extends considerably farther north. This species breeds from western and northern Alaska east across Canadian Arctic islands to Baffin Island and north to northern Ellesmere Island. Along the Canadian mainland it breeds in northern Mackenzie, eastern Keewatin, northern Quebec (AOU 1957, Godfrey 1966), and probably northern Labrador (Godfrey 1966).

North American populations migrate south along both coasts and in the Pacific and Atlantic Oceans to winter off South America (AOU 1957).

World Distribution In the Old World, Red Phalaropes breed from Greenland and Iceland east through the Arctic islands of Spitsbergen and southern Novaya Zemlya to the Novosibirskiye Islands. Along the mainland they breed across northern Siberia from the Taimyr Peninsula east to the Chukotski Peninsula and the coast of Anadyrland (AOU 1957, Vaurie 1965).

Primary wintering grounds are at sea off both coasts of South America south to Patagonia and the Falklands, off west Africa south to southern Arabia, and probably in the Pacific off the Bonin Islands and Seven Islands of Izu (Vaurie 1965) south to New Zealand (AOU 1957).

DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

North Carolina Red Phalaropes occasionally occur along the coast of North Carolina (Pearson et al. 1942) and are seen inland infrequently. Through the early 1960's there were few records, but with the recent increase in offshore observations, it has become clear that the Red Phalarope is a regular migrant that is sometimes encountered in large numbers (Lee and Booth 1979). Most migration occurs between 30 September and 29 December, and again between 8 March and 4 May according to Lee and Booth (1979). They suggested that the species may winter in North Carolina waters because large numbers are seen in late December and early April.

Lee and Booth (1979) implied there were at least 43 records of Red Phalaropes occurring in North Carolina. We found about 40 published records, but list below only coastal records that involve five or more birds. Seven or eight records are for inland localities where these phalaropes occur from 30 September through 21 March. There are records for all intervening months except February; all other records are from the coast or offshore.

1896	2 or 3 Apr.	ca. 12	found dead at Cape Lookout Lighthouse	Pearson et al. 1942
1907	8 Apr.	6	coll. at Bodie Island	Pearson et al. 1942
1907	17 Apr.	6	coll. at Bodie Island	Pearson et al. 1942
1937	1, 3 May	2,8	seen at Pea Island NWR	Pearson et al. 1942
1956	14 Apr.	23	seen (3 coll.) at Pea Island NWR	Chamberlain 1956b
1965	24 Apr.	72	seen 30 mi ESE Wrightsville Beach	Jones 1965
1966	9 Apr.	149	seen S of Beaufort	Parnell 1966b
1966	23 Apr.	1,000+	seen 6 mi off Wrightsville Beach	Parnell 1966b
1966	4 Sep.	88	seen off Hatteras Inlet	Parnell 1967a
1973	6 Dec.	200	seen 5 mi off Charleston	Teulings 1974b
1974	14 Nov.	150	seen in 3 flocks, 40-50 mi NE Charleston	Teulings 1975a
1975	26 Jan.	28	seen inshore, Wrightsville Beach	Teulings 1975b
1975	Aug.-Oct.	"a few"	seen in Cape Hatteras area	Teulings 1976a
1977	29 Dec.	100's-1,000's	seen off North Carolina	Lee and Booth 1979
1978	4 Apr.	100's-1,000's	seen off North Carolina	Lee and Booth 1979
1978	17 Apr.	1,100	seen in Gulf Stream off Oregon Inlet	Teulings 1978a
1978	14 Nov.	8	seen off Oregon Inlet	LeGrand 1979a
1978	5 Dec.	100's-1,000's	seen off North Carolina	Lee and Booth 1979

1978	30 Dec.	100's-1,000's	seen off North Carolina	Lee and Booth 1979
1979	23 Apr.	1,000+	seen off Oregon Inlet	LeGrand 1979c

South Carolina Burton (1970) considered the Red Phalarope the rarest of the three phalaropes in South Carolina. He added two records to the two certain ones reported by Sprunt and Chamberlain (1949). There are four additional records, all from offshore. The numbers seen suggest that the status of this species in South Carolina is similar to its status in North Carolina, i.e., common to abundant in late fall and early winter, as well as in early spring. The birds seen in 1898 were not positively identified as Red Phalaropes, but considering the difference in seasonal abundance between this species and the Red-necked Phalarope off the Atlantic coast, this identification is the most probable.

1898	17 Mar.	"enormous flocks"	seen ca. 50 mi off northern coast	Sprunt and Chamberlain 1949
1900	4 Dec.	1	male caught at Mt. Pleasant	Sprunt and Chamberlain 1949
1934	22 Apr.	1	seen near Charleston Lightship	Sprunt 1934
1960	11 June	1	seen off Cape Island near McClellansville	Baldwin 1960
1963	15 Sep.	1	seen on pond near Wallace River, Rantowles, Charleston Co.	Shuler 1964
1964	12 Mar.	21	seen 26-30 mi SE Charleston Harbor	Sykes 1966
1972	30 May	2	seen offshore 35 mi ESE Charleston	Teulings 1972c
1973	6 Dec.	ca. 200	seen 5 mi off Charleston	Teulings 1974b
1974	14 Nov.	125	seen 40-50 mi NE Charleston	Teulings 1975a

Georgia Denton et al. (1977) considered the Red Phalarope accidental in Georgia and listed only two records. One phalarope was collected 29 October (Denton et al. 1977) or 5 November 1970 (Teulings 1971a) inland at Thomaston, 50 mi NE of Columbus. Another was seen 28 mi off St. Simons Island 8 March 1975 (Teulings 1975b). We know of no records since then but believe that these phalaropes are almost certainly abundant offshore; they go unrecorded for lack of observation.

Florida - Atlantic Coast Kale (1979 ms a) reported that this species is rare offshore during migration and in winter. The number of reports for the Florida Atlantic coast are few (ca. 37), but the numbers seen offshore during recent surveys make it clear that Red Phalaropes are common and at times abundant. Too few data are available to delineate periods of peak abundance or to estimate total populations occurring offshore.

Howell (1932) and Sprunt (1954) together listed eight observations for the Atlantic coast of Florida; we found another 29, almost half of them made since 1970. We list below only those published subsequent to Sprunt (1954) and those known to involve more than one bird. Extreme dates of occurrence range from 23 July to 27 April, but a preponderance (ca. 85%) of the records are from 14 August to 27 March.

1956	2 Jan.	small numbers	seen 10-20 mi off Cocoa Beach	Stevenson 1956b
1956	27 Mar.	small numbers	seen 10-20 mi off Cocoa Beach	Stevenson 1956b
1959	7 Feb.	7	seen 10 mi off Miami	Stevenson 1959b
1960	Mar.	ca. 500	seen off Canaveral	Stevenson 1960b, 1961
1964	31 July	20	seen 18 mi off Cocoa	Stevenson 1964b
1967	16 Feb.	22	seen at Jacksonville Beach	Stevenson 1967b
1971	27 Apr.	2	seen 10-30 mi E Port Canaveral	Kale 1971
1971	14 Aug.	31	seen 15-28 mi off Cocoa	Ogden 1971
1971	5 Sep.	500	seen off Port Canaveral	Robertson 1972
1972	22 Jan.	20-100	seen off Jacksonville	Stevenson 1972a
1972	23 July	2	seen off Cocoa	Ogden 1972
1973	21 Jan.	19	seen off Mayport	Woolfenden 1973
1973	2 Aug.	8	seen off Canaveral	Edscorn 1974
1973	9 Sep.	120+	seen 24 mi off Mayport	Edscorn 1974
1974	28 July	4	seen 20 mi off Cocoa	Ogden 1974
1975	7 Sep.	67	seen on peak count off Mayport	Edscorn 1976
1977	23 Jan.	400±	seen 10-15 mi off Canaveral	Stevenson 1977
1977	11 Sep.	20	seen off Boynton Inlet	Edscorn 1978

Florida - Gulf Coast Kale (1979 ms b) considered this species extremely rare on the Florida Gulf coast and inland. Sprunt (1954) listed three records from the coast, and we found only seven since, listed below. The temporal span of these records, all but one involving single birds, is 29 October to 8 May; half of these sightings occurred in November and December. The status of this species offshore may be quite different. Red Phararopes were regularly reported off Pensacola (mostly by commercial fishermen) from 1946 through 1954, in large numbers. Reports published in American Birds and by Weston (1953) reveal that birds were seen on at least 26 individual dates during this period. Most of these were summarized by Weston (1953), who concluded that the Red Phalarope could be "considered a regular, and sometimes common, winter resident of the middle northern Gulf of Mexico." He added that all but a few observations were made more than 30 miles out in the Gulf and that only one observation was made as near as 5 miles. These observations spanned a period from 13 October (Weston 1953) through 11 April (Newman 1954); the largest numbers of birds were seen from late December through late February. We do not list these offshore records or the three records given by Sprunt (1954) here, but include them in Table 9.

1957	21 Apr.	1	seen on inland pond at Pensacola	Newman 1957b
1959	7 May	3	seen 5 mi off Manasota Key	Stevenson 1959c
1962	30 Nov.	1	found inland at WCTV Tower	Stevenson 1967a
1965	8 May	1	seen near Alligator Point	Cunningham 1965b
1966	21 Nov.	1	found inland at WCTV Tower	Stevenson 1967a
1967	6 Dec.	1	seen inland at Lake Talquin	Stevenson 1968a
1975	27 Nov.	1	found injured at Navarre	Purrington 1976

Alabama Imhof (1976b) considered the Red Phalarope regular and sometimes common in winter off the Alabama coast, primarily on the basis of observations made out of Pensacola Bay. Imhof (1976b) listed five records off Pensacola from 29 October 1946 (Weston 1947) through 23 December 1954 (Newman 1955). He pointed out that these observations could have been made off either the Alabama or Florida coasts. We have chosen to include these observations with the Florida Gulf coast records for the purposes of Table 9. The only other observations available to Imhof (1976b) were four from inland; we know of only two subsequent reports, one from inland, one from offshore. Numbers present in Alabama waters remain a mystery. Duncan and Havard (1979 ms) saw only one bird off Alabama in several years of observation, but they mentioned that commerical fishermen in Alabama report large numbers of phalarope-like birds in winter.

1924	last half Jan.	1	coll. inland at Pickett Springs	Holt 1924
1968	20 Oct.	1	seen inland in Shelby Co.	Purrington 1969
1972	5-11 Jan.	1	seen inland at Lake Purdy	Imhof 1976b, James 1972

1972	10-15 Sep.	1	photogr. inland at Lake Purdy	Imhof 1976b, 1973
1976	May	1	female seen 100 km off Alabama coast	Duncan and Havard 1979 ms
1978	5 Nov.	1	seen inland at Eufaula Refuge	Purrington 1979

Mississippi We know of only three records for the Red Phalarope from Mississippi. One was seen inland on the Hattiesburg sewage lagoons on 9 October 1977 (Gates and Runzo 1978) and another was seen there 12 to 15 October 1980 (Moore et al. 1981). The only record from the coast is of one seen off Biloxi on 30 September 1978 (Purrington 1979). It is likely that the species is more common offshore.

Louisiana We know of only three records of Red Phalaropes in Louisiana: one was collected 12 October 1950 on the Baton Rouge Campus of Louisiana State University; another was collected 16 September 1961 1 mi W of Holly Beach, Cameron Parish; and one was seen 29 November-10 December 1970 at the Natchitoches Fish Hatchery (Lowery 1974). Lowery commented that these phalaropes should occur in offshore waters in winter.

Texas According to Oberholser (1974), Red Phalaropes are casual in Texas in fall and accidental in spring. We know of only 18 records of this species in Texas, 11 of which are listed by Oberholser (1974). We list below only records from coastal areas and those published subsequent to Oberholser (1974). Two-thirds of the records were made inland and all but four records were made in the fall or early winter (8 September-24 November). There are three spring records (1 April-31 May), and one summer record (15 July); the latter was probably an early fall migrant. These four records are all from the coast, suggesting that Red Phalaropes are more common there than inland in spring and summer.

1935	1 Apr.	1	seen at Cove	Oberholser 1974
1952	5-6 Oct.	1	seen at Rockport	Oberholser 1974
1952	9 Oct.	1	seen on W shore of Laguna Atascosa	Oberholser 1974
1973	19-28 Sep.	1	seen inland at Austin sewage pond	Webster 1974a
1975	13 Sep.- 1 Nov.	2	seen inland at Austin sewage ponds	Webster 1976a
1975	15 Nov.	1	seen inland at Mitchell Lake, San Antonio	Webster 1976a
1976	31 May	1	female seen at Bolivar Flats, Galveston	Webster 1976c

1977	8 Mar.	11	seen (incl. 4 females) off Port Aransas	Webster 1977c
1978	15 July	1	photogr. at Laguna Atascosa NWR	Webster 1979a
1978	4 Nov.	1	seen inland at Austin sewage ponds	Webster 1979a

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

Breeding The Red Phalarope has the most northerly distribution of the three phalaropes, breeding circumpolarly in the northern Holarctic between 60° and 82° N latitude (BOU 1971). They breed from northern and western Alaska through northern Quebec, Greenland, and Iceland, along the Arctic Eurasian coast, and on islands from Spitsbergen east to Siberia.

Winter The winter range of the Red Phalarope is at sea and believed to be primarily off the coasts of southern South America, western Africa, and southern Arabia.

Migration Red Phalaropes migrate along continental coastlines and over the broad expanses of the Atlantic, Pacific, and Indian Oceans. They are common migrants off the southeastern Atlantic coast of the United States that occasionally winter. They occur later in the fall and earlier in the spring along the Atlantic coast than do Red-necked Phalaropes (Lee and Booth 1979, Tables 9, 10). Along the Pacific coast of the United States Red Phalaropes migrate about one month later than do Red-necked Phalaropes. The spring migration there is short and usually near the coast; fall migation is longer and birds are found over a wider area and farther out to sea (Taylor 1978).

Migrants usually occur singly or in small flocks. Rowlett (1980) reported that Red Phalaropes in the northern Chesapeake Bight are seen in flocks of 20 to 80 birds in April and December, Scott (1959) observed that migrants in the Bay of Fundy in August generally occur in flocks of 15-30 birds, but noted two flocks that contained at least 500 birds.

The status of the Red Phalarope in the northern Gulf of Mexico is largely unresolved and there are few recent records from any state, leading Duncan and Havard (1979 ms) to regard it as casual in occurrence. On the other hand, scattered observations (Weston 1953, Duncan and Havard 1979 ms) suggest that it may be periodically, perhaps regularly, common in some offshore areas. More extensive pelagic surveys are needed to define its temporal, geographical, and numerical distribution in the northern Gulf. Although Red Phalaropes occur commonly and are at times numerically abundant off the southeastern coast, the proportion of the world or continental population of the species that occurs there must be very small.

Table 9. Approximate number of Red Phalaropes recorded by month for the coastal southeastern United States (a).

State/region	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
North Carolina	28	1	14	3456	10	-	-	4	96	5	160	503
South Carolina	-	-	21	1	2	1	-	-	1	-	125	200
Georgia	-	-	1	-	-	-	-	-	1	-	-	-
Florida-Atlantic Coast	447	30	503	41	-	-	26	41	689	1	1	5
Subtotal-ATLANTIC COAST	475	31	539	3498	12	1	26	45	787	6	286	708
Florida-Gulf Coast	227	667	87	36	4	-	-	-	-	24	35	1033
Alabama	2	-	-	-	1	-	-	-	1	1	1	-
Mississippi	-	-	-	-	-	-	-	-	1	2	-	-
Louisiana	-	-	-	-	-	-	-	-	1	1	1	1
Texas-Coast	-	-	11	1	1	-	1	-	-	2	-	-
Subtotal-GULF COAST	229	667	98	37	6	-	1	-	3	30	37	1034
TOTAL-ALL AREAS	704	698	637	3535	18	1	27	45	790	36	323	1742

(a) Birds found dead in the first 10 days of a month are arbitrarily assigned to the previous month. We assumed only one was seen if the source did not specify whether one or more was seen. If an indefinite number was seen (e.g., "a few", "numbers", "hundreds to thousands"), or if a range was given, we have assumed the smallest number implied by the statement.

Table 10. Dates of occurrence for Red Phalaropes in the coastal southeastern United States.

State	Approximate number of occurrences	Dates of occurrence (a)		
North Carolina	43+	4 September	- 4 May	(29 May, 19-30 August)
South Carolina	9	15 September	- 22 April	(30 May-11 June)
Georgia	2	29 October	- 8 March	
Florida-Atlantic Coast	37	14 August?	- 27 April	(28 July-2 August)
Florida-Gulf Coast	36	13 October	- 21 April	(7-8 May)
Alabama	6	10 September	- 15+ January	(May)
Mississippi	2	30 September	- 9 October	
Louisiana	3	16 September	- 10 December	
Texas	6	5 October	- 1 April	(31 May, 15 July)

(a) Exceptional dates of occurrence are listed in parentheses.

HABITAT

Nesting Red Phalaropes nest primarily in low coastal Arctic tundra. Mayfield (1979) described the nesting habitat at Bathurst Island in the Canadian Arctic as sedge-moss tundra interspersed with freshwater ponds. Similar habitat in eastern Siberia was described by Kistchinski (1975) as polygonal and tussocky moss-sedge tundra rich in swamps, lakes, and temporary ponds. These birds usually nest near water, but the "ponds" may be very small, sometimes only a few square meters in extent (Portenko 1921). Hohn (1969) noted that Red Phalarope nests are never found more than a few miles inland, pointing out that this species is more coastal in its nesting distribution than is the Red-necked Phalarope.

Red Phalaropes on Bathurst Island in the Canadian Arctic usually place their nests among sedges tall enough to cover them but not thick enough to completely conceal the eggs (Mayfield 1979). Mayfield discerned no relationship between nest-site and prominent features of the habitat (e.g., ponds, marsh edge, boulders) except that nests were always on the wetter portions of flats. In eastern Siberia, Red Phalarope nests were found mostly (84.9%, n = 93) among sedges near the edges of temporary ponds or on tussocks in flooded swamps. They nested less frequently along permanent lakes (7.5%), on islets in small lakes (7.5%) or on dry tussocks and ridges in the polygonal tundra (7.5%) (Kistchinski 1975). Sites reported elsewhere include the mossy rim of an Ivory Gull (Pagophila eburnea) nest on bare Seymour Island near Bathurst Island (MacDonald in Mayfield 1979), piles of seaweed in the open in Spitsbergen (Munsterhjelm and LeRoi in Lovenskiold 1964), and shingle (Lovenskiold 1964).

Red Phalaropes, like other phalaropes, tend to nest near one another. Some observers (Kistchinski 1975, Mayfield 1979) have referred to this as clustering of nests; others consider the species to be colonial (Lovenskiold 1964, Kozlova 1961 in Mayfield 1979). Hohn (1965 in Mayfield 1979) stated that all three phalaropes nested "...mostly in loose colonies of four to eight pairs; solitary pairs are rarer." Mayfield (1979) found groups of three to five nests at Bathurst Island, while the largest colony found by Lovenskiold (1964) in Spitsbergen contained 25 pairs.

Nest density, in what Mayfield (1979) considered optimum habitat from 1970 to 1976 at Bathurst Island, averaged 4.9 nests/sq km (12.9 nests/sq mi), but the number of nests present in the 1 sq km (0.39 sq mi) study plot varied from 0 to 14 (0-36.3 nests/sq mi) from year to year. Mayfield pointed out that nest densities reported in other areas were much greater. Citing other authors, he mentioned densities of 7 and 15 pairs/sq km (18.1 and 38.9 pairs/sq mi) on southwestern Baffin Island, and estimates of 20 and 12 pairs/sq km (51.8 and 31.2 pairs/sq mi) for Cambridge Bay, Victoria Island, and Jenny Lind Island, respectively. At a 0.67 sq km (0.26 sq mi) study area near Barrow, Alaska, in 1974 and 1975, densities of 9.0 and 24.0 nests/sq km (23.3 and 62.2 nests/sq mi) were found by Schamel and Tracy (1977). One particularly favorable marsh held 90% of all nests at a density of 44.6 nests/sq km (115.5 nests/sq mi). Mayfield (1979) also noted earlier papers that suggested concentrations of 50-

100 males/sq km (130-260 males/sq mi) in Siberian nesting areas, but he remarked that "the units of area may be misleading if the best nesting areas are attenuated and discontinous."

Feeding On the breeding grounds, Red Phalaropes feed in or near their nesting habitats. Phalaropes near Barrow, Alaska, fed extensively at the edges of shallow (1-2 cm) ponds (Schamel and Tracy 1977). In eastern Siberia, incubating males fed both on temporary ponds and permanent lakes; the latter are used later in the season, after the temporary ponds have dried up, and may be far from the nests (Kistchinski 1975). Red Phalaropes breeding near lagoons and the sea on the Chukchii Peninsula fed near the surf, in the estuaries, and "wherever else they can find much food." When the sea was rough these birds fed between the surf and the shore run-off, but preferred calmer waters such as bays and lagoons (Portenko 1972).

Nonbreeding and Offshore Prebreeding phalaropes arriving at the breeding grounds on the Chukchii Peninsula remain around lagoons where the ice opens sooner than on the sea (Portenko 1972). Postlaying females and nonbreeding males in eastern Siberia depart from the nesting grounds and move to lakes and coastal lagoons; by mid-July virtually all phalaropes except incubating males are found along the seashore (Kistchinski 1975). Some females occur well offshore, particularly among ice floes (Portenko 1972). During migration, the Red Phalarope is the most pelagic of the phalaropes (Mayfield 1979) and is seldom seen inshore. Migrant Red Phalaropes in the northern Chesapeake Bight, north of North Carolina, occasionally fed around small clumps of sargasso weed (*Sargassum* sp.) and along rip tides containing detritus (Rowlett 1980). Red Phalaropes seen here were usually more than 70 km (44 mi) from shore.

FOOD AND FEEDING BEHAVIOR

Red Phalaropes, like Red-necked Phalaropes, feed primarily by surface-seizing, and like that species often exhibit the characteristic "spinning" behavior. Ridley (1980) recently described differences in feeding techniques for three situations: (1) birds on the water and feeding on prey below the surface may immerse the head and neck with the bill pointing vertically downward while tipping up (much in the manner of a dabbling duck); (2) birds feeding on land and at the edge of a pool probe and peck vertically downward; and (3) birds feeding on organisms on the surface or on vegetation seize their prey with the beak held horizontally. Ridley termed these three techniques "deep-feeding", "edge-feeding" and "surface-feeding", and concluded that females on the breeding grounds in Svalbard consistently prefer deep-feeding and that incubating males prefer surface-feeding. Ridley also pointed out that 80% of all pecks were successful in obtaining prey and noted that high rates of pecking were observed in surface-feeding birds while considerably lower ones were seen in edge- and deep-feeders.

Like Red-necked Phalaropes, Red Phalaropes are gregarious throughout the year. They often gather in feeding flocks of four or five birds during the breeding season, but incubating males may also feed solitarily (Kistchinski 1975). Most feeding probably occurs by day, but these phalaropes have also been seen feeding on bright nights (Portenko 1972).

Wetmore (1925) provided the only detailed account of the diet of North American Red Phalaropes, on the basis of 36 stomachs collected from May to November, mostly from the Pribilof Islands. These phalaropes consumed almost entirely animal food. Insects made up most of the diet; the most important food items were beetles (Coleoptera), which made up 27.3% of the bulk, and flies, which accounted for 22.7%. A considerable variety of species was eaten, but only dung-flies (Scatophaga) were found in a large proportion (38.8%) of the stomachs. Crustacea were also frequently taken and represented 33.5% of the bulk eaten. Amphipods were found in 14 stomachs and water-fleas (Daphniidae) were found in three. A number of very small fishes were also eaten; those that could be identified were sculpins (Cottidae). A few spiders, molluscs and other insects were eaten infrequently.

Little recent information from North America is available. Hohn (1971) examined three stomachs from birds collected in June in western Hudson Bay. One contained larval chironomids and small eumelibranchs; the others contained seeds or willow catkins and flowers. Wander (1981) observed a phalarope feeding on the carcasses of a Red Knot (Calidris canutus) and a Herring Gull at Jamaica Bay Wildlife Refuge in New York City.

LeRoi (in Lovenskiold 1964) remarked on the diet of Red Phalaropes on Svalbard, basing his comments on an examination of the contents of 58 stomachs. Of these, 67.2% contained Crustacea, primarily either gammarids or ostracods, depending on where the birds were collected. Also found in a significant proportion of the stomachs were molluscs (46.6%), dipterid larvae (15.5%), and algae (22.4%); a few arachnids, annelids, and one beetle were also taken. Ridley (1980) based a more recent report of food eaten on Svalbard on an analysis of 21 faecal samples obtained during the 1978 breeding season. The diet consisted primarily of small flies; chironomids were most important, but mycetophilids also were eaten commonly. These and a few other flying insects were present in 95% of the samples and were abundant (i.e., more than 10 individual remains) in nearly half of them. Spiders were also important and were found in 63.6% of the samples; the remains of unidentified Crustacea were found in 22%. Ridley (1980) noted that different foods were taken in different habitats. Phalaropes feeding below the surface of the water took fly larvae and Crustacea, surface-feeding birds took flies, and those feeding on land or at the edge of the water took spiders, flies, and (perhaps) Collembola.

In experimental studies, Dodson and Egger (1980) found that Red Phalaropes prefer to feed on larger zooplankton (particularly those more than about 1 mm long). They chose cladocerans over copepods and chose Daphnia middendorffiana, D. pulex, Eurycercus lamellatus, and Diaptomus bacillifer most frequently. Two species of small calanoid copepods (Diaptomus bacillifer and Eurytemora canadensis) were taken more frequently than was predicted on the basis of their size. Dodson and Egger suggested that this may have occurred (1) because phalaropes are somehow specialized for catching copepods; (2) because the smaller, slower food items are more easily caught; and (3) because the smaller copepods are more visible to the phalaropes than the larger, more transparent cladocerans.

SUSCEPTIBILITY TO OIL POLLUTION

We found little record of Red Phalaropes being affected by oil. They are a gregarious, surface-feeding bird that occurs in large numbers off the Atlantic coast, however, and are potentially moderately susceptible to oiling, at least during cold weather. The strongly pelagic distribution of this species suggests that it would be vulnerable only to large offshore spills and not to inshore development.

King and Sanger (1979) gave the Red Phalarope a high oil vulnerability index value indicating that they are among the most vulnerable shorebirds occurring in the northeastern Pacific region. In general, phalaropes are much less susceptible to oiling than other marine birds. Connors and Gelman (1979) reported that naive young Red Phalaropes initially were equally likely to choose pans of food that did or did not have a thin film of oil on the surface of the water. Experienced birds preferred clear water and fed for longer periods. As a result of these observations, Connors and Gelman suggested that phalaropes can easily learn to avoid oiled surfaces.

BIBLIOGRAPHY

1982

Conners, P. G. and K. G. Smith. 1982. Oceanic plastic particle pollution: suspected effect on fat deposition in Red Phalaropes. Mar. Pollut. Bull. 13: 18-20.

Orr, C. D., R. M. P. Ward, N. A. Williams and R. G. B. Brown. 1982. Migration patterns of Red and Northern Phalaropes in southwest Davis Strait and in the northern Labrador Sea. Wilson Bull. 94: 303-312.

1981

Green, J. C. 1981. First Red Phalarope for Minnesota Point. Loon 53: 52-53.

Moore, J. R., T. Fairley, D. Hamilton and P. Rodriguez. 1981. Observations of a Red Phalarope in Hattiesburg, Mississippi. Mississippi Kite 11: 15-17.

Pigeon, P. 1981. Observation d'un Phalarope a bec etroit *Phalaropus lobatus* et d'un Phalarope a bec large *Phalaropus fulicarius* a Aulnois-sous-Laon (Aisne). Alauda 49: 432.

Wander, W. 1981. Red Phalarope eating carrion. Wilson Bull. 93: 557.

1980

Chappell, M. A. 1980. Thermal energetics of chicks of Arctic breeding shorebirds. Comp. Biochem. Physiol. A. Comp. Physiol. 65: 311-317.

Dodson, S. I. and D. L. Egger. 1980. Selective feeding of Red Phalaropes on zooplankton of arctic ponds. Ecology 61: 755-763.

Nistico, P. 1980. Red Phalarope in the Maryland Piedmont at Hughes Hollow. Md. Birdlife 36: 139.

Ridley, M. W. 1980. The breeding behavior and feeding ecology of Grey Phalaropes Phalaropus fulicarius in Svalbard. Ibis 122: 210-226.

1979

Connors, P. G. and S. Gelman. 1979. Red Phalarope responds to thin oil films in foraging experiments. (Abstract only.) Pac. Seabird Group Bull. 6: 43.

Gustafson, D. 1979. A Red Phalarope in Milwaukee. Passenger Pigeon 41: 136.

Maurizio, R. 1979. Thorshuehnchen auf dem Silsersee bei Maloja. [Grey Phalarope at Silser Lake near Maloja.] Ornithol. Beob. 76: 134-135.

Mayfield, H. F. 1979. Red Phalaropes breeding on Bathurst Island. Living Bird 17: 7-39.

Roudybush, T. E., C. R. Grau, M. R. Petersen, D. G. Ainley, K. V. Hirsch, A. P. Gilman and S. M. Patten. 1979. Yolk formation in some charadriiform birds. Condor 81: 293-298.

1978

Brown, A. 1978. Reaction of Grey Phalarope to Sparrowhawk. Scott. Birds 10: 22.

Brown, B. and P. C. M. Latham. 1978. Grey Phalarope in the Bay of Plenty. Notornis 25: 198-202.

Gates, L. and J. Kunzo. 1978. A Red Phalarope in Hattiesburg, Mississippi. Mississippi Kite 8: 2.

Huber, H. 1978. Red Phalarope--Mille Lacs Lake. Loon 50: 45-46.

Mayfield, H. F. 1978. Undependable breeding conditions in the Red Phalarope. Auk 95: 590-592.

Taylor, W. B. 1978. Seasonal status, population size, and habitat utilization of Red and Northern phalaropes in the Southern California Bight. (Abstract only.) Pac. Seabird Group Bull. 5: 74.

1977

Anderson, E. 1977. Red Phalarope at Moorhead. Loon 49: 173.

Savaloja, T. 1977. Minnesota's second Red Phalarope. Loon 49: 44-45.

Schamel, D. and D. Tracy. 1977. Polyandry, replacement clutches and site tenacity in the Red Phalarope (*Phalaropus fulicarius*) at Barrow, Alaska. Bird-Banding 48: 314-324.

Schiemann, H. 1977a. Uber das Vorkommen der Wassertreter (Phalaropodidae) in den brandenburgischen sachsischen und thuringischen Bezirken, souie in Berlin. Beitr. Vogelkd. 23: 49-56.

Sinclair, J. C. 1977. The phalaropes. Bokmakierie 29: 90-91.

Wachtler, D. and G. Wachtler. 1977. Red Phalarope at Moorhead. Loon 49: 172-173.

Watson, G. E. 1977. A second specimen of Red Phalarope from Delaware. Delmarva Ornithol. 12: 49.

1976

Brinkschroder, W. 1976. Beobachtung eines Thorswassertreters (*Phalaropus fulicarius*) im Reg.-Bez. Osnabruck. Vogelkd. Ber. Nieders. 8: 24.

Risebrough, R. W., G. E. Watson and J. P. Angle. 1976. A Red Phalarope (*Phalaropus fulicarius*) in breeding plumage on Anvers Island. Antarct. J. U.S. 11: 226.

Smith, F. T. H. 1976. An Australian record of the Grey Phalarope. Austr. Bird Watcher 6: 292-299.

Wheeler, J. 1976. A new wader for Australia--Grey Phalarope *Phalaropus fulicarius*. Geelong Nat. 13: 52.

1975

Buhler, P. 1975. Thorshuhnchen (*Phalaropus fulicarius*) im Prachtkleid, in Suddeutschland. Jahresh. Ges. Naturkd. Wuerttemb. 129: 78-80.

Heise, G. 1975. Thorwassertreter (*Phalaropus fulicarius*) in der Uckermark. Beitr. Vogelkd. 21: 362-364.

Kazama, T. 1975. [A new record of *Phalaropus fulicarius* from Japan Sea.] Tori 23: 29-30. [In Japanese with English summary.]

Kistchinski, A. A. 1975. Breeding biology and behaviour of the Grey Phalarope *Phalaropus fulicarius* in East Siberia. Ibis 117: 285-301.

van Swelm, N. D. 1975. Foraging behaviour of Grey Phalarope. Bird Study 22: 52.

1974

Adams, R. J., Jr. and D. E. Wood. 1974. First spring record of a Red Phalarope in Michigan. Jack-Pine Warbler 52: 44.

Boyle, G. L. 1974. Grey Phalarope feeding on earthworms. Brit. Birds 67: 352.

Brown, J. F. 1974. Grey Phalaropes (_Phalaropus fulicarius_) near Lagos. Bull. Nigerian Ornithol. Soc. 10: 53.

Gillandt, L. 1974. Beobachtungen an einer Thorshuhnchen-Population (_Phalaropus fulicarius_) in Sudwest-Island (Aves: Charadriiformes: Phalaropodidae). Abh. Verh. Naturwiss. 17: 55-83. [In German.]

Lauermann, H. 1974. Ein Thorshuhnchen (_Phalaropus fulicarius_) am Meiseldorfer Teich. Egretta 17: 23-27.

Marsh, C. and R. J. Hoder. 1974. Red Phalarope in Wake County, N.C. Chat 38: 71-72.

Noer, H. and B. M. Sorensen. 1974. Forekomen af stormfugle Procellariae, Thorshane _Phalaropus fulicarius_ og Sabinemage, _Xema sabini_ ved Blavandshuk 1963-71. Dan. Ornithol. Foren. Tidsskr. 68: 15-24.

Steinbach, R. 1974. Vorkommer der wassertreter _Phalaropus lobatus_ (L.) und _Phalaropus fulicarius_ (L.) im Gebiet der Haselbachar und Eschefelder Teiche sowie am Speicherbechten Windischleuba. Abh. Ber. Naturkundemus. 'Mauritanium' 8: 333-338.

1973

But'ev, V. T. 1973. [On the nesting of the Grey Phalarope in the north of Novaya Zemla Is.] Ornitologiya 10: 329-330. [In Russian.]

Fitzpatrick, J. 1973. Great Crested Grebes attacking Grey Phalarope and Storm Petrel. Brit. Birds 66: 365.

Kistchinskii, A. A. and Y. I. Chernov. 1973. Notes on the foods of the Grey Phalarope in the tundra of east Siberia. Moscow Society of Naturalists. Fauna and Ecology of Waders. Issue 1: 61-64.

Kocian, L. 1973. Novy vyskyt lyskonoha ploskozobeho _Phalaropus fulicarius_ (L., 1758) na Slovenska. [New record of _Phalaropus fulicarius_ (L., 1758) in Slovakia.] Zb. Slov. Nar. Muz. Prir. Vedy 19: 197. [In Czech with German summary.]

Lok, C. M. 1973. Some observations on the Grey Phalarope. Sterna 12: 284-285.

Rettig, K. 1973. Thorswassertreter (Phalaropus fulicarius) am Rysumer Nacken [Red Phalarope at Rysum Neck.] Ornithol. Mitt. 25: 222. [In German.]

Sannazzaro, A. 1973. Il Phalaropus fulicarius in Piemonte. [Phalaropus fulicarius in Piedmont.] Riv. Ital. Ornitol. 43: 462-466. [In Italian.]

Schmitz, J.-P. and J. Weis. 1973. Premiere observation et capture du phalarope a bec large (Phalaropus fulicarius) dans le Grand-Duche de Luxembourg. Regulus 11: 3-5.

Stelzer, H. 1973. Uber das Vorkommen der Wassertreter (Phalaropodidae) in der Schweiz und ihren Randgebieten. Ornithol. Beob. 70: 157-170. [In German with French summary.]

van Avermaet, G. 1973. Franjepoten. Wielwaal 39: 216-220.

Webster, R. E. 1973. Short notes. Grey Phalarope. Distribution. Lammergeyer 15: 76.

1972

Portenko, L. A. 1972. Ptisy Chukotskogo poluostrova i ostrova Vrangelya. [Birds of the Chukchii Peninsula and Wrangel Island.] Volume 1. xv and 446 pp. [1981 translation. Amerind Publ. Co., New Delhi.]

Prigge, R. 1972. Beobachtung eines Thorwassertreters (Phalaropus fulicarius) am Treuel/Elbe im Bezirk Magdeburg. Beitr. Vogelkd. 18: 434.

Sehl, R. H. 1972. Red Phalarope in Bucks County. Cassina 53: 46-47.

Summerfield, D. 1972. Red Phalarope in December. Kentucky Warbler 48: 18.

1971

Bond, S. I. 1971. Red Phalarope mortality in southern California. Calif. Birds 2: 97.

Danks, H. V. 1971. A note on the early season food of Arctic migrants. Can. Field-Nat. 85: 71-72.

Fantin, G. 1971. Notizie dal Veneto: il Falaropo becco largo. [Reports from Venice: the Grey Phalarope.] Riv. Ital. Ornitol. 41: 17-24. [In Italian.]

Hohn, E. O. 1971. Observations on the breeding behaviour of Grey and Red-necked phalaropes. Ibis 113: 335-348.

King, B. 1971. Grey Phalarope on autumn passage plunging into waves. Brit. Birds 64: 29-30.

1970

Rettig, K. 1970. Thorswassertreter bei Emden. Ornithol. Mitt. 22: 47.

1969

Hohn, E. O. 1969. The phalarope. Sci. Am. 220: 104-111.

Kittinger, H. H. and J. N. Carusos. 1969. Second inland Red Phalarope record in Alabama. Ala. Birdlife 17: 50-51.

Schiemann, H. 1969. Uber das Vorkommen den Wassertreter (Phalaropodidae) in Suddeutschland. Vogelwelt 90: 184-188.

Schmidt, G. D. 1969. Polymorphus petrochenkoi sp. n. (Acanthocephala) from the Red Phalarope, Phalaropus fulicarius L., in Alaska. J. Parasitol. 55: 335-336.

Sutton, G. M. 1969. The Red Phalarope in Oklahoma. Bull. Okla. Ornithol. Soc. 2: 26-28.

1968

Bengtson, S.-A. 1968. Breeding behaviour of the Grey Phalarope in West Spitsbergen. Var Fagelvarld 27: 1-13.

Ruppell, G. 1968. Phalaropus fulicarius (Phalaropodidae) Bruten. Encyclopaedia Cinematographica. E1381. Angaben zum Film and Filmenhalt, pp. 1-6. [In German.]

1967

Smith, W. and R. Klauke. 1967. A sight record of the Red Phalarope in Alberta. Blue Jay 25: 25.

Spasskij, A. A. and J. N. Konovalov. 1967. Anomotaenia reticulata sp. n. Cestoidea, Dilepididae, a parasite of Phalaropus fulicarius. Vestn. Zool. 1967: 43-48.

1966

Hohn, E. O. 1966. Ringing (banding) and recoveries of phalaropes--a summary of presently available information. Bird-Banding 37: 197-200.

1965

Cooch, F. G. 1965. An example of sinistralism in Red Phalaropes (Phalaropus fulicarius). Auk 82: 276-277.

Hohn, E. O. 1965. Die Wassertreter. Neue Brehm-Bucheri 359. Ziemsen Verlag, Wittenberg. 60 pp.

Woodward, I. D. 1965. The status and distribution of the Grey Phalarope in Hertfordshire. Birds Illust. 11: 150.

1964

Acton, J. R. 1964. Red Phalarope recorded from eastern Washington. Murrelet 45: 11.

Lovenskiold, H. L. 1964. Avifauna svalbardensis, with a discussion on the geographical distribution of the birds in Spitsbergen and adjacent islands. Skr. Nor. Polarinst. No. 129. 460 pp.

Prozesky, O. P. M. 1964. Notes on the Grey Phalarope (Phalaropus fulicarius (Linnaeus)) found at Voortrekkerhoogte, Pretoria, Transvaal. Ostrich 35: 70.

Shuler, J. B. 1964. Sight record of a Red Phalarope in Charleston County, South Carolina. Chat 28: 30.

1963

Lakeman, M. 1963. Red Phalarope at Hunting Creek? Atl. Nat. 18: 250.

1962

Breiding, G. H. 1962. Red Phalarope in West Virginia. Wilson Bull. 74: 288.

1961

Alderson, G. 1961. Inland occurrences of the Red Phalarope in Oregon. Condor 63: 97-98.

Cohen, E. and J. H. Taverner. 1961. Colouration of soft parts of Grey Phalaropes. Brit. Birds 54: 116-117.

1960

Baldwin, W. P. 1960. Red Phalarope at Cape Romain, S.C. Chat 24: 76.

Cowcill, L. and A. Smith. 1960. Grey Phalarope blowing bubbles. Brit. Birds 53: 574.

Milne, B. S. 1960. Huge flocks of Grey Phalaropes in the Isles of Scilly. Brit. Birds 53: 403.

Olier, A. 1960. Phalarope Phalaropus fulicarius au Maroc oriental. Alauda 28: 69-70. [In French.]

1959

George, U. 1959. Thorwassertreter (Phalaropus fulicarius) bei Hamburg. Ornithol. Mitt. 11: 235.

Gilmore, R. M. 1959. Red Phalarope in mid-eastern Pacific. Condor 61: 227.

Lee, H. J. 1959. Grey Phalarope at Lake Nakuru. J. East Afr. Nat. Hist. Soc. 23: 175.

Wilcox, L. 1959. Large flights of Red Phalaropes on Long Island. Kingbird 9: 24-25.

1956

Christensen, N. H. 1956. Odinshanens (Phalaropus lobatus L.) og Thorshanens (Phalaropus fulicarius L.) forekomst i Danmark. [The occurrence in Denmark of the Red-necked Phalarope and the Grey Phalarope.] Dan. Ornithol. Foren. Tidsskr. 50: 191-206. [In Danish with English summary.]

1955

Andrew, D. G. 1955. Note on the display of the Grey Phalarope. Brit. Birds 48: 546.

Geroudet, P. 1955. Le passage des Phalaropes en Suisse romande. Nos Oiseaux 23: 42-47. [In French.]

1954

Sage, B. L. 1954. On the bill-colour of the adult Grey Phalarope in winter plumage. Bull. Br. Ornithol. Club 74: 12.

Young, C. G. 1954. Phalaropes, storm petrels and Barn Owl at sea. Ibis 96: 311.

1953

Adler, O. 1953. Thorshuhnchen im Binnenland Osterreichs. Ornithol. Mitt. 5: 55.

Musacchia, X. J. 1953. A study of the lipids in Arctic migratory birds. Condor 55: 305-312.

Sciple, G. W. 1953. Red Phalarope in Utah. Wilson Bull. 65: 205.

Stanford, W. P. 1953. Winter distribution of the Grey Phalarope Phalaropus fulicarius. Ibis 95: 483-491.

Weston, F. M. 1953. Red Phalarope (*Phalaropus fulicarius*) wintering near Pensacola, Florida. Auk 70: 491-492.

1952

Kennedy, J. 1952. An unusual record of the Grey Phalarope in Southern Rhodesia. Ostrich 23: 122.

1951

[Wood, J. D.]. 1951. Studies of some species rarely photographed. XXXI. The Grey [and] Red-necked Phalarope. Brit. Birds 44: 235-236.

1947

Weston, F. M. and M. M. Wernicke. 1947. The Red Phalarope in Florida. Auk 64: 473.

1946

Walker, W. M. 1946. A Red Phalarope in Tennessee. Auk 63: 102.

1944

Wilson, W. 1944. The Grey Phalarope on Deeside. Proc. Liverpool Nat. Field Club 83: 19-20.

1943

Lowe, W. P. 1943. Grey Phalaropes off the west coast of Africa. Ibis 85: 103.

Wust, W. 1943. Thorshuhnchen, *Phalaropus fulicarius* (L.) im Ismaninger Teichgebiet. Ornithol. Monatsber. 51: 43.

1942

Stanford, J. K. 1942. Grey Phalaropes off the west coast of Africa. Ibis 84: 520.

1941

Einarsen, A. S. 1941. The effects of storm on shore birds. Murrelet 22: 36.

Slipp, J. W. 1941. Notes on the Red Phalarope in the north-west. Murrelet 22: 38.

1939

Griscom, L. 1939. Migration of the Red Phalarope off Massachusetts. Auk 56: 185.

Holmes, P. F. 1939. Some oceanic records and notes on the winter distribution of phalaropes. Ibis (14th Ser.) 3: 329-342.

1938

Michael, C. W. 1938. Feeding behavior of a Red Phalarope. Condor 40: 181.

Stoner, E. 1938. Red Phalarope at Benicia, California. Condor 40: 182.

Wilcox, L. 1938. A flight of Red Phalaropes (*Phalaropus fulicarius*) on Long Island, N.Y. Proc. Linn. Soc. N.Y. 49: 60-63.

1937

Low, G. C. 1937. Grey and Red-necked Phalaropes in the Arabian Sea. Ibis (14th Ser.) 1: 866.

Meinertzhagen, R. 1937. Grey and Red-necked Phalaropes in Arabian Sea. Ibis (14th Ser.) 1: 667.

1936

Chislett, R. 1936. Grey Phalarope in Yorkshire. Naturalist (Lond.) 1936: 7.

1935

Brooks, A. 1935. On *Phalaropus fulicarius jourdaini* Iredale. Ibis (13th Ser.) 5: 887-888.

Gabrielson, I. N. 1935. Destruction of Red Phalaropes. Murrelet 16: 27-28.

Jewett, S. G. 1935. A Red Phalarope disaster. Murrelet 16: 15-16.

Pearse, T. 1935. Red Phalaropes on Vancouver Island. Murrelet 16: 16-17.

1934

Jourdain, F. C. R. 1934. The status of *Phalaropus fulicarius jourdaini* Iredale. Condor 36: 220.

Peters, J. L. 1934a. The status of *Phalaropus fulicarius jourdaini* Iredale. Condor 36: 85.

_____. 1934b. Further comment on *Phalaropus fulicarius jourdaini*. Condor 36: 220-221.

Sprunt, A., Jr. 1934. The Red Phalarope off South Carolina. Auk 51: 374.

1933

Ingram, G. C. S. and H. M. Salmon. 1933. Ruff and Grey Phalarope in Carmarthenshire. Brit. Birds 27: 206-207.

Taning, A. V. 1933. The winter quarters of the phalaropes. Ibis (13th Ser.) 3: 132-133.

Wilson, W. and F. C. R. Jourdain. 1933. Grey Phalaropes in Cheshire, Hampshire, Sussex and Devon. Brit. Birds 27: 207-208.

Young, C. G. 1933. The winter quarters of the phalaropes. Ibis (13th Ser.) 3: 548.

1932

Urner, C. A. 1932. Phalaropes in New Jersey in spring. Auk 49: 475-476.

1930

Trautman, M. B. and C. F. Walker. 1930. Another record of the Red Phalarope in Ohio. Auk 47: 249-250.

1928

Hine, J. S. 1928. The Red Phalarope (*Phalaropus fulicarius*) in Ohio. Auk 45: 94-95.

Schorger, A. W. 1928. The wintering area of the Red and Northern Phalaropes. Auk 45: 206.

1926

Friedmann, H. 1926. Red Phalarope at sea 100 miles west of Gibralter. Auk 43: 234.

Grote, H. 1926. Zur Verbreitung von *Phalaropus lobatus* (L.) und *Phalaropus fulicarius* (L.). Ornithol. Monatsber. 34: 122.

1925

Coles, R. J. 1925. Sea-birds at Cape Lookout, North Carolina. Auk 42: 123-124.

Meinertzhagen, R. 1925. The distribution of the phalaropes. Ibis (12th Ser.) 1: 325-344.

Rapine, J. 1925. Les phalaropes. Rev. Fr. Ornithol. 17: 54-56.

Wetmore, A. 1925. Food of American phalaropes, avocets, and stilts. U.S. Dep. Agric. Bull. 1359. 20 pp.

1924

Holt, E. G. 1924. _Phalaropus fulicarius_: a new bird for Alabama. Auk 41: 601.

Roberts, A. 1924. Red Phalarope (_Phalaropus fulicarius_) in Africa. Auk 41: 600-601.

1923

Tschusi zu Schmidhoffen, V. 1923. _Phalaropus fulicarius_, _P. lobatus_ und _Acanthis flavirostris_ in Oberosterreich. Ornithol. Monatsber. 31: 62.

1922

Jourdain, F. C. R. 1922. [Remarks on the Spitsbergen phalarope.] Bull. Br. Ornithol. Club. 42: 55-56.

Ross, R. C. 1922. Red Phalarope in southern California. Condor 24: 66-67.

Welch, L. W. 1922. Vermillion Flycatcher and Red Phalarope at Long Beach, California. Condor 24: 62.

1919

Laubmann, A. 1919. Zur nomenklatur der Gattung _Phalaropus_ Brisson 1760. Ornithol. Monatsber. 27: 75-76.

Stone, W. 1919. Occurrence of the Red Phalarope in Pennsylvania. Auk 36: 419-420.

1915

Haviland, M. D. 1915. Notes on the breeding habits of the Grey Phalarope. Brit. Birds 9: 11-16.

1914

Bridge, L. E. 1914. Red Phalarope (_Phalaropus fulicarius_) off Boston Harbor in summer. Auk 31: 536.

1913

Lowe, P. R. 1913. [Grey Phalarope recorded from near the Cape Verde Islands.] Bull. Br. Ornithol. Club 33: 40-41.

1910

Willett, G. 1910. Red Phalarope in southern California in winter. Condor 12: 175.

1909

Haag, F. 1909. Plattschnabliger Wassertreter (Phalaropus fulicarius L.). Zs. Oologie 19: 102-104.

1908

Banks, R. C. 1908. Grey Phalarope in Co. Wexford. Brit. Birds 2: 240-241.

Champernowne, A. W. 1908. Grey Phalarope in summer in Devonshire. Brit. Birds 2: 204-205.

1906

Dyche, L. L. 1906a. The Red Phalarope (Crymophilus fulicarius Linn.). A new bird for the Kansas list. Trans. Kans. Acad. Sci. 20: 132.

_____. 1906b. The Red Phalarope (Crymophilus fulicarius), a new bird for the Kansas list. Auk 23: 220.

1902

Thayer, G. H. 1902. The Red Phalarope in North Carolina. Auk 19: 285-286.

1901

Patten, C. J. 1901. The natural history of the Grey Phalarope (Phalaropus fulicarius). Irish Nat. 10: 53-67.

Wayne, A. S. 1901. The Red Phalarope (Crymophilus fulicarius) on the coast of South Carolina. Auk 18: 271.

Adult Laughing Gull in breeding plumage. Photograph by Roger B. Clapp.

LAUGHING GULL

(Larus atricilla)

[FR: Goeland atricille, SP: Gaviota risuena, SW: Amerikansk skrattmas]

GENERAL DISTRIBUTION

North America Laughing Gulls are among the most abundant coastal breeding birds of the southeastern United States. They are largely restricted in their breeding distribution to North America and the Caribbean. In Canada these gulls breed very locally in Nova Scotia and southern New Brunswick (Godfrey 1966). Within the United States, the great majority of breeding birds are found along the Atlantic and Gulf coasts from Maine and Massachusetts south to Texas (AOU 1957). Within this area none breed in Rhode Island, Connecticut, Georgia, Alabama, and Mississippi, but, for the first time in many years, the species has returned to breed on Long Island, New York (Buckley et al. 1978a, Post and Riepe 1980).

In the Pacific states Laughing Gulls formerly bred on islands at the south end of the Salton Sea in southeastern California (Small 1974). In Mexico they breed at least on Alacran Reef and Cayos Arcas in the southern Gulf (Paynter 1955), and along the northwestern coast in Sinaloa and Sonora (AOU 1957). In the West Indies, they breed "on many of the smaller islands or cays..." (Bond 1956), and Dewey and Nellis (1980) reported that they breed at 12 of 27 seabird colonies in the U.S. Virgin Islands. Details of distribution and population sizes in these areas are poorly known.

Laughing Gulls winter south on the Pacific coast from southern Mexico to Lima, Peru (ca. 12° S). On the Atlantic side of the continent they winter from North Carolina south along the Atlantic and Gulf coasts to the mouth of the Amazon near the equator in Brazil (AOU 1957, Blake 1977). Some also winter in the Caribbean, but these gulls are not common from October to March in the West Indies (Bond 1956) and from November to March in Trinidad and Tobago (ffrench 1973), suggesting that these are not major wintering areas.

World Distribution Laughing Gulls breed on islands off the coast of Venezuela (La Orchila, Los Roques, Las Aves) (Blake 1977), on Little Tobago, and probably on St. Giles Island, and on the north coast of Tobago (ffrench 1973). Breeding was also recently reported on Grand Connetable Island and the Battures de Malmanoury, French Guiana (Condamin 1978).

Nonbreeding birds often remain in wintering areas during the northern breeding season, and wandering birds may straggle well outside the breeding or wintering ranges. Laughing Gulls have strayed frequently to Great Britain (BOU 1971, Preston 1975, Verrall 1977, Rogers et al. 1982), and also have wandered to Sweden, France (Albrektsson and Lindberg 1967), and Morocco (Kennerley 1979). In the New World these gulls also have wandered to northern Ontario (Godfrey 1966), southern Saskatchewan (Savile and Savile 1976), and to Greenland (AOU

1957). They have also been found in the Pacific Ocean on Hawaii (Berger 1972), on Johnston Atoll (Amerson and Shelton 1976), the Phoenix and Line Islands (King 1967), and Western Samoa (Muse et al. 1980, Muse and Muse 1981). One bird banded as a flightless juvenile near Barnegat Light, New Jersey, was recovered in Kauai, Hawaii, less than five months later (Telfer and Shisler 1981).

DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

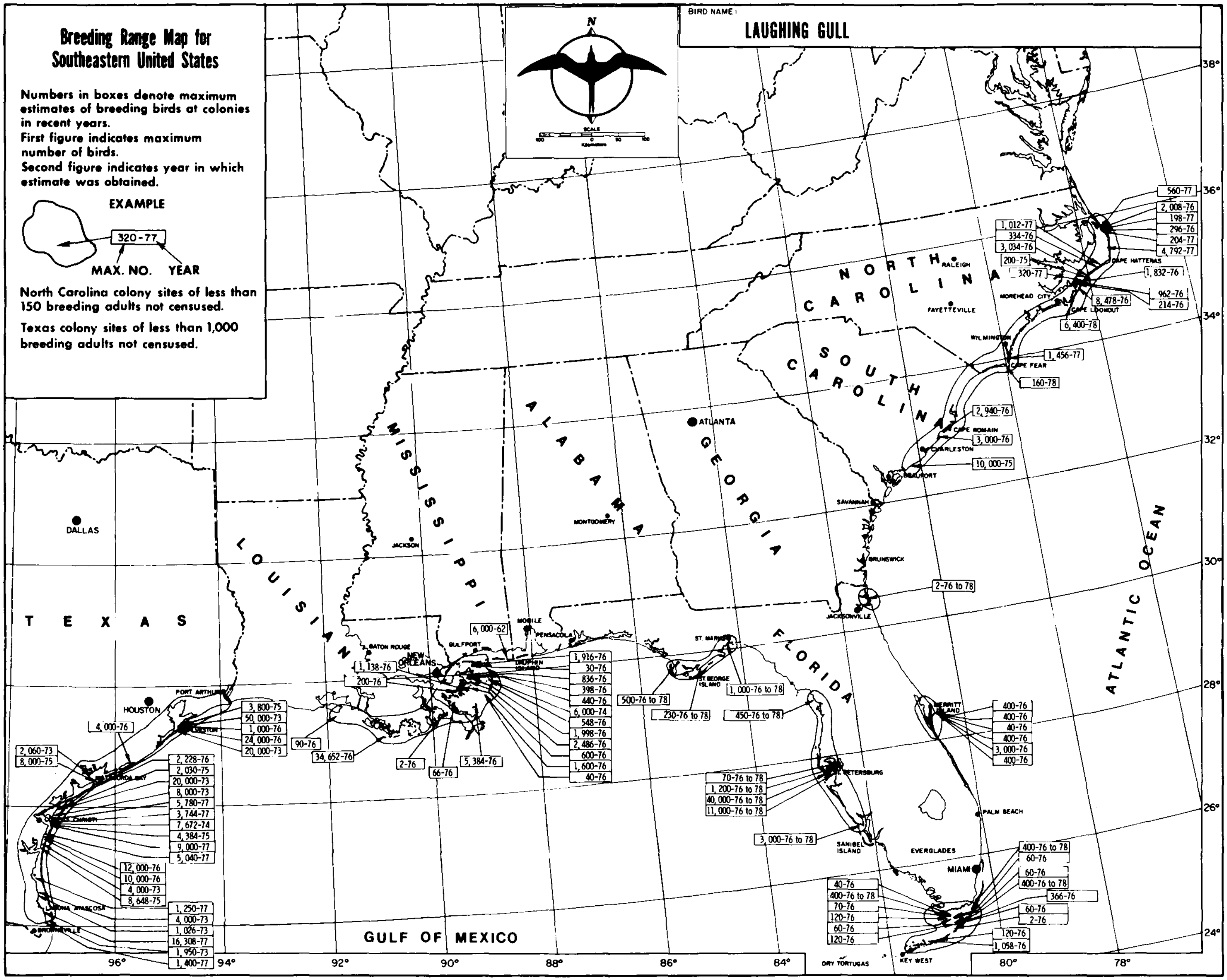
North Carolina Laughing Gulls occur in North Carolina throughout the year. They nest in large numbers but are uncommon in winter. Pearson et al. (1942) believed that as many as 15,000 bred there in 1939. About 26,790 bred in 20 colonies in North Carolina in 1973 (Soots and Parnell 1975a), and about 25,030 bred in 20 colonies in 1977. Figures for 1976 (Table 11) are similar to those reported for other years. Laughing Gulls now breed in North Carolina south to the Cape Fear River (Map 1) and the breeding population is believed to be stable (Parnell and Soots 1979 ms).

The largest colonies reported in 1977 were as follows: one on a dredge-spoil island in Roanoke Sound, Dare County, that had about 1,850 breeding birds; one on Gull Island, Dare County, with about 4,790; one on Beacon Island, Hyde County, with about 2,850; one with about 3,740 on Morgan Island, Carteret County; and one with just over 7,000 birds on a dredged island in Carteret County. These five colonies between them contained over four-fifths of the Laughing Gull nests censused in 1977, and the last island listed was the largest colony in the state in 1976 and 1977 (Parnell and Soots 1979 ms).

Most Laughing Gulls return to North Carolina by late March and most breeding occurs from May through late July (Parnell and Soots 1979 ms). Wintering populations are small compared to those occurring in Florida and the coast of Texas, but reach at least the low thousands (Map 2).

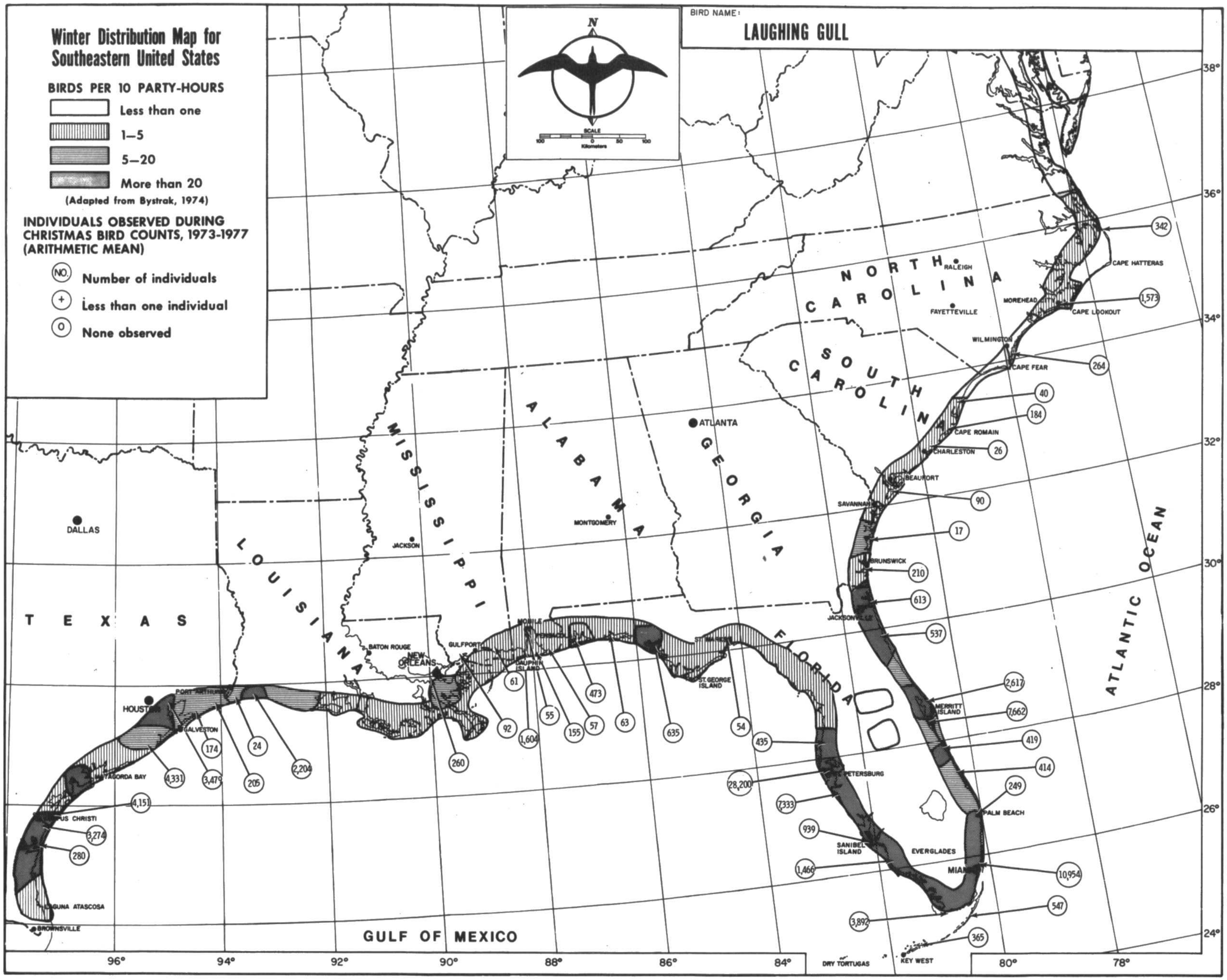
South Carolina Laughing Gulls are abundant along the South Carolina coast throughout the year. Eggs are usually laid in late May or early June (Sprunt and Chamberlain 1949). Little is known of breeding, transient, or wintering populations. In 1976, about 10,940 breeding birds were found nesting at three localities: White Banks (ca. 2,940 birds), Deveaux Bank (ca. 5,000), and Bird Island (ca 3,000) (Portnoy et al. 1981). This figure is probably a gross underestimate of the total number breeding in the state, however, because Laughing Gulls breed there at more than three localities. Blus and Lamont (1979) reported that Laughing Gulls "nest on almost all of the South Carolina barrier islands", and stated that rough estimates in 1975 suggested more than 10,000 pairs bred there--a breeding population more that double that reported by Portnoy et al. (1981). Relatively few birds have been reported on recent Christmas Bird Counts (Map 2).

Georgia Denton et al. (1977) regarded Laughing Gulls as abundant along the Georgia coast in spring and fall, but as uncommon in winter. Burleigh (1958) considered the species most abundant as a spring and fall migrant. Laughing Gulls are not known to breed in Georgia and little attention has been



Breeding Range Map for Southeastern United States
Numbers in boxes denote maximum estimates of breeding birds at colonies in recent years.
First figure indicates maximum number of birds.
Second figure indicates year in which estimate was obtained.
EXAMPLE
320-77
MAX. NO. YEAR
North Carolina colony sites of less than 150 breeding adults not censused.
Texas colony sites of less than 1,000 breeding adults not censused.
BIRD NAME:
LAUGHING GULL
N
TEXAS
LOUISIANA
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
SOUTH CAROLINA
NORTH CAROLINA
ATLANTIC OCEAN
GULF OF MEXICO
DALLAS
HOUSTON
PORT ARTHUR
BATON ROUGE
NEW ORLEANS
JACKSON
MONTGOMERY
ATLANTA
MOBILE
PENSACOLA
GULFPORT
RALEIGH
FAYETTEVILLE
WILMINGTON
MOREHEAD CITY
CAPE HATTERAS
CAPE LOOKOUT
CAPE FEAR
CAPE ROMAIN
CHARLESTON
BEAUFORT
SAVANNAH
BRUNSWICK
JACKSONVILLE
ST MARKS
ST GEORGE ISLAND
MERRITT ISLAND
ST PETERSBURG
SANIBEL ISLAND
PALM BEACH
EVERGLADES
MIAMI
KEY WEST
DRY TORTUGAS
BROWNSVILLE
560-77
2,008-76
198-77
296-76
204-77
4,792-77
1,012-77
334-76
3,034-76
200-75
320-77
1,832-76
8,478-76
962-76
214-76
6,400-78
1,456-77
160-78
2,940-76
3,000-76
10,000-75
2-76 to 78
6,000-62
1,138-76
200-76
1,916-76
30-76
836-76
398-76
440-76
6,000-74
548-76
1,998-76
2,486-76
600-76
1,600-76
40-76
500-76 to 78
230-76 to 78
1,000-76 to 78
450-76 to 78
3,800-75
50,000-73
1,000-76
24,000-76
20,000-73
4,000-76
90-76
34,652-76
2-76
66-76
5,384-76
2,060-73
8,000-75
2,228-76
2,030-75
20,000-73
8,000-73
5,780-77
3,744-77
7,672-74
4,384-75
9,000-77
5,040-77
12,000-76
10,000-76
4,000-73
8,648-75
1,250-77
4,000-73
1,026-73
16,308-77
1,950-73
1,400-77
400-76
400-76
40-76
400-76
3,000-76
400-76
70-76 to 78
1,200-76 to 78
40,000-76 to 78
11,000-76 to 78
3,000-76 to 78
400-76 to 78
60-76
60-76
400-76 to 78
366-76
60-76
2-76
120-76
1,058-76
40-76
400-76 to 78
70-76
120-76
60-76
120-76
38°
36°
34°
32°
30°
28°
26°
24°
96°
94°
92°
90°
88°
86°
84°
80°
78°

Map 1


Winter Distribution Map for Southeastern United States
BIRDS PER 10 PARTY-HOURS
Less than one
1–5
5–20
More than 20
(Adapted from Bystrak, 1974)
INDIVIDUALS OBSERVED DURING CHRISTMAS BIRD COUNTS, 1973-1977 (ARITHMETIC MEAN)
NO. Number of individuals
+ Less than one individual
0 None observed
BIRD NAME:
LAUGHING GULL
N
SCALE
Kilometers
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI
LOUISIANA
TEXAS
FLORIDA
ATLANTIC OCEAN
GULF OF MEXICO
RALEIGH
FAYETTEVILLE
ATLANTA
MONTGOMERY
JACKSON
DALLAS
HOUSTON
BATON ROUGE
NEW ORLEANS
GULFPORT
MOBILE
DAUPHIN ISLAND
ST. GEORGE ISLAND
PORT ARTHUR
GALVESTON
MATAGORDA BAY
LAGUNA ATASCOSA
BROWNSVILLE
CAPE HATTERAS
MOREHEAD
CAPE LOOKOUT
WILMINGTON
CAPE FEAR
CAPE ROMAIN
CHARLESTON
BEAUFORT
SAVANNAH
BRUNSWICK
JACKSONVILLE
MERRITT ISLAND
PALM BEACH
MIAMI
EVERGLADES
SANIBEL ISLAND
ST. PETERSBURG
KEY WEST
DRY TORTUGAS
342
1,573
264
40
184
26
90
17
210
613
537
2,617
7,662
419
414
249
10,954
547
365
3,892
1,466
939
7,333
28,200
435
54
635
63
57
473
155
55
1,604
61
92
260
2,204
24
205
174
3,479
4,331
4,151
3,274
280
38°
36°
34°
32°
30°
28°
26°
24°
96°
94°
92°
90°
88°
86°
84°
80°
78°

Map 2

Table 11. Recent estimates of Laughing Gull populations nesting in the southeastern United States (a).

State	Number found breeding in 1976 (b)	Percent of southeastern breeding population
North Carolina	24,710	9.4
South carolina	10,940	4.2
Georgia	none	
Florida-Atlantic Coast	ca. 4,640	1.8
Florida-Keys (c)	ca. 2,800	1.1
Florida-Gulf Coast (d)	ca. 58,450	22.2
Alabama	none	
Mississippi	none	
Louisiana	56,090	21.3
Texas	105,620	40.1
	263,250	

(a) In similar tables in other species accounts we compared estimates made in 1976 with those made other years to suggest the maximum breeding populations that may be present during any given nesting season. Laughing Gull populations are so poorly known, however, that we are unable to do so in this instance. The Texas Coastal Waterbird Survey recorded breeding popuiations in 1973 and 1977 that were almost half again as large as as that recorded in 1976 and larger populations have doubtless occurred in other southeastern states. Consequently, maximum breeding populations in the southeast may be as much as several hundred thousand larger than is implied by this table.

(b) Totals rounded to the nearest 10.

(c) About 2,250 breeding birds were present at 13 colonies in southern Florida (Portnoy el al. 1981). An earlier report of this survey (Kushlan and White 1977) listed 2 additional colonies and an estimated total breeding population of about 2,800 birds. The two additional colonies, Upper Arsnicker Key (4 breeding birds) and Nest Key (ca. 500 breeding birds), evidently were accidentally omitted during the preparation of the atlas by Portnoy et al. (1981).

(d) This figure is highly speculative. The true number may be considerably more (R.W. Schrieber, pers. comm.).

paid to the size of migrant and wintering populations.

Florida - Atlantic Coast and Keys Laughing Gulls are common to abundant in this area throughout the year. Formerly rare as a breeder along the coast, several thousands now nest there (Kale 1979 ms a). A 1976 survey of the

Florida Atlantic coast south to Key West (Portnoy et al. 1981) revealed about 2,250 nesting birds in 13 colonies. All of these colonies were either in Florida Bay at the southern tip of Florida or in the Keys. Information about nesting populations further north along the coast is incomplete. Various sources (Map 1, Kale 1979 ms a) indicate that the primary breeding ground farther north is on spoil islands in the Banana River, Merritt Island NWR, and suggest that the breeding population is considerably larger than that reported for southern Florida.

Because Florida is one of the primary wintering grounds for Laughing Gulls from colonies to the north, wintering populations are immense and are far larger than breeding populations. Concentrations reported on Christmas Counts from both the Atlantic and Gulf coasts are larger than have been reported from any other part of the wintering range (Map 2). Populations wintering in Florida more than tripled between 1966 and 1972 (Schreiber and Schreiber 1977) with peak populations present from November to March (Kale 1979 ms a); Kale noted that over 18,000 Laughing Gulls were recorded on one Christmas Count in Dade County.

Florida - Gulf Coast Laughing Gulls are abundant on the Florida Gulf coast year round. The largest known breeding and wintering populations of the species occur there (Maps 1, 2), but the total numbers present are poorly known. The breeding population of this species in the Tampa Bay-Charlotte Harbor area showed a huge increase from the mid-1960's to the mid-1970's that Schreiber and Schreiber (1977) suggest was due to increased amounts of food available at garbage dumps and to increased exploitation of these areas by Laughing Gulls. Populations continue to increase (R.W. Schreiber, pers. comm.).

Most nesting occurs between April and September. Peak egg laying usually occurs during the first week of May. Most young fledge in June and leave the breeding areas by early August (Schreiber and Schreiber 1978).

Alabama Laughing Gulls are common to abundant along the Alabama coast all year but are not known to breed there. Numbers are much smaller in midwinter and mid-summer than in migration (Imhof 1976b). Concentrations of more than 10,000 have been seen (Table 12), but few data are available on numbers present in the state. Band recoveries from New Jersey, Virginia, and North Carolina (Imhof 1976b) show that at least some proportion of the fall and winter birds come from Atlantic coast colonies.

Mississippi Although frequently abundant in Mississippi waters, Laughing Gulls have been known to breed there only once (Jackson et al. 1980). Williams (1962a) found a colony of about 6,000 pairs nesting on the western end of Petit Bois Island on 24 June 1962. Young were seen during this visit, some of which had fledged by 18 July, and some fresh eggs were still present on this later date.

In some years Laughing Gulls are nearly absent from late November to early March (Burleigh 1944). Most common during migration, they are less abundant from early May through June, a period when most birds are probably concentrated near their breeding colonies in Louisiana.

Louisiana Laughing Gulls are abundant along the coast throughout the year but are rarely seen inland. Smaller numbers are present during the winter than during the breeding season (Lowery 1974). A 1976 survey of the northern Gulf coast revealed about 56,000 breeding Laughing Gulls in 19 colonies in Louisiana (Portnoy 1977). More than half (ca. 34,650 birds) the total breeding population was found in a single colony on Raccoon Point (#602031). Anecdotal reports of former colonies suggest that larger populations may have occurred there in the past. About 47,000 breeding adults were present on the islands of the Breton and Louisiana Audubon reservations in 1908 (Kopman 1908a) and another 35,000 birds, mostly young, were present on the East Timbalier reservation (Kopman 1908b).

Lowery (1974) stated that the main nesting grounds are in the Chandeleur Islands and on the mud lumps at the mouth of the Mississippi River. The breeding season is from April through July with eggs recorded from early April (Oberholser (1938) through mid-July (Portnoy 1977).

Texas Laughing Gulls are the most abundant breeding marine bird in coastal Texas. Eggs have been recorded from 8 April to 7 July (Oberholser 1974) and young birds were still present in mid-September 1977 in colonies in and near Corpus Christi and the northern Laguna Madre (Chaney et al. 1978).

Laughing Gulls breed all along the Texas coast but are most abundant on the upper Gulf coast (Blacklock et al. 1978 ms). The largest colonies in recent years have been one that contained about 12,000 birds on South Bird Island, Kleberg County, in 1976; one with about 10,000 on islands south of this locality in 1976; one with about 20,000 on Danger Island, Neuces County, in 1973; one with about 24,000 on North Deer Island and nearby spoil islands in Galveston County, in 1976; another on South Deer Island that contained about 20,000 in 1973; and one on Pelican Island, Galveston County, that held about 50,000 breeding birds in 1973 and about 10,000 in 1976 (Blacklock et al. 1978). The four largest colonies in 1976 between them contained about 56,000 breeding birds, or more than half of all those breeding in the state. Although breeding Laughing Gulls are more abundant in Texas than anywhere else in the southeast, Blacklock et al. (1978 ms) believed the population to be declining and felt that the species numbers should be carefully monitored.

Laughing Gulls are also abundant migrants and winter residents on the Texas coast (Table 12). Five-year averages (Map 2) for recent Christmas counts in seven coastal areas have totaled about 16,000 birds. Considering the extremely small area that these counts covered, total wintering populations must be at least an order of magnitude larger.

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

Breeding Laughing Gulls breed solely in the New World. Most breeding populations are found along the Atlantic coast of the United States, along the

Table 12. Peak concentrations of migrant and wintering Laughing Gulls in the coastal southeastern United States.

Date seen		Number seen	Locality	Source
			NORTH CAROLINA	
1971	24 Nov.	10,000	vicinity of Morehead City	Teulings 1972a
			FLORIDA	
1971	18 Dec.	30,000	Sebastian Inlet	Stevenson 1972a
....	winter	80,000	St Petersburg-Tampa Area	Kale 1979 ms a
			ALABAMA	
1956	6 Oct.	11,000+	Mobile Bay	Imhof 1976b
1959	28 Dec.	1,631	Mobile	Imhof 1976b
			MISSISSIPPI	
1960	8 Sep.	1,400	Pass Christian	Gandy and Turcotte 1970
1960	22 Sep.	2,000	Gulfport	Gandy and Turcotte 1970
1960	13 Oct.	1,000	Deer Island	Gandy and Turcotte 1970
1969	7 Dec.	210	Bay St. Louis to Gulfport	James 1970
1978	16 Aug.	3,500	around sunken fishing boat, Gulfport	Purrington 1979

Gulf of Mexico, and in the Caribbean, while an unknown number also breed on islands along the northern coast of South America.

The Laughing Gull is the most abundant breeding marine bird in the southeastern United States. However, they are also difficult to census adequately and censuses of the southeastern United States have been few and incomplete. Consequently, the total breeding population in the southeast could be considerably larger than is suggested by Table 11.

Laughing Gulls are also abundant breeding birds along the northern Atlantic coast of the United States. Surveys of this coast in 1977 revealed about 138,400 Laughing Gulls nesting from Maine to Virginia (ca. 460 in Maine [Korschgen 1979], 400 in Massachusetts, 61,880 in New Jersey, 190 in Delaware, 4,460 in Maryland, and 62,390 in Virginia [Erwin 1979a]). Some populations in this area are far smaller than they were in the late 1800's and early 1900's. Breeding populations at their peak on Muskeget Island, Massachusetts, numbered over 40,000 birds in the late 1930's and early 1940's, and about twice as many bred in Maine during the 1960's (Nisbet 1971a) than at present.

Breeding populations on the North Atlantic coast (and in the southeastern United States) may vary considerably from year to year. The census totals for the 1977 census given by Erwin (1979a) and Korschgen (1979) may not be an adequate estimation of the numbers usually nesting in the North Atlantic states. Erwin reported that about 61,880 Laughing Gulls nested in 25 colonies in New Jersey during 1977, but Buckley and McCaffrey (1978) reported about 70,488 in 31 colonies during the same year. Another unspecified recent census (J. Galli in Burger 1981b) indicated that some 108,000 birds bred in 75 colonies in New Jersey. An undetermined number of Laughing Gulls also breed in the southern Gulf of Mexico and in the Caribbean. Breeding populations there may be substantial.

Winter Laughing Gulls winter primarily in the southeastern United States, the Caribbean, and along the coasts of Mexico south to Panama and the northern coast of South America. They may winter as far south along the Atlantic coast of South America as the mouth of the Amazon, and along the Pacific coast south to Peru. Southern's (1980a) analysis of 1,521 banding recoveries led him to conclude that a significant proportion winter in Central America and northwestern South America. Wetmore (1965) reported that large concentrations winter in the Gulf of Panama and Laughing Gulls evidently are common in winter in northern South America (Murphy 1936). The largest proportion of banded birds recovered north of 19° N came from Florida and Cuba and neighboring areas, with smaller numbers reported from the Carolinas and the Gulf coast (Southern 1980a). The sizes of wintering populations are poorly known but reach their peak in the United States along the coasts of Florida and Texas (Map 2). Young dispersing from colonies on the west coast of Florida occur widely in winter throughout the peninsular west coast of Florida and also migrate to the Caribbean. Few from the west coast winter on the east coast (Schreiber and Schreiber 1977).

Migration Little detailed information is available on the migration of Laughing Gulls. Northward migration begins in March (Southern 1980a) and by April and May large flocks may be seen streaming north close to the Atlantic coast. Most fall migration takes place from late August to November. Numbers peak in Panama in October and November, and again in April (Wetmore 1965).

HABITAT

Nesting Habitats chosen for nesting vary from area to area. Laughing Gulls in the northern portion of the breeding range tend to nest in tidal salt marshes; those further south nest both in salt marshes and in drier situations on isolated man-made and natural islands, as well as along barrier beaches. Those nesting in areas undisturbed by flooding consistently returned to sites used during previous nesting seasons (Burger and Shisler 1980a).

Much has been published on nesting areas chosen by Laughing Gulls in the eastern United States. We summarize some of this information by state below.

Massachusetts Laughing Gulls at Monomoy Island nest mostly in dense beach grass in hollows between dunes, but sometimes under or around bayberry (Myrica pensylvanica) bushes. Most nests are 1-5 m (3-16 ft) above high water (Nisbet 1976b).

New Jersey At Barnegat Bay, New Jersey, about 90% of the Laughing Gulls nest in low marsh dominated by salt marsh cord grass (Spartina alterniflora) (Burger and Shisler 1980a). Many moved to higher sites containing less alterniflora and more Spartina patens during a year with unusually high tides. Some use Juncus, Phragmites, and bushes as well, but none nest on low marsh islands vegetated only with alterniflora.

Montevecchi (1978a) reported that nest sites at Brigantine NWR were generally on or near mats of Spartina in tall grass on low ground near water. Nests near pools in the marsh usually were closer to water (2.7 ± 0.3 m [8.9 ± 1.0 ft]) than were those nesting near tidal creeks (4.8 ± 0.2 m [15.7 ± 0.6 ft]), but gulls nested near creeks nearly twice as often as near pools. The height of the grass (Spartina alterniflora) around newly begun nests averaged 33.8 ± 0.8 cm [13.3 ± 0.3 in].

Laughing Gulls on Ring Island, a tidal marsh near Cape May, New Jersey, prefer to nest in the tallest alterniflora (Bongiorno 1970). Of 156 nests, 86 (55.1%) were built in alterniflora 0.8 m [2.6 ft] high or higher. This habitat represented only 17.9% of vegetated area (1,540 sq m [16,576 sq ft]) available for nesting. In this tall grass the nest density was 0.3 nests/sq m (2.8/100 sq ft). The smallest proportion of nests were found in alterniflora less than 0.4 m (1.3 ft) in height and in Spartina patens 0.2-0.4 m (0.6-1.3 ft) tall. In these areas the nest density was 0.02 nests/sq m (0.2/100 sq ft).

Although both Bongiorno (1970) and Montevecchi (1978a) found nests on wrack (piles of debris washed up on the marsh by high or storm tides), none occur on such sites at Barnegat Bay, presumably because wrack is found there only at the high tide line (Burger and Shisler 1980a). Also, Burger and Shisler (1980a) did not find vegetation height a significant factor in nest-site selection at Barnegat Bay.

North Carolina Laughing Gulls in North Carolina use dredge-spoil islands as nest sites almost as frequently as natural sites. In 1973, 53.3% of the birds nested on spoil and 46.7% nested on natural islands (Soots and Parnell 1975a). Comparable figures for 1977 were 65.7% and 34.3%, respectively (Parnell and Soots 1979 ms). Nests sites were usually on low, grassy flats (primarily S. patens), in swales between more elevated ground, and on the lower slopes of dredge-spoil islands (Parnell and Soots 1975).

Laughing Gulls in North Carolina tend to nest in more vegetative cover than any other marine birds studied except Herring Gulls (Parnell and Soots 1975, Soots and Parnell 1975a). Most nesting colonies (73%) contained Spartina patens, and typical nesting habitat was moderately to densely vegetated, usually with more than 50% ground cover. Plants most frequently associated with the nest sites were seaside goldenrod (Solidago sempervirens), Mexican tea (Chenopodium ambrosioides), and sea ox-eye (Borrichia frutescens) (Soots and Parnell 1975a).

Florida - Gulf Coast Laughing Gulls nesting on dredge-spoil islands avoid open areas of sand and gravel and nest among low grasses and bushes (Schreiber and Schreiber 1978). Nests tend to be clumped around bushes when these are present. Where bushes are absent, nests are widely spaced, some 2-3 m (7-10 ft) apart. Nest densities range from 0.5/sq m (4.6/100 sq ft) in seaside paspalum (Paspalum vaginatum) to 0.33-0.5/sq m (3.1-4.6/100 sq ft) among groundsel (Baccharis halimifolia) and dog fennel (Eupatorium capillifolium). Where there is less cover, nest density becomes as little as 0.125/sq m (1.2/100 sq ft)(Schreiber and Schreiber 1978). Nest densities at a colony in Boca Ciega Bay, southern Pinellas County, for the three years 1975-1977 were 0.146, 0.165, and 0.321/sq m (1.36, 1.53, and 2.98/100 sq ft), respectively (data recalculated from Schreiber et al. [1979]).

Louisiana Laughing Gull nests in Louisiana are found primarily along coastal beaches and secondarily in salt marshes. Nests in marshes are on shell or S. alterniflora; those along barrier beaches are mostly in S. patens (Portnoy 1977).

Texas Laughing Gulls nesting in Texas are found about equally often on natural and dredged sites (Chaney et al. 1978). They prefer to nest near bushes in grassy areas, but they have also been found on wind-blown mats of Spartina spp.

Feeding Laughing Gulls feed in a wide variety of habitats that reflect their varied food habits. They typically forage in marshes, along beaches and mudflats, and in bays and inlets. They frequently feed in small flocks offshore (Burleigh 1958, Kale 1979 ms a).

In coastal Maine these gulls preferred to forage on mudflats (Hunt and Hunt 1973). Many of the Laughing Gulls breeding at Monomoy, Massachusetts fed near their nesting area in tide-rips, over mudflats at falling tide, and along the shores (Nisbet 1976b). Smaller numbers foraged further away, picking food from the surface of the sea or feeding over sandbars on schools of small fish or on small fish driven to the surface by predatory fish (Nisbet 1976b). Laughing Gulls feeding in marshes at Brigantine NWR, New Jersey, fed primarily during low tide and more often during a rising tide than during a falling tide (Burger 1976).

Although Laughing Gulls forage less on dumps in Maine than other species of Larus (Hunt and Hunt 1973), dumps in other areas have become major sources of food (Schreiber and Schreiber 1980, Burger 1981b). Burger (1981b) pointed out that recent use of dumps by Laughing Gulls in New Jersey has increased considerably since 1975. Increasing daily use of land-moving equipment has made more garbage and refuse available to Laughing Gulls for longer periods. It also affords aerial Laughing Gulls more opportunities to seize food between moving bulldozers, a manuever at which they are more adept than are Herring Gulls.

On the eastern shore of Maryland and Virginia (Wolk 1959; Clapp, pers. observ.) and in South Carolina (Sprunt and Chamberlain 1949), Laughing Gulls frequently forage on insects and other invertebrates turned up by tractors and plows. Oberholser (1974) noted that they occasionally feed a short distance inland in fields, pastures, and on prairies.

Laughing Gulls readily forage behind boats and ferries along the Atlantic and Texas coasts, scavenging discarded fish remains from the former and seizing bread thrown by tourists from the latter. They also scavenge discarded garbage along wharfs (Burleigh 1958).

Nonbreeding and Offshore Habitats used in winter are similar to those used during the breeding season. Most birds are found along the coasts (Murphy 1936, Wetmore 1965) but some are found inland in pastures (Murphy 1936) or on lakes and water impoundments (Wetmore 1965). Blake (1977) indicated that the primary habitats in South America are seacoasts, islands, and estuaries.

Laughing Gulls frequently feed offshore. Kale (1979 ms b) noted that hundreds were seen in November 1974 feeding over a school of fish some 80 mi (130 km) west of Naples on the Florida Gulf coast. In the southern Chesapeake Bight, Laughing Gulls seen offshore from early spring to late fall are found mostly inshore of the 10-fathom contour (19 km [12 mi] offshore)(Rowlett 1980). Transients occasionally occur farther offshore and nonbreeding birds may forage as much as 95 km (60 mi) offshore.

FOOD AND FEEDING BEHAVIOR

Laughing Gulls engage in much aerial feeding. Gulls in Maine do about 22% of their foraging from the air (Hunt and Hunt 1973). They hawk insects in the air (Forbush 1924, Mayr 1948), and from the surface of the water (Lauro 1977), and seize them from leaves, twigs, and branches (Forbush 1924). Laughing Gulls diving for food along the Texas coast usually hover at a height of less than 10 ft (3 m) and swoop to pick food from the surface of the water or slightly below it (Zusi 1962, pers. comm.). They often lower their feet while reaching for food and paddle them in the water. Laughing Gulls seldom submerge deeply when diving and usually leave at least the wings and tail exposed (Zusi 1962).

Tolonen (1970) noted small groups of Laughing Gulls "ploughing" (i.e., running through the water with the lower mandible immersed and seizing any small fish encountered). He also saw low-flying birds paddle with their feet in the water while keeping the lower mandible constantly immersed. Laughing Gulls also "tread" when foraging in shallow water (Wood 1949). They stamp their feet rapidly and alternately, apparently to scare small food items to the surface where these may be seized more easily (Wood 1949). Laughing Gulls also feed on dead fish and other items on mudflats and beaches, and alight on the water to reach down and seize food (Zusi 1962). They often feed on scraps behind fishing vessels (Zusi 1962) or ferries, and readily seize bits of food thrown to them. Adults and young-of-the-year that were thrown pieces of bread in North Carolina and Texas preferred to seize the pieces in flight (Clapp, pers. observ.). Adults are considerably more adept at seizing food thrown in the air than are juveniles (Schreiber and Young 1974; Clapp, pers. observ.).

Laughing Gulls also kleptoparasitize other species of birds, chasing them and forcing or frightening them into disgorging or dropping their prey, which is then seized by the gull. Chasing may be done either by individuals or small groups of birds. As many as 11 gulls chased a single tern (Sterna spp.) at Petit Manan Island, Maine, but most chasing was done by groups of 2-4 gulls (Hatch 1975). These gulls also kleptoparasitize Black Skimmers (Zusi 1958, Leck 1968), and Brown Pelicans (Pelecanus occidentalis)(Murphy 1936, Baldwin 1946).

Burger (1981b) described feeding behavior in the fall at a dump in East Brunswick, New Jersey. Laughing Gulls hovered over the dump, dipped down, and picked up food items exposed by bulldozers. The age distribution of birds using the dump was 53% adults, 8% subadults (birds 15 to 16 months old), and 39% young-of-the-year. The rate at which Laughing Gulls found food varied inversely with the number of Herring Gulls present and there were apparently no differences in feeding success related to age. Burger (1981b) suggested that the lack of difference in feeding success between age groups resulted from competition with Herring Gulls, i.e., all ages of Laughing Gulls were prevented from feeding when concentrations of Herring Gulls kept them from reaching food.

The diet of the Laughing Gull is highly varied but poorly known. Birds taken in Alabama in summer had fed largely on crustaceans and insects, while most from the Atlantic coast had eaten fish (Howell 1932). Those taken in Alabama had eaten crabs and shrimp and a variety of insects but had also eaten a number of small catfish (Howell 1928). An examination of 32 stomachs from both areas showed that about 47% of the bulk was crustaceans and about 43% was fish (Howell 1932).

Laughing Gulls also occasionally eat young Clapper Rails (Rallus longirostris) (Segre et al. 1968), tern eggs (Oberholser 1938), and small passerines. Daniels (1973) noted adult and immature Laughing Gulls chasing and capturing small passerines, evidently Catharus thrushes, over Delaware Bay in early October. In another instance, an escaped Galapagos finch (Camarhynchus parvulus) was seized and eaten as it fled a ship at the mouth of the Rio Guayas, Ecuador (Wiggins 1965).

IMPORTANT BIOLOGICAL PARAMETERS

Egg Laying Laughing Gulls arrive and nest at northern localities a bit later than at southern ones (Montevecchi et al. 1979). Peaks of laying occur during the first two weeks of June in Massachusetts, in late May in New Jersey, and in the first two weeks of May on the Gulf coast of Florida (authors cited by Montevecchi et al. 1979). The peak of egg laying may vary a week or more from year to year in some areas but it usually occurs within a two week period in Massachusetts, New Jersey and Florida (Schreiber et al. 1979). Montevecchi et al. (1979) studied patterns of egg laying at Brigantine NWR, New Jersey, and found a moderate degree of synchrony. Females in the center of the colony consistently laid earlier than those at the periphery. Schreiber et al. (1979) reported that most eggs in Florida are laid between 0700 and 1900 hrs.

Mean Clutch Size Laughing Gulls lay two to five eggs, but most nests contain two or three eggs. Montevecchi (1978a) reported that birds in the central areas of the colony have a modal clutch size of three eggs, compared to two eggs for birds laying at the periphery (Table 13). At a Florida colony clutch size was greater, although not significantly so, in areas of the colony where eggs were first laid (2.63 vs. 2.51 for an area in which birds laid later) (Schreiber et al. 1979). Schreiber et al. found no significant decrease in the clutch size as the breeding season progressed in this colony.

Incubation Period Nisbet (1976b) reported an average incubation period of about 29 days for Laughing Gulls nesting at Monomoy Island, Massachusetts. Laughing Gulls at Brigantine NWR, New Jersey, had an average incubation period of 21-23 days (Segre et al. 1968). Most of the eggs incubated on the Florida Gulf coast hatched in 23-25 days with 56% of the incubation periods over 23.5 and under 25 days (Schreiber et al. 1979). Schreiber et al. found no significant difference in incubation period in relation to when eggs were laid. They thought that larger samples might show significant differences in incubation periods between different eggs of the clutch, but pointed out that the degree of variability was so slight that it was probably of no biological importance.

Hatching Success Reported hatching success rates vary (Table 14). In some areas, hatching success may depend on how close Laughing Gull nests are to those of the predatory Herring Gull. Burger (1979) reported that 86% of the Laughing Gull eggs hatched at Clam Island, New Jersey, where the Laughing Gulls were well separated from Herring Gulls. Where the two species nested in close proximity, only 60% of the Laughing Gull eggs hatched. In 1976 in Florida, as the season progressed hatching success of three-egg clutches declined, but hatching success of two-egg clutches increased (Schreiber et al. 1979).

Age at Fledging Schreiber and Schreiber (1980) obtained records of fledging periods accurate to within 1-3 days for young at a colony on the Florida Gulf coast. Young fledged at a mean age of 42.5 days, with a range of 35-50 days. Nisbet (1976b) suggested that Laughing Gulls at Monomoy Island, Massachusetts, fledge at about 34 days.

Fledging Success Schreiber and Schreiber (1980) reported fledging success (i.e., percent of eggs laid that resulted in fledged young) as 44% and 36% for nests with three and two eggs, respectively, at one colony in Florida in 1976. These nests produced 1.32 and 0.71 young per pair, respectively. Hahn (1981) reported a production of 2.13 young per pair for nests with three eggs in New Jersey.

Mortality of Eggs and Young Laughing Gull nests and eggs are often lost to high water or storms (Hailman 1960b, Bongiorno 1968, Schreiber and Schreiber 1980), sometimes resulting in the reestablishment of the colonies on higher

Table 13. Mean clutch sizes reported for the Laughing Gull (a).

Mean clutch size	Number of clutches	Locality and year of observation	Source
2.51	--	New Jersey, Brigantine NWR, 1972-74	Montevecchi 1978a
2.21	--	New Jersey, Brigantine NWR, 1972-74	Montevecchi 1978a
2.85	94	Florida, lower Boca Ciega Bay, 1972	Dinsmore and Schreiber 1974
2.76	17	Florida, lower Boca Ciega Bay, 1973	Dinsmore and Schreiber 1974
2.84	95	Florida, lower Boca Ciega Bay, 1975	Schreiber et al. 1979
2.52	138	Florida, lower Boca Ciega Bay, 1976	Schreiber et al. 1979
2.19	193	Florida, lower Boca Ciega Bay, 1977	Schreiber et al. 1979
2.41	70	Texas, islands in Laguna Madre, 1977	Chaney et al. 1978
2.15	160	Texas, Galveston Bay, Little Pelican Island, 1977	Chaney et al. 1978
2.29	17	Texas, Galveston Island, Jigsaw Islands, 1977	Chaney et al. 1978

(a) Some of these figures are derived from counts of contents of nests during short-term visits. They may not adequately represent clutch size for the population, because a proportion of the population may have still been laying eggs. The first figure listed for New Jersey is for birds laying in the center of the study area; the second is for birds laying at the periphery. The figure listed for islands in the Laguna Madre is a composite derived from 10 nests at each of seven different localities. Mean clutch size at these localities ranged from 1.80 to 2.80.

ground. Montevecchi (1978a) regarded tidal flooding as the greatest threat to Laughing Gull nests at Brigantine NWR, New Jersey. He reported that 70-100% of the nests there were destroyed by floods on average once every two years over a ten-year period.

Loss of eggs or young to predators is common, but is not a major source of nest failure. Predation was believed to have caused only 3-10% of the loss of eggs laid at one Florida colony (Schreiber et al. 1979), and Montevecchi (1977) reported that only 4.4% of the eggs in a New Jersey colony were lost to predation.

Herring Gulls are often reported as predators (Montvecchi 1977, Burger 1981a), and take both eggs and young. Crows (*Corvus ossifragus* and *C. brachyrhynchos*) also frequently take eggs. Montevecchi (1977) stated that both adults and young are preyed upon by Barn Owls (*Tyto alba*) and Great Horned Owls (*Bubo virginianus*), and suggested, but did not document, predation by Short-eared Owls (*Asio flammeus*), Turkey Vultures (*Cathartes aura*), and Northern Harriers (*Circus cyaneus*). Clapper Rails (*Rallus longirostris*) also occasionally prey on eggs (Segre et al. 1968).

Table 14. Rates of hatching success reported for the Laughing Gull (a).

Percent of eggs laid that hatch	Number of eggs	Locality and year of observation	Source
		All clutches	
11.1	27	Texas, island in Laguna Madre, 1977	Chaney et al. 1978
51.3	39	Texas, Galveston Bay, 1977	Chaney et al. 1978
92.9	126	Florida, lower Boca Ciega Bay, 1972	Dinsmore and Schreiber 1974
79.2	265	Florida, lower Boca Ciega Bay, 1975	Schreiber et al. 1979
81.3	344	Florida, lower Boca Ciega Bay, 1976	Schreiber et al. 1979
		Three-egg clutches	
77.6	237	Florida, lower Boca Ciega Bay, 1975	Schreiber et al. 1979
86.8	228	Florida, lower Boca Ciega Bay, 1976	Schreiber et al. 1979
		Two-egg clutches	
92.9	28	Florida, lower Boca Ciega Bay, 1975	Schreiber et al. 1979
70.7	116	Florida, lower Boca Ciega Bay, 1976	Schreiber et al. 1979

(a) The data for Florida in 1972 are recalculated from the cited source. Eggs that disappeared at about the time hatching was expected are not included, but the eggs last noted as pipped or cracked are considered to have hatched successfully.

Extensive mortality of young (and adult) Laughing Gulls in Corpus Christi, Texas, in 1978 was attributed to feeding on insects in cotton fields that had been poisoned with parathion, an organophosphate insecticide (White et al. 1979b). Starvation was a major cause of nestling fatality in one instance (Schreiber and Schreiber 1980).

Renesting Birds whose nests are flooded out early in the nesting cycle may renest at other localities (Burger and Shisler 1980a). Schreiber et al. (1979) observed that 11 of 134 nests that lost a clutch received replacements at a colony in Boca Ciega Bay, Florida in 1976. Although birds at these 11 nests were unmarked, Schreiber et al. believed that behavioral characteristics of eight pairs identified them as the original pairs. Eggs in seven of these eight nests were replaced 5 to 30 days after the first set disappeared. Replacement clutches in 7 of 8 instances contained the same number of eggs or less than did the original clutch.

Age at First Breeding Unknown.

Maximum Natural Longevity The oldest known Laughing Gull was a bird banded as an immature at Muskeget Island, Massachusetts, that was found dead there at an estimated minimum age of 15 years, 1 month (Clapp et al. 1982a).

Weight Data on weights of Laughing Gulls for the southeastern United States and elsewhere are given in Table 15.

SUSCEPTIBILITY TO OIL POLLUTION

Few reports exist of Laughing Gulls dying from the direct effects of oiling. Records in the banding office at Patuxent WRC, Laurel, MD, revealed only four Laughing Gulls whose death was attributed to oil pollution. The four birds were from New Jersey, Panama, Texas, and Louisiana. Presumably, the Laughing Gulls' aerial and terrestrial feeding behavior make them less vulnerable to oil spills than other diving and more marine species. Because they are one of the most abundant breeding seabirds of the Atlantic and southeastern coasts, occasional oil spills are not likely to have much effect on the populations of this species. Secondary effects of offshore oil development and oil pollution (e.g. disturbance, loss of feeding and breeding areas) pose a much greater hazard.

Long-term, low-level oil pollution in the environment might have adverse affects on this species. Several papers have explored the effect of experimental contamination. White et al. (1979a) examined some effects of oil on Laughing Gull eggs. They treated eggs at an island in Matagorda Bay, Texas, with 20 microliters of No. 2 fuel oil and recorded embryonic mortality after five days of natural incubation. Eighty-three percent of 58 treated eggs were dead, as opposed to 2% of 56 control eggs, a significant difference. Laboratory studies of artificially incubated eggs revealed a lower hatchability in treated eggs (2 of 51 at a 20 microliter dosage hatched, as opposed to 26 of 51 control eggs).

King and LeFever (1979) examined the effect of oil transferred from incubating Laughing Gulls to their eggs. Forty-two gulls on Sundown Island, in Matagorda Bay, were captured and 2.5 ml of No. 2 fuel oil were applied to their breast feathers. Significant embryonic mortality occurred in the eggs these gulls were incubating, with 41% mortality in the treated group versus 2% for the 20 controls.

These studies show that low-level oiling can cause significant reproductive losses in Laughing Gulls. Studies are needed on the prevalence and impact of oiling in breeding birds.

Table 15. Weights (in grams) of Laughing Gulls (a).

Mean weight	Range	Number weighed	Sample and season	Area	Source
			Fledged birds		
---	182-360	16	adults	Florida	Dinsmore and Schreiber 1974
249	150-345	125	adult males	Florida	Schreiber and Schreiber 1979
348	282-392	13	adult males	Texas	Zusi 1962, pers. comm.
294	---	19	males	Florida	Hartman 1955
204	137-300	26	males, 1 year	Florida	Schreiber and Schreiber 1979
224	150-300	224	adult females	Florida	Schreiber and Schreiber 1979
306	---	8	females	Florida	Hartman 1955
247	---	1	female, May	Mexico	LSU
256	---	1	female, Dec.	Mexico	LSU
220	---	1	female, Sep.	Ohio	Trautman 1956
178	140-272	22	females, 1 year	Florida	Schreiber and Schreiber 1979
318	---	1	2nd winter female, Dec.	Mexico	LSU
			Chicks		
309	---	--	36-day-olds	Florida	Schreiber and Schreiber 1980
28.8	23.1-34.1	17	newly hatched	New Jersey	Ricklefs et al. 1978
---	30-33	4	newly hatched	Florida	Dinsmore and Schreiber 1974
---	25-35	--	newly hatched	Florida	Schreiber and Schreiber 1980
			All eggs of clutch (a)		
42.7	35.3-50.1	27		New Jersey	Ricklefs et al. 1978
38.1	30.4-43.3	9		Florida	Schreiber and Lawrence 1976

Table 15. Concluded.

Mean weight	Range	Number weighed	Sample and season	Area	Source
			All eggs of clutch (continued)		
42.8	34.2-60.6	716	1975	Florida	Schreiber el al. 1979
40.0	28.5-57.6	1061	1976	Florida	Schreiber et al. 1979
			First egg of clutch		
44.8	39.4-50.2	9	--	New Jersey	Ricklefs et al. 1978
43.4	36.1-48.2	60	1975	Florida	Schreiber et al. 1979
42.5	36.0-47.5	77	1976	Florida	Schreiber et al. 1979
43.3	38.6-47.0	11	1975	Florida	Schreiber et al. 1979
41.5	34.5-47.5	60	1976	Florida	Schreiber et al. 1979
			Second egg of clutch		
42.8	36.0-49.6	9	--	New Jersey	Ricklefs et al. 1978
43.2	34.6-50.4	59	1975	Florida	Schreiber et al. 1979
40.9	33.0-48.0	78	1976	Florida	Schreiber et al. 1979
42.9	35.7-48.7	12	1975	Florida	Schreiber et al. 1979
38.7	28.5-47.5	60	1976	Florida	Schreiber et al. 1979
			Third egg of clutch		
40.6	32.6-48.6	9	--	New Jersey	Ricklefs et al. 1978
39.2	34.2-48.3	60	1975	Florida	Schreiber et al. 1979
36.3	30.5-41.8	78	1976	Florida	Schreiber et al. 1979

(a) All egg weights are for fresh or near fresh eggs. Figures for range from Rickelefs et al. (1978) are the mean ± 2 S. D. The second set of figures for the first egg and second eggs of a clutch from Schreiber et al. (1979) are for second eggs of two-egg clutches.

BIBLIOGRAPHY

1982

Reid, M. and C. S. Hacker. 1982. Spatial and temporal variation in lead and cadmium in the Laughing Gull, Larus atricilla. Mar. Pollut. Bull. 13: 387-389.

van den Berg, A. B. 1982. Laughing Gull with flame-scarlet bill and legs. Dutch Birding 4: 55.

1981

Andrews, R. 1981. The gull population on Monomoy Island, Massachusetts, USA. (Abstract only.) Colonial Waterbirds 4: 194.

Burger, J. 1981b. Feeding competition between Laughing Gulls and Herring Gulls at a sanitary landfill. Condor 83: 328-335.

Burger, J. and M. Gochfeld. 1981a. Age-related differences in piracy behaviour of four species of gulls, Larus. Behaviour 77: 242-267.

Erwin, R. M., J. Galli and J. Burger. 1981. Colony site dynamics and habitat use in Atlantic coast seabirds. Auk 98: 550-561.

Gochfeld, M. and J. Burger. 1981. Age-related differences in piracy of frigatebirds from Laughing Gulls. Condor 83: 79-82.

Hahn, D. C. 1981. Asynchronous hatching in the Laughing Gull: cutting losses and reducing rivalry. Anim. Behav. 29: 421-427.

Muse, C. J. and S. Muse. 1981. First gull record for Samoa. Elepaio 41: 130-131.

Telfer, T. C. and J. K. Shisler. 1981. Record movement of a Laughing Gull to Hawaii from New Jersey. J. Field Ornithol. 52: 340-341.

Tessen, D. 1981. A Laughing Gull in Manitowoc County. Passenger Pigeon 43: 63.

1980

Brock, K. J. 1980. Laughing Gull at Michigan City Harbor. Indiana Audubon Q. 58: 19.

Burger, J., M. Fitch, G. Shugart and W. Werther. 1980. Piracy in Larus gulls at a dump in New Jersey. Proc. 1979 Conf. Colonial Waterbird Group 3: 87-98.

Burger, J. and J. Shisler. 1980a. Colony and nest site selection in Laughing Gulls in response to tidal flooding. Condor 82: 251-258.

King, K. A. and C. A. LeFever. 1980. Effects of oil transferred from incubating gulls to their eggs. (Abstract only.) Proc. 1979 Colonial Waterbird Group 3: 258.

Muse, C., S. Muse and D. Muse. 1980. First record of a gull (Larus atricilla) for the Samoan Islands. Am. Birds 34: 848-849.

Post, P. W. and D. Riepe. 1980. Laughing Gulls colonize Jamaica Bay. Kingbird 30: 11-13.

Schreiber, E. A. and R. W. Schreiber. 1980. Breeding biology of Laughing Gulls in Florida. Part II: nestling parameters. J. Field Ornithol. 51: 340-355.

Southern, W. E. 1980a. Comparative distribution and orientation of North American gulls. Pp. 449-498 in J. Burger, B. C. Olla and H. E. Winn (eds.). Behavior of Marine Animals. Vol. 4: Marine Birds. Plenum Press, NY. xvii and 515 pp.

1979

Blus, L. J. and T. G. Lamont. 1979. Organochlorine residues in six species of estuarine birds, South Carolina, 1971-75. Pestic. Monit. J. 13: 56-60.

Burger, J. 1979. Competition and predation: Herring Gulls versus Laughing Gulls. Condor 81: 269-277.

Grant, P. J. 1979. Field identification of west Palearctic gulls. Part II. Common, Mediterranean, Ring-billed, Laughing, and Franklin's Gulls. Brit. Birds 72: 142-182.

Hamer, F. 1979. Observation of Black-headed Gull-Laughing Gull courtship. Cassinia 57: 46.

Kennerley, P. R. 1979. Goeland atricille (Larus atricilla) au Maroc. [Laughing Gull (Larus atricilla) in Morocco.] Alauda 47: 214-215. [In French.]

King, K. A. and C. A. LeFever. 1979. Effects of oil transferred from incubating gulls to their eggs. Mar. Pollut. Bull. 10: 319-321.

Miller, J. C. 1979. Laughing Gull nesting mortality. N. Am. Bird Bander 4: 165.

Montevecchi, W. A., M. Impekoven, A. Serge-Terkel and C. G. Beer. 1979. The seasonal timing and dispersion of egg-laying among Laughing Gulls Larus atricilla. Ibis 121: 337-344.

Nunnally, S., D. Nunnally, R. Needham and R. Lennon. 1979. Nocturnal feeding of gulls at a lighted pier. Chat 43: 63.

Schreiber, E. A., R. W. Schreiber and J. J. Dinsmore. 1979. Breeding biology of Laughing Gulls in Florida. Part I: Nesting, egg, and incubation parameters. Bird-Banding 50: 304-321.

Schreiber, R. W. and E. A. Schreiber. 1979. Notes on measurements, mortality, molt, and gonad condition in Florida west coast Laughing Gulls. Fla. Field Nat. 7: 19-23.

White, D. H., K. A. King and N. C. Coon. 1979a. Effects of No. 2 fuel oil on hatchability of marine and estuarine bird eggs. Bull. Environ. Contam. Toxicol. 21: 7-10.

White, D. H., K. A. King, C. A. Mitchell, E. F. Hill and T. G. Lamont. 1979b. Parathion causes secondary poisoning in a Laughing Gull breeding colony. Bull. Environ. Contam. Toxicol. 23: 281-284.

1978

Buckley, F. G., M. Gochfeld and P. A. Buckley. 1978. Breeding Laughing Gulls return to Long Island. Kingbird 28: 203-207.

Burger, J. 1978. Determinants of nest repair in Laughing Gulls. Anim. Behav. 26: 856-861.

Burger, J. and J. Shisler. 1978a. Nest site selection and competitive interactions of Herring and Laughing Gulls in New Jersey. Auk 95: 252-266.

Condamin, M. 1978. Nidifications d'oiseaux de mer en Guyane. Oiseau Rev. Fr. Ornithol. 48: 115-121. [In French with English summary.]

Green, J. C. 1978. First adult Laughing Gull for Minnesota. Loon 50: 167-168.

Montevecchi, W. A. 1978a. Nest site selection and its survival value among Laughing Gulls. Behav. Ecol. Sociobiol. 4: 143-161.

_____. 1978b. Corvids using objects to displace gulls from nests. Condor 80: 349.

Ricklefs, R. E., D. C. Hahn and W. A. Montevecchi. 1978. The relationship between egg size and chick size in the Laughing Gull and Japanese Quail. Auk 95: 135-144.

Snodderly, D. M., Jr. 1978. Eggshell removal by the Laughing Gull (Larus atricilla): normative data and visual preference behaviour. Anim. Behav. 26: 487-506.

1977

Burger, J. 1977b. Role of visibility in nesting behavior of *Larus* gulls. J. Comp. Physiol. Psychol. 91: 1347-1358.

Hahn, D. C. 1977. The mechanism and function of asynchronous hatching in the Laughing Gull. Ph.D. thesis, Rutgers Univ./New Brunswick, NJ.

Halmi, N. S. 1977. Sight record of a Laughing Gull by the Coralville Reservoir. Iowa Bird Life 47: 64.

Kushlan, J. A. and D. A. White. 1977. Laughing Gull colonies in extreme southern Florida. Fla. Field Nat. 5: 44-46.

Lauro, A. J. 1977. Gull predation on an ant swarm. Kingbird 27: 87-88.

Loftin, R. W. and R. Sallas. 1977. Laughing Gull breeds in northeast Florida. Fla. Field Nat. 5: 17-18.

Montevecchi, W. A. 1977. Predation in a salt marsh Laughing Gull colony. Auk 94: 583-585.

Schreiber, E. A. and R. W. Schreiber. 1977. Gulls wintering in Florida: Christmas Bird Count analysis. Fla. Field Nat. 5: 35-40.

Verrall, K. 1977. Laughing Gull in Argyllshire. Scott. Birds 9: 381-382.

1976

Burger, J. 1976. Daily and seasonal activity patterns in breeding Laughing Gulls. Auk 93: 308-323.

Impekoven, M. 1976. Responses of Laughing Gull chicks (*Larus atricilla*) to parental attraction- and alarm-calls and effect of prenatal auditory experience on the responsiveness to such calls. Behaviour 56: 250-278.

Montevecchi, W. A. 1976a. Egg size and the egg predatory behavior of crows. Behaviour 58: 307-320.

_____. 1976b. Eggshell removal by Laughing Gulls. Bird-Banding 47: 129-135.

Munoz, R. V., Jr., E. S. Hacker and T. E. Gessell. 1976. Environmentally acquired lead in the Laughing Gull. J. Wildl. Dis. 12: 139-142.

Nisbet, I. C. T. 1976b. The colonization of Monomoy by Laughing Gulls. Cape Nat. 5: 4-8.

Savile, D. B. O. and C. E. Savile. 1976. Sight record of Laughing Gulls (*Larus atricilla*) in Saskatchewan. Can. Field-Nat. 90: 187.

Schreiber, R. W. and J. M. Lawrence. 1976. Organic material and calories in Laughing Gull eggs. Auk 93: 46-52.

1975

Burger, J. and C. G. Beer. 1975. Territoriality in the Laughing Gull (*Larus atricilla*). Behaviour 55: 301-320.

Campredon, P. 1975. Observation d'un Goeland atricille *Larus atricilla* sur la Reserve Naturelle du banc d'Arguin (Gironde). Alauda 43: 325.

Dennis, R. H. 1975. Scottish bird report 1974. Scott. Birds 8: 395-467.

Dubke, K. H. and L. H. Dubke. 1975. Black-legged Kittiwakes and Laughing Gulls at Chickamauga Dam, Chattanooga. Migrant 46: 81.

Hatch, J. J. 1975. Piracy by Laughing Gulls *Larus atricilla*: an example of the selfish group. Ibis 117: 357-365.

Hill, F. S., Jr. 1975. Laughing Gulls in flight. Chat 39: 36.

Jutro, P. R. 1975. Territorial defense of people by Laughing Gulls. Living Bird 14: 157-161.

King, K. A. 1975. Unusual food item of the Western Diamondback Rattlesnake (*Crotalus atrox*). Southwest. Nat. 20: 416-417.

Lansdowne, P. G. 1975. Laughing Gull *Larus atricilla*. Isles Scilly Bird Rep. 1974: 25.

Latham, R. 1975. Laughing Gulls, *Larus atricilla*, nesting at Orient, Long Island. Pitch Pine Nat. 3: 3.

Montevecchi, W. A. 1975. Behavioral and ecological factors influencing the reproductive success of a tidal marsh colony of Laughing Gulls (*Larus atricilla*). Ph.D. thesis, Rutgers Univ./New Brunswick, NJ.

Moore, C. L. 1975. Nest repair in Laughing Gulls. Wilson Bull. 87: 271-274.

Preston, K. 1975. Laughing Gull in Co. Cork. Brit. Birds 68: 158-159.

1974

Dinsmore, J. J. and R. W. Schreiber. 1974. Breeding and annual cycle of Laughing Gulls in Tampa Bay, Florida. Wilson Bull. 86: 419-427.

Forsythe, D. M. 1974a. An ecological study of gull populations to reduce the bird/aircraft strike hazard at Charleston Air Force Base. Air Force Weapons Lab. Tech. Rep. 73. 142 pp.

Schreiber, R. W. and S. N. Young. 1974. Evidence for learning to feed in Laughing Gulls. Fla. Field Nat. 2: 16-17.

1973

Bohlen, H. D. 1973. First specimen of Laughing Gull from Illinois. Wilson Bull. 85: 233.

Daniels, G. 1973. Laughing Gulls prey on migrants. Linn. Newsl. 27: 1.

Hunt, G. S., Jr. and M. W. Hunt. 1973. Habitat partitioning by foraging gulls in Maine and northwestern Europe. Auk 90: 827-839.

Impekoven, M. 1973. The response of incubating Laughing Gulls (*Larus atricilla* L.) to calls of hatching chicks. Behaviour 46: 94-113.

Lincer, J. L. and D. Salkind. 1973. A preliminary note on organochlorine residues in the eggs of fish-eating birds of the west coast of Florida. Fla. Field Nat. 1: 3-6.

1972

Bierly, M. L. 1972. Laughing Gull in Maury County. Migrant 43: 93-94.

Dawson, W. R., J. W. Hudson and R. W. Hill. 1972. Temperature regulation in newly hatched Laughing Gulls (*Larus atricilla*). Condor 74: 177-184.

Forsythe, D. M. 1972. Laughing Gull band recoveries from South Carolina. Bird-Banding 43: 264-266.

Tucker, V. A. 1972. Metabolism during flight in the Laughing Gull (*Larus atricilla*). Am. J. Physiol. 222: 237-245.

Wallace, D. I. M. 1972. Laughing Gull in the Isles of Scilly. Brit. Birds 65: 79-81.

1971

Hailman, J. P. 1971. The role of stimulus-orientation in eliciting the begging response from newly-hatched chicks of the Laughing Gull (*Larus atricilla*). Anim. Behav. 19: 328-335.

Impekoven, M. 1971. Prenatal experience of parental calls and pecking in the Laughing Gull (*Larus atricilla* L.). Anim. Behav. 19: 475-480.

Morton, A. and C. Nicholson. 1971. Laughing Gull in London County. Migrant 42: 89.

Nisbet, I. C. T. 1971a. The Laughing Gull in the northeast. Am. Birds 25: 677-683.

Nisbet, I. C. T. 1971b. Laughing Gull colonies in the northeast. Mass. Audubon 55: 2-10.

Stewart, P. A. 1971. Rejection of Tobacco Hornworm moths by Laughing Gulls. Chat 35: 53.

1970

Beer, C. G. 1970a. On the responses of Laughing Gull chicks (*Larus atricilla*) to the calls of adults. I. Recognition of the voices of the parents. Anim. Behav. 18: 652-660.

_____. 1970b. On the responses of Laughing Gull chicks (*Larus atricilla*) to the calls of adults. II. Age changes and responses to different types of call. Anim. Behav. 18: 661-677.

Bongiorno, S. F. 1970. Nest-site selection by adult Laughing Gulls (*Larus atricilla*). Anim. Behav. 18: 434-444.

Hatch, J. J. 1970. Predation and piracy by gulls at a ternery in Maine. Auk 87: 244-254.

Tolonen, K. E. 1970. Ring-billed Gull and Laughing Gull catch fish by "ploughing" and "skimming". Wilson Bull. 82: 222-223.

1969

Beer, C. G. 1969. Laughing Gull chicks: recognition of their parents' voices. Science 166: 1030-1032.

Brown, N. R. and P. A. Pearce. 1969. New Brunswick specimens of the Field Sparrow and Laughing Gull. Can. Field-Nat. 83: 403.

1968

Bongiorno, S. F. 1968. Egg puncturing behavior in Laughing Gulls. Auk 85: 697-699.

des Forges, G. 1968. An old record of Laughing Gull in Sussex. Brit. Birds 61: 213-214.

Hailman, J. P. 1968a. Spectral reflectance of gull's bill: physiological and evolutionary implications for animal communication. Science 162: 139-140.

_____. 1968b. Visual-cliff responses of newly-hatched chicks of the Laughing Gull *Larus atricilla*. Ibis 110: 197-200.

Leck, C. F. 1968. An additional observation of Laughing Gulls robbing a Black Skimmer. Cassinia 50: 27.

Marshall, R. V. A. 1968. Laughing Gull in Essex. Brit. Birds 61: 415-416.

Segre, A., J. P. Hailman and C. G. Beer. 1968. Complex interactions between Clapper Rails and Laughing Gulls. Wilson Bull. 80: 213-219.

Tuck, L. M. 1968. Laughing Gull (Larus atricilla) and Black Skimmers (Rynchops nigra) brought to Newfoundland by hurricane. Bird-Banding 39: 200-208.

Weston, F. M. 1968. Laughing Gull nesting near Pensacola [Florida]. Fla. Nat. 41: 35.

1967

Albrektsson, T. and P. Lindberg. 1967. Field-characters of the immature Laughing Gull. Brit. Birds 60: 159-160.

Alsop, F. J. 1967. Laughing Gull in Knox County. Migrant 38: 61-62.

Bongiorno, S. F. 1967. Substrate and the distribution of Laughing Gull, Larus atricilla, nests. Ph.D. thesis, Rutgers Univ./New Brunswick, NJ. 130 pp.

Buck, W. F. A. and D. W. Taylor. 1967. Laughing Gull in Kent: a species new to Britain and Ireland. Brit. Birds 60: 157-159.

Frohling, R. C. 1967. A partial albino Laughing Gull. Bird-Banding 38: 235-236.

Grant, P. J. 1967. The European records of Laughing Gulls in 1964-66. Brit. Birds 60: 489-490.

Hailman, J. P. 1967. The ontogeny of an instinct. The pecking response in chicks of the Laughing Gull (Larus atricilla L.) and related species. Behaviour Suppl. 15. vii and 159 pp.

Harriman, A. E. 1967. Laughing Gulls offered saline in preference and survival tests. Physiol. Zool. 40: 273-279.

von Schmidt, K. 1967. Note on the breeding plumage of the Laughing Gull (Larus atricilla). Fla. Nat. 40: 103.

1966

Frohling, R. C. 1966. A social flight of the Laughing Gull. Bird-Banding 37: 206-207.

Hailman, J. P. 1966a. Four color preferences of the Laughing Gull (Larus atricilla). (Abstract only.) Am. Zool. 6: 288.

Hailman, J. P. 1966b. Mirror-image color-preferences for background and stimulus-object in the gull chick (_Larus atricilla_). Experientia 22: 257-258.

1965

Albrektsson, T. and R. Berndtsson. 1965. Amerikansk skrattmas (_Larus atricilla_) observerad i Goteborgs fiskhamn. [American Laughing Gull (_Larus atricilla_) observed at Gothenburg.] Var Fagelvarld 24: 289-293. [In Swedish with English summary.]

Schmerler, S. and J. P. Hailman. 1965. Discrimination of orientation in the Laughing Gull, _Larus atricilla_ L. Am. Zool. 5: 655.

Wiggins, I. L. 1965. Galapagos Finch captured in flight by Laughing Gull. Condor 67: 82.

1964

Hailman, J. P. 1964a. The ontogeny of an instinct: the pecking response in chicks of the Laughing Gull (_Larus atricilla_ L.) and related species. Ph.D. thesis, Duke Univ./Durham, NC.

_____. 1964b. Coding of the colour preference of the gull chick. Nature 204: 710.

Medley, M. 1964. Observations on Laughing Gulls and Franklin's Gulls at St. Joseph, Michigan. Jack-Pine Warbler 42: 231.

1963

Nicholson, D. J. 1963. A Laughing Gull (_Larus atricilla_) seen in Orange County. Fla. Nat. 36: 126-127.

Penner, L. R. and B. Fried. 1963. _Philopthalmus regeneri_ sp. n., an ocular trematode from birds. J. Parasitol. 49: 974-977.

Voous, K. H. 1963. Tern colonies in Aruba, Curacao, and Bonaire, South Carribean Sea. Proc. Internatl. Ornithol. Congr. 13: 1214-1216.

1962

Hailman, J. P. 1962a. Laughing Gull colony on Gull Island in Pamlico Sound. Chat 26: 19.

_____. 1962b. Pecking of Laughing Gull chicks at models of the parental head. Auk 79: 89-98.

1961

Hailman, J. P. 1961. Age of Laughing Gull chicks indicated by tarsal length. Bird-Banding 32: 223-226.

1960

Hailman, J. P. 1960b. Destruction of Pea Island Laughing Gull colony in 1960. Chat 24: 98.

_____. 1960c. Banded Pea Island Laughing Gull recovered in Cuba. Chat 24: 24.

1959

Wolk, R. G. 1959a. Laughing Gulls following the plow. Wilson Bull. 71: 387-388.

1958

Moynihan, M. 1958. Notes on the behavior of some North American gulls. II. Non-aerial hostile behavior of adults. Behaviour 12: 95-182.

Zusi, R. L. 1958. Laughing Gull takes fish from Black Skimmer. Condor 60: 67-68.

1957

Preston, F. W. 1957. Pigmentation of eggs: variation in the clutch sequence. Auk 74: 28-41.

1956

Gunter, G. 1956. On the reluctance of gulls to fly under objects. Auk 73: 131-132.

1953

Nicholson, D. J. 1953. First record of the Laughing Gull for Orange County, Florida. Fla. Nat. 26: 136.

Preston, F. W. and E. J. Preston. 1953. Variation of the shapes of birds' eggs within the clutch. Ann. Carnegie Mus. 33: 129-139.

1952

Parkes, K. C. 1952. Taxonomic notes on the Laughing Gull. Proc. Biol. Soc. Wash. 65: 193-196.

1951

Gross, A. O. 1951. Laughing Gulls nesting at Stratton Island. Bull. Maine Audubon Soc. 7: 52-54.

Small, A. 1951. Laughing Gull on the coast of southern California. Condor 53: 101.

1949

Hawksley, O. and J. Hawksley. 1949. Laughing Gulls nesting off the coast of Maine. Bull. Maine Audubon Soc. 5: 77.

Wood, H. B. 1949. Laughing Gulls tread out their food. Bird-Banding 20: 103.

1948

Mayr, E. 1948. Gulls feeding on flying ants. Auk 65: 600.

1946

Baldwin, W. P. 1946. Laughing Gull robs Brown Pelican. Auk 63: 96-97.

1945

Gross, A. O. 1945. The Laughing Gull on the coast of Maine. Bird-Banding 16: 53-58.

1943

Noble, G. K. and M. Wurm. 1943. The social behavior of the Laughing Gull. Ann. N.Y. Acad. Sci. 45: 179-220.

1940

Hickey, J. J. 1940. Courtship note on the Laughing Gull. Auk 57: 111-112.

Noble, G. K. and D. S. Lehrman. 1940. Egg recognition by the Laughing Gull. Auk 57: 22-43.

Noble, G. K. and M. Wurm. 1940. The effect of hormones on the breeding of the Laughing Gull. Anat. Rec. 78 (Suppl.): 50-51.

Snyder, L. L. 1940. Laughing Gull breeding in Nova Scotia. Auk 57: 568-569.

1938

Buckalow, H. [sic]. 1938. Food of young Laughing Gulls. Auk 55: 672.

1936

Murray, J. J. 1936. Laughing Gull in the North Carolina mountains. Auk 53: 81-82.

1935

Sprunt, A., Jr. 1935. Second recorded nesting of the Laughing Gull on the South Carolina coast. Auk 52: 308-309.

1934

Lincoln, F. 1934. Banded Laughing Gull recovered in El Salvador. Condor 36: 36-37.

Weston, F. M. 1934. A melanistic Laughing Gull at Pensacola, Florida. Auk 51: 82-83.

1933

Burton, E. M. and E. B. Chamberlain. 1933. Laughing Gull breeding on the South Carolina coast. Auk 50: 360.

1932

Allen, R. P. 1932. Eggs of Royal Tern in Laughing Gull's nest. Auk 49: 219-220.

1929

Gudger, E. W. 1929. How the Laughing Gull, the feathered Buccaneer of Florida waters, gets its dinner. Sci. Mon. 29: 435-439.

Miller, L. and A. J. van Rossem. 1929. Nesting of the Laughing Gull in southern California. Condor 31: 141-142.

1928

Phillips, C. L. 1928. Early arrival of the Laughing Gull in Massachusetts. Auk 45: 366-367.

1925

Hix, G. E. 1925. Abundance of the Laughing Gull (*Larus atricilla*) about New York City. Auk 42: 125.

1924

Forbush, E. H. 1924. Gulls and terns feeding on the Seventeen-year Cicada. Auk 41: 468-470.

Stone, W. 1924. Franklin's Gull at Philadelphia--a correction. Auk 41: 468.

1921

Alexander, E. G. 1921. Laughing Gull (*Larus atricilla*) captured by snapping turtle. Auk 38: 596.

Pearson, T. G. 1921. Notes on the bird-life of southeastern Texas. Auk 38: 513-523.

1916

Williams, J. 1916. Laughing Gull (*Larus atricilla*) nesting near St. Marks, Fla. Wilson Bull. 28: 36.

1907

Brownson, W. H. 1907. Visit to a colony of Laughing Gulls. J. Maine Ornithol. Soc. 9: 57-66.

1898

Mackay, G. H. 1898. The terns of Muskeget Island, Massachusetts. Part IV. Auk 15: 168-172.

1897

Mackay, G. H. 1897. The terns of Muskeget Island, Massachusetts. Part III. Auk 14: 383-390.

1896

Mackay, G. H. 1896. The terns of Muskeget Island, Massachusetts. Part II. Auk 13: 47-55.

1895

MacKay, G. H. 1895. The terns of Muskeget Island, Massachusetts. Auk 12: 32-48, 178.

1893

Mackay, G. H. 1893. Observations on the breeding habits of *Larus atricilla* in Massachusetts. Auk 10: 333-336.

FRANKLIN'S GULL

(Larus pipixcan)

[DA: Praeriemage; FR: Mouette de Franklin, SP: Apipizca de Franklin, Gaviota de Franklin; SW: Prariemas, Franklinmas]

GENERAL DISTRIBUTION

North America Franklin's Gulls breed only in interior North America. In Canada, they breed in the eastern half of Alberta, central and southern Saskatchewan, and southwestern Manitoba (Godfrey 1966). In the United States, they breed from the Canadian border south to central-eastern Oregon, northwestern Utah, eastern North Dakota, northeastern South Dakota, southwestern Minnesota, and northwestern Iowa (AOU 1957).

Franklin's Gulls winter in small numbers on the coasts of Louisiana and Texas, and from Guatemala south to the Gulf of Panama (AOU 1957). The main wintering grounds are on the Pacific coast of South America south to Arauca, Chile (Blake 1977).

Most migrants follow a narrow route south through the Great Plains, Texas, and eastern Mexico (DuMont 1941, Blake 1977), and thence southward. Franklin's Gulls are pronounced wanderers. To the east and southeast, they have straggled to New Brunswick (Godfrey 1966); Virginia and Maryland (Burford 1963, Wierenga 1976); six times to England (Billet and Grant 1971, Rogers 1972, Blick 1979, Brown 1979, Harrison 1979, Rogers et al. 1981, 1982); twice to France (Beaudoin 1979, Kerautret 1981); twice to Sweden (Jonsson and Wennberg 1981); to Norway (Rogers et al. 1981) and off the Faroe Islands (Grandjean 1981); to St. Bartholomew and Puerto Rico in the West Indies (Bond 1971); and to the Atlantic coast of South Africa (Cooper and Williams 1975). To the south and west, Franklin's Gulls have strayed to the Galapagos Islands (AOU 1957); the Marquesas Islands (Dupont 1976); Hawaii (Berger 1972); Johnston Atoll and the Line Islands in the Central Pacific (Clapp 1968, Amerson and Shelton 1976); the Marshall Islands (Anderson 1978); and southwestern Australia (Serventy and Whittell 1976). One was also seen recently at Marion Island in the Indian Ocean (Sinclair 1981). In the New World Franklin's Gulls have strayed as far north as Cook Inlet, Alaska (Gibson and MacDonald 1971), and as far south as the Straits of Magellan (Peterson and Watson 1971).

World Distribution See above.

DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

Franklin's Gulls have been recorded from all the southeastern states, but their status there varies from being a very rare vagrant in the northeast to an abundant migrant in the southwest.

North Carolina Franklin's Gulls are accidental in North Carolina (Wray and Davis 1959). The only record for the state is of a female collected inland on the Catawba River near Charlotte on 12 October 1952 (Chamberlain 1953).

South Carolina Franklin's Gull is a casual vagrant in South Carolina that is known only from four sight records. Two records are from inland. One was seen about 1 mi SE of Townville 8 May 1975 (LeGrand 1975) and another was seen at Lake Greenwood 2 April 1978 (Teulings 1978a, Lewis 1979). Another was seen along the coast at Huntington Beach State Park on 26 September 1976 (Lewis and Lewis 1977, Teulings 1977a) and one in summer plumage was seen at Barnwell Island near the mouth of the Savannah River on 18 March 1978 (Smith 1978).

Georgia Two sight records of Franklin's Gulls have been made inland at Columbus, but adequate documentation of their occurrence in the state is still lacking. The first, an adult, was seen 24 April 1965 (Wells and Wells 1965); the second, a first-year bird was seen 20 May 1966 (Parnell 1966b). The bird seen near Barnwell Island on the South Carolina-Georgia border also occurred in Georgia (Smith 1978).

Florida Franklin's Gulls are rare visitors to Florida, where they have been recorded twice as frequently on the Gulf coast as on the Atlantic. Most records from states north of Florida are apparently of straggling migrants, whereas most Florida records are apparently of wintering birds. All but one of the Atlantic coast records are between 6 November and 8 December, and all but two of the Gulf records are between 24 October and 26 February.

Florida - Atlantic Coast

1938	4 Dec.	1	found inland at Lakeport, Lake Okeechobee (banded in Manitoba)	McClanahan 1941
1956	17 Nov.	1	remains found near Princeton, Miami Miami	Stevenson 1957a
1956	18 Nov., 8 Dec.	3, 1	seen near Princeton, Miami	Stevenson 1957a, 1957b
1961	15 Mar.	1	seen inland at Lake Florence near Cocoa	Stevenson 1961
1975	11 Nov.	1	imm. seen, photogr. at New Smyrna Beach	Edscorn 1976
1976	1 Dec.	1	seen, photogr. at Cocoa	Stevenson 1977
1977	6 Nov.	(1?)	seen off Canaveral	Edscorn 1978
1977	19 Nov.	(1?)	seen at Mayport	Edscorn 1978

Florida - Gulf Coast

1918	26 Feb.	1	seen at St. Petersburg	Pangburn 1919
1955	12 June-1 July	1	ad. coll. inland at Lake Jackson, Leon Co.	Stevenson 1959a
1957	10-11 Dec.	1	seen near Franjo	Stevenson 1958b
1957-58	28 Dec., 28 Jan.	1	seen near Flamingo	Stevenson 1958b
1958	9-10 Nov.	1	imm. seen at Fair Point, 3 mi S Pensacola	Monroe 1959, Newman 1959
1958	12 Nov.	5	seen (4 imm., 1 ad.) 1 mi SW Pace, Santa Rosa Co.	Monroe 1959
1958	30 Nov.	1	imm. seen 3 mi W Pace, Santa Rosa Co.	Monroe 1959
1960	4 Dec.	1	seen near Franjo	Stevenson 1961
1961	24 Feb.	1	seen at Naples	Stevenson 1961
1963	1 Dec.	1	seen at St. Marks	Stevenson 1964a
1977	27 Nov.	(1?)	seen at Alligator Point	Edscorn 1978
1977-78	10 Dec.-6 Jan.	2	seen at St. Petersburg, Toytown Dump	Stevenson 1978
1978	20 Apr.	1	ad. seen at St. Petersburg, Toytown Dump	Kale 1978a
1978	24 Oct.-17 Nov., et seq.	1, 2	seen at Toytown Dump, Pinellas Co.	Edscorn 1979
1978	28 Oct.	1	seen at Ft. Desoto Park, Pinellas Co.	Edscorn 1979
1979	to 12 Jan.	3(?)	seen in Pinellas Co.	Stevenson 1979a

Alabama Imhof (1976b) considered Franklin's Gull a rare migrant in Alabama. He pointed out that they may occur regularly in fall, but have been overlooked because of difficulties in distinguishing this species from the Laughing Gull. At present there are only nine records from Alabama. Most of these are of wintering birds, and only two are from coastal areas. The frequency with which Franklin's Gulls have been reported recently from the Gulf coast of Florida, in areas considerably farther from the main migratory pathways than Alabama, suggests that Imhof is correct and that Franklin's Gulls probably are more common in Alabama than the few sightings indicate.

1958	1 June	1	ad. seen inland at Decatur	Imhof 1976b
1960	4 Jan.	1	ad. seen inland at Decatur	Imhof 1976b
1970	25 Oct.	2	ad. seen at Cochrane Causeway, Mobile	Imhof 1976b
1972	4 July	1	ad. seen inland at Horseshore Bend Dam, Franklin Co.	Imhof 1976b, Stewart 1972
1972	14 Dec.	1	ad. seen inland at Birmingham	Imhof 1976b
1972	26 Dec.	3	ad. seen inland at Decatur	Imhof 1976b
1977	24-25 Apr.	1	ad. seen inland at Decatur	Imhof 1977
1977-78	winter	1	ad. seen [no locality given]	Hamilton 1978
1979	28 Jan.	1	ad. seen at Dauphin Island	Hamilton 1979

Mississippi The status of Franklin's Gull in Mississippi is inadequately known. We have found only nine records, including a bird reported by Burleigh (1944) as a Bonaparte's Gull that is apparently the first specimen of Franklin's Gull taken in Mississippi. It seems clear that Franklin's Gulls are largely uncommon winter residents in the state.

1938	25 Nov.	1	female coll. (USNM #432219) at Gulfport	this paper
1960	early Nov.	1	juv. seen at Gulfport	Williams and Clawson 1963
1961	24 Dec.	1	juv. female coll. at Gulfport	" , Gandy and Turcotte 1970
1968	6 Jan.	8	seen inland at Legion Lake, Bolivar Co.	James 1968
1972	27 Dec.	7	ad. seen inland at Sardis Lake	Purrington 1973b
1976	31 Dec.	1	seen inland on Hattiesburg CBC	Gates 1977
1979	23 Oct.	1	imm. seen inland at Hattiesburg	Jackson and Schardien 1980
1980	10 Nov.	22	ad. seen on mudflat at Bay St. Louis	Hodges and Toups, 1981
1981	11 May	1	ad. seen at Pascagoula River Marsh	Jackson 1981

Louisiana Oberholser (1938) stated that Franklin's Gull were a rare winter resident on the coast and listed only eight records for the state. Lowery (1974) indicated that this gull occurs regularly in small numbers in southwestern Louisiana. They are much less common in the southeastern part of the state, even though the largest count recorded in this century (175 birds) was seen over Lake Ponchartrain on 25 October 1959 (Lowery 1974). As in Mississippi, Franklin's Gulls are probably more common in Louisiana than is presently thought because of the difficulty in distinguishing this species from other black-headed gulls.

Texas Franklin's Gulls are common to abundant migrants in coastal Texas. They occur in fall migration from late September to early December, and in spring migration from early April to early June (Oberholser 1974, Blacklock 1978 ms). Peak numbers are present in October and November and in April (Blacklock 1978 ms, Table 16). Small numbers winter casually along the coast (Oberholser 1974).

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

Breeding Franklin's Gulls breeds only in the Nearctic, where they are confined to freshwater marshes of central North America in an area between about 43° and 54° N latitude and 90° and 110° W longitude (Southern 1980a).

Migration In the southeastern United States, Franklin's Gull occurs mainly as a migrant but occasionally as a winter visitor. They are rare to accidental along the Atlantic coast and rare to uncommon in the eastern Gulf (Table 16), but their status in the northern Gulf (Alabama, Mississippi, Louisiana) is ill-defined and the species may be more common there than is currently thought. Migration occurs within a brief span of time, primarily in late October and November and from mid-April through early May (Tables 17, 18). The species follows a narrow migration path from its northern breeding areas that takes it along the Texas coast, where enormous concentrations have been seen.

Winter Small numbers winter in the Gulf of Mexico and on the Pacific coast of Central America. Most of the population winters along the Pacific coast of South America.

HABITAT

Nesting Franklin's Gulls nest colonially in marshes or sloughs, often in shallow water with semi-open emergent cover (R. Stewart 1975). Bent (1921), Guay (1968), and Burger (1974) agreed that Franklin's Gulls prefer to nest near open water and that the earliest nests of the season are along the outer edge of the reeds. The nests usually are placed on a clump of emergent vegetation that was either bent over or broken from the previous year (Guay 1968).

Table 16. Approximate number of Franklin's Gulls recorded by month for the area from North Carolina to Mississippi (a).

State/region	JAN	FEB	MAR	APR	MAY	JUN	JUL	SEP	OCT	NOV	DEC
	Months										
North Carolina	-	-	-	-	-	-	-	-	1	-	-
South Carolina	-	-	1	1	1	-	-	1	-	-	-
Georgia	-	-	-	1	1	-	-	-	-	-	-
Florida-Atlantic Coast	-	-	1	-	-	-	-	-	-	7	3
Subtotal-ATLANTIC COAST	-	-	2	2	2	-	-	1	1	7	3
Florida-Gulf Coast	6	2	-	1	-	1	1	-	2	10	6
Alabama	2	-	-	1	-	1	1	-	2	1	4
Mississippi	8	-	-	-	1	-	-	-	1	23	9
Subtotal-GULF COAST	16	2	-	2	1	2	2	-	5	34	19
TOTAL - ALL AREAS	16	2	2	4	3	2	2	1	6	41	22

(a) Birds found dead in the first 10 days of a month are arbitarily assigned to the preceding month. If the source did not make it clear whether one or more was seen, we assumed only one was seen. If the source indicated more than one was seen but did not specifiy how many (e.g. "several", "a few"), we assumed two were seen. Birds seen in more than one month were counted separately in each month. Birds recorded in two states are listed under the state in which first seen. Records with unspecified dates (e.g., "winter", "spring") were omitted.

Guay (1968) considered the most important factor in the choice of a successful nest site to be the presence of appropriate emergent vegetation. In the Alberta marsh where he studied this gull, the important plants are bulrush (Scirpus acutus) or cattail (Typha latifolia). In other areas other species of plants comprise the important emergent vegetation. R. Stewart (1975) noted that the important species in North Dakota are bulrush, alkalai bulrush (Scirpus paludosus [= maritimus]), whitetop (Scolochloa festucacea), and phragmites (Phragmites communis[= australis]). At a colony at Davis Lake, Montana, the predominant emergent vegetation is alkalai bulrush, with some softstem bulrush (Scirpus validus) and cattail (Typha latifolia) (Rothwiler 1960). Water depth in the marsh ranged from 0 to 6 in (0-15 cm). Burger (1974) concluded that both density and dispersal of emergent plants are important in the choice of a nest site.

In central Alberta, Guay (1968) found little variation in nest density between study plots. Overall density was 1 nest per 80.7 sq ft (1/7.5 sq m), but more desirable nesting areas had greater nest density (1/68.6 sq ft [= 1/6.4 sq

Table 17. Dates of occurrence for Franklin's Gulls in the coastal southeastern United States (a).

State	Number of occurrences	Dates of occurrence
North Carolina	1	12 Oct.
South Carolina	3	26 Sep. - 2 Apr.
Georgia	2	24 Apr. - 20 May
Florida-Atlantic Coast	8	6 Nov. - 15 Mar.
Florida-Gulf Coast	ca. 15	24 Oct. - 20 Apr. (12 June - 1 July)
Alabama	9	25 Oct. - 25 Apr. (1 June - 4 July)
Mississippi	5	23 Oct - 11 May
Louisiana	??- scattered reports	25 Sep. - 17 May
Texas	many	late Sep. - early June (29 June - mid-July)

(a) Particularly unusual dates are listed in parentheses.

Table 18. Peak concentrations of migrant Franklin's Gulls in coastal Texas (a).

Date seen		Number seen	Locality	Source
1958	13 Apr.	500+	Austin	Webster 1958b
1972	14 Apr.	1,000	Bartlett	Webster 1972c
1979	17 Apr.	1,800	moving N over Austin	Webster 1979c
1959	21 Apr.	200	San Antonio	Webster 1959
1962	25 Apr.	4,550	Austin	Webster 1962b
1958	26 Apr.	827+	Austin	Webster 1958b
1960	29 Apr.	1,640+	Austin	Webster 1960b
1961	30 Apr.	6,000+	over Lake Travis, 15 mi W of Austin	Webster 1961b
1960	1 May	2,170+	Austin	Webster 1960b
1952	11 Oct.	15,000±	over Cove	Goldman and Watson 1953a
1952	14 Oct.	1,000	feeding near Hockley	Goldman and Watson 1953a
1955	29 Oct.	20,000±	Cove	Webster 1956a
1951	30 Oct.	20,000±	over El Campo	Goldman and Watson 1952
1951	1 Nov.	50,000±	over Rockport	Goldman and Watson 1952
1959	2 Nov.	10,000±	roosting on Lake Travis	Webster 1960a
1967	10 Nov.	1,200±	Neuces area	Webster 1968a
1964	11 Nov.	20,000±	between Freeport and Angleton	Webster 1965
1967	12 Nov.	7,500±	Los Fresnos, N of Brownsville	Webster 1968a

(a) Records are arranged chronologically by time of year.

m]). Nest density was lower (1/100.5 sq ft [= 1/9.3 sq m]) in less desirable nesting areas. Burger (1974) obtained similar results in Minnesota. She found an average of 12.6 nests per 6 sq m sample plot in areas next to open water, and a mean of 4.0 for plots entirely within stands of cattail. Even in open areas the density of nests was inversely proportional to the density of cattail stems (but the presence of some cattails was necessary).

Colonies vary greatly in size. They usually consist of a few hundred pairs but may contain as many as 50,000 pairs (McNicholl 1971). Franklin's Gulls evidently are less faithful to their nest sites than many other species of gulls. From 1969 through 1971, only one of seven colonies was used continuously at Agassiz National Wildlife Refuge in Minnesota (Burger 1974).

Feeding Franklin's Gulls forage in marshes and fields. Breeding birds in Alberta fed both over the nesting area and over adjacent land under cultivation. Most birds breeding at a colony in northwestern Minnesota fed within 16 km (10 mi) of the colony, but one was seen as far away as 39 km (24 mi) (Burger 1974). Birds breeding at Sand Lake Refuge, South Dakota, mainly fed in fields to at least 36 mi (58 km) from the colony (DuMont 1941).

Nonbreeding and Offshore Wintering birds in South America are abundant along the coast, on sandy beaches and shores, in harbors, and in cultivated fields (Murphy 1936).

FOOD AND FEEDING BEHAVIOR

Franklin's Gulls obtain most of their food by aerial pursuit of flying insects (Guay 1968). When over water, they feed on fish by surface-dipping (Murphy 1936) and frequently surface-seize (Burger 1974), i.e., swim on the surface of the water picking prey at or just below the surface. Franklin's Gulls are also noted for the propensity with which they follow ploughs.

Franklin's Gulls feed on a wide variety of food items but are mainly insectivorous, particularly during the breeding season. The little information available for migrant and wintering birds suggests that this gull feeds more opportunistically during those periods.

McAtee and Beal (1912) examined 93 stomachs, almost all from birds on the breeding grounds. Animal food made up 94.5% of the diet by volume; vegetable food made up 5.5%. The most important food was grasshoppers (43.4%). Most of the rest of the food were insects (beetles, crickets, dragonfly nymphs, ants, May beetles). The only plant food of any significance was wheat, which more than half-filled two stomachs. Cottam (1944) reported three Franklin's Gulls from Manitoba and North Dakota with stomachs containing significant amounts of oat or wheat kernels.

Most of the remaining information on the diet of Franklin's Gull is from breeding areas and is summarized below.

Alberta Guay (1968) examined 27 stomachs collected in June at Hays Lake. By volume, insects predominated (88%). Overall, Coleoptera (46%), Diptera (12%), and Hemiptera (7%) were the most important, but what was most important at any one time varied seasonally. During May, dytiscid beetles were most important, followed by Corixidae and midges (Chironomidae). During most of June, Corixidae were most important, with Carabidae and Scarabeidae eaten more later in the month. In July, Scarabeidae were followed in importance by Carabidae and then Lepidoptera.

Montana Rothweiler (1960) reported the frequency of occurrence of food by family from 108 stomachs collected on the breeding grounds at Freezeout Lake. Plants (mainly wheat and barley) were found in enough stomachs so that he believed these foods were not taken incidentally. His data show a seasonal change in diet. In April and May, 88.9% of the stomachs contained plants, 27.8% contained amphibians, and insects were common (Scarabeidae - 72.2%; Carabidae - 44.4%; Chironomidae - 38.9%; Dytiscidae - 27.8%; Muscidae - 27.8%). In June and July, plants were found in 92.6% of the stomachs, and amphibians in 14.8%. A strong shift in diet occurred in August and September. Plants were still found in 75.0% of the stomachs, but amphibians (*Ambystoma tigrinum*) in only 1.6%. The insects eaten changed greatly, with grasshoppers (Acrididae) occurring in 87.5% of the stomachs; beetles were next in importance (Carabidae - 64.1%; Scarabeidae - 37.5%).

North Dakota Aughey (1878) examined 10 stomachs collected in May from 1868-1877. These contained locusts, frogs, fish, snails, crayfish, and a lizard. Saugstad (1940) reported on another 10 stomachs, nine from adults and juveniles in July, and one from an October adult. The former contained mostly grasshoppers (*Melanoplus mexicanus*, *M. bivittatus*, *M. differentialis*), as well as some beetles and plant bugs; the latter largely contained beetles (Carabidae).

Minnesota Roberts (1900) made general comments based on observations in 1892-1893 and in 1899. In June, adults and young fed largely on dragonfly nymphs, but later fed extensively on earthworms and cockchafer grubs; grasshoppers were favored at the end of the breeding season. Burger (1974) found evidence of considerable seasonal change in food habits. In early May, birds ate many earthworms and took barley and oats as well. In late May and late June adults fed mainly on midges (Chironomidae). In early June, samples from young birds mostly contained earthworms.

Migrants apparently are also largely insectivorous. Stomachs from birds collected in Louisiana in fall contained grasshoppers, true bugs, and beetles (McAtee and Beal 1912). A Franklin's Gull collected in fall in Kansas had eaten stinkbugs (Pentatomidae), an adult prairie vole (*Microtus ochrogaster*), and an adult western harvest mouse (*Reithrodontomys megalotis*) (Easterla and Damman 1977). Birds seen in South Carolina in early May and in Florida in mid-November were hawking insects (Monroe 1959, LeGrand 1975).

Wintering birds evidently feed largely on fish and crustaceans. The stomachs of six of eight birds collected in January at Pacasmayo, Peru, all showed traces of fish (Murphy 1936). One held about 300 small crustaceans, and the remains of a mollusc were found in another.

IMPORTANT BIOLOGICAL PARAMETERS

Egg Laying Most nesting takes place in the latter half of May, although a few nests may be started in early May and in June (Rothweiler 1960, Guay 1968, Burger 1974). The period of egg laying in any given year is short compared to other gulls (Burger 1974), and may last no more than 21 days (Guay 1968, Burger 1974).

Mean Clutch Size Burger (1974) stated that Franklin's Gulls normally lay 3-egg clutches, although a few nests contain 4 eggs. At Hays Lake in central Alberta, the range was 1-3 eggs; the modal number of eggs was two (in 56% of 208 nests) (Guay 1968). Guay reported mean clutch sizes of 2.16, 2.09, and 2.39 for 58, 117, and 33 nests in 1964, 1965, and 1966, respectively. The mean clutch size for 42 nests at San Francisco Lake in southern Alberta in 1964 was 2.45; three eggs were found in half the nests (Wolford in Guay 1968).

The mean number of eggs laid at Hays Lake was more than that found by inspecting nests because examination of 68 reproductive tracts showed that 90% of the females had laid three eggs (Guay 1968). If the rest of birds examined laid two eggs, this would result in a mean clutch size of 2.90.

Incubation Period Guay (1968) gave a range of 22-28 days for incubation of the first egg of a clutch (mean = 24.6, n = 11); 21-26 days for the second egg (mean = 24.4, n = 38); and 24-27 days for the third egg (mean = 25.0, n = 9) in central Alberta. The mean incubation period for all 80 eggs monitored was 24.6 days. In another study at San Francisco Lake in southern Alberta, Wolford (in Guay 1968) reported a mean incubation period of 23.5 days for 11 clutches with a range of 21-25 days.

Hatching Success In central Alberta in 1964, 75.7% of all eggs or an average of 1.69 eggs per nest hatched; in 1965, 60.4% hatched for an average of 1.27 per nest (Guay 1968).

Age at Fledging In Alberta in 1964, age at first flight ranged from 23 to 33 days, with a mean of 30 days. In 1965, it ranged from 24 to 31 days, with a mean of 28 days (Guay 1968).

Fledging Success The average number of birds fledged per nest was 0.34 in 1964 in central Alberta. In 1965, the average was only 0.16 (Guay 1968).

Mortality of Eggs and Young Of 418 eggs lost in 1964 and 1965 at colonies in Alberta, 66% were destroyed, 2% disappeared, 26% were abandoned, 1% dropped into the water, and 5% died during hatching (Guay 1968). Destruction was caused primarily when neighboring Franklin's Gulls pecked at or ate eggs in unattended nests. Considering the large proportion of abandoned nests, one suspects that the major factor in egg loss during this study was disturbance by the investigator, a hazard also noted by Burger (1974). Guay (1968) stated, however, that areas which he did not disturb also "showed reduced clutch sizes and evidences of pecked and eaten eggs."

Competitive interaction with other species may also cause egg loss. Burger (1974) observed an American Coot (Fulica americana) aggressively displace a nesting gull from its eggs and then eat the eggs. In another part of the colony in an area around a coot's nest, she found 19 gull nests with pecked eggs.

Other sources of nest loss include flooding and predation. In one Minnesota colony, high water pulled nests from their sites (Roberts 1900); in another colony, a snapping turtle (Chelydra serpentina) killed an adult and ate the eggs (Preston 1886).

In Alberta in 1964-65 loss of young was attributed primarily to attacks by neighboring adults, and to exposure to heavy rains (Guay 1968). Guay suggested that this loss resulted in large part by disturbance caused by the observer.

Avian predators also reduce fledging success. In Minnesota, Burger (1974) saw Northern Harriers (Circus cyaneus) attacking adults and chicks, and saw one carrying a dead adult. She also reported that a Great Horned Owl (Bubo virginianus) killed 12 adults and four nearly-grown juveniles in a period of 12 days.

Mammalian predators may not be as significant a factor in nest loss in Franklin's Gulls as in other colonial waterbirds, possibly because this species tends to nest out near the edge of the water (Burger 1974). However, aquatic mammals can be a source of predation. Burger (1974) was told that mink (Mustela vison) had caused some destruction of a Franklin's Gull colony in North Dakota, but found visible evidence of predation by this species in only one year of her 3-year study in Minnesota. In early July 1971, she found over 45 dead and dying fledglings on nest platforms and in the water that she attributed to predation by mink.

Renesting The extent to which Franklin's Gulls replace lost nests is almost unknown. Ovarian inspection of gulls at a colony in Alberta suggested that at least three females had replaced clutches lost earlier (Guay 1968).

Age at First Breeding Most Franklin's Gulls probably do not breed until they are at least two years old. Examination of the ovaries of birds in the immature plumage characteristic of one-year-olds showed that they occasionally lay eggs (Guay 1968), but the proportion that do so is small.

Maximum Natural Longevity A Franklin's Gull banded as a juvenile in Montana had reached a minimum age of 9 years and 5 months when recovered (Clapp et al. 1982a).

Weights We found few published weights of Franklin's Gulls (Table 19). The weight of adults, excluding birds that are evidently under- or overweight varies between 210-340 g (7.4-12.0 oz). Guay (1968) found no significant difference in the weights of 100 adult males and 69 adult females from central Alberta.

Table 19. Weights (in grams) of Franklin's Gulls (a).

Mean Weight	Range	Number of birds	Sample and Season	Area	Source
157	---	1	ad. male, May	Pacific Ocean, Johnston Atoll	USNM
240	---	1	male, June	Indiana	Mumford 1962
280.8	220-335	29	breeding ad. males	Minnesota	Burger 1974
268.7	---	-	male, August	Minnesota	Marshall and Erickson 1945
325	---	1	ad, Oct.	Missouri	Easterla and Damman 1977
452	---	4	ad. males, Oct.	Minnesota	Burger 1974
201.2	191-212	2	ad. females, May	Mexico	LSU
173.5	171-176	2	ad. females, May	Pacific Ocean, Palmyra Atoll	USNM
278.6	250-325	11	breeding ad. females	Minnesota	Burger 1974
208.4	---	1	ad. female, Oct.	Honduras	LSU
243	---	1	imm. male, Oct.	Mexico	LSU
318	313-323	2	imm. males, Nov.	Michigan	Fisher et al. 1966
209.5	---	1	imm. female, Dec.	Mexico	LSU
375	---	4	juveniles, Oct.	Minnesota	Burger 1974
263	240-286	-	fledging young	Alberta	Guay 1968
26	20-35	79	hatching chicks	Alberta	Guay 1968

(a) Range figures for fledging young in Alberta are the mean $\pm$ 2 S.D.

SUSCEPTIBILITY TO OIL POLLUTION

Franklin's Gulls seldom dive into water but readily sit on the surface. Food obtained in flight may be eaten while the bird rests on the water (Wierenga 1976). These gulls are mainly insectivorous, however, and are as likely to be seen in terrestrial situations as in aquatic ones. Consequently they are less susceptible to oil pollution than other marine birds occurring in the southeastern United States.

Throughout much of the southeast, the Franklin's Gull is rare or accidental, but they are seasonally abundant in Texas. Those months when it passes through the state in great numbers (April, late October, and November) are the only times when a significant number might be likely to be adversely affected by oil spills.

BIBLIOGRAPHY

1981

Grandjean, P. 1981. Praeriemage *Larus pipixcan* ved Faeroerne 1976. Dan. Ornithol. Foren. Tidsskr. 75: 146-147. [In Danish with English summary.]

Grant, P. J. 1981. Mystery photographs. 55. Brit. Birds 74: 298-299.

Hodges, M. F. and J. A. Toups. 1981. A flock of Franklin's Gulls in Bay St. Louis, Mississippi. Mississippi Kite 11: 17.

Jonsson, P. E. and O. Wennberg. 1981. Prariemasen *Larus pipixcan* patraffad i Sverige. [Records of Franklin's Gull *Larus pipixcan* in Sweden.] Var Fagelvarld 40: 263-269. [In Swedish with English summary.]

Kerautret, L. 1981. Une Mouette de Franklin (*Larus pipixcan*) dans le Pas-de-Calais. Oiseau Rev. Fr. Ornithol. 51: 337-338.

Littlefield, C. D. and S. P. Thompson. 1981. History and status of the Franklin's Gull on Malheur National Wildlife Refuge, Oregon. Great Basin Nat. 41: 440-444.

Weseloh, D. V. [C.] 1981. A probable Franklin's X Ring-billed Gull pair nesting in Alberta. Can. Field-Nat. 95: 474-476.

Weseloh, D. V. C. and M. T. Myres. 1981. Seasonal fluctuations in gull numbers at Calgary, Alberta, Canada and a model for estimating their numbers. Colonial Waterbirds 4: 132-137.

1980

Allaire, P. N. 1980. Noteworthy species (including Franklin's Gull) in Bell County. Kentucky Warbler 56: 18-20.

Schulenberg, T. S. 1980. A Franklin's Gull (Larus pipixcan) in southeastern Peru. Gerfaut 70: 403-404.

Southern, W. E. 1980a. Comparative distribution and orientation of North American gulls. Pp. 449-498 in J. Burger, B. C. Olla and H. E. Winn (eds.). Behavior of Marine Animals. Vol. 4: Marine Birds. Plenum Press, NY. xvii and 515 pp.

1979

Beaudoin, J.-C. 1979. Une Mouette de Franklin (Larus pipixcan) a Angers, Maine-et-Loire: premiere donnee francaise. Oiseau Rev. Fr. Ornithol. 49: 45-49. [In French with English summary.]

Blick, M. A. 1979. Franklin's Gull in Cleveland. Brit. Birds 72: 478-479.

Brown, B. J. 1979. Franklin's Gull in Suffolk. Brit. Birds 72: 479-482.

Grant, P. J. 1979. Field identification of west Palearctic gulls. Part II. Common, Mediterranean, Ring-billed, Laughing, and Franklin's Gulls. Brit. Birds 72: 142-182.

Harrison, G. R. 1979. Franklin's Gull in Norfolk. Brit. Birds 72: 476-478.

Lewis, B. 1979. Franklin's Gull in Greenwood County, S.C. Chat 43: 63-64.

Wennberg, O. 1979. Franklinmas (Larus pipixcan) for forsta gangen antraffad i Sverige. Bubo 1978: 25-26.

1978

Abbott, J. M. and D. F. Abbott. 1978. Franklin's Gull in Alexandria, Virginia. Raven 49: 67-68.

Anderson, D. A. 1978. A Franklins Gull from the Marshall Islands. Micronesica 14: 361-362.

Hochbaum, G. and G. Ball. 1978. An aggressive encounter between a Pintail with a brood and a Franklin Gull. Wilson Bull. 90: 455.

Nickerson, A. W. 1978. Sighting of a Franklin's Gull in Vineyard Sound, Massachusetts. Bird Obs. East. Mass. 6: 222-223.

Ryder, R. A. 1978. Gulls in Colorado: their distribution, status, and movements. Proc. 1977 Conf. Colonial Waterbird Group 1: 3-9.

Smith, T. C. 1978. Franklin's Gull near Savannah River mouth. Oriole 43: 54.

1977

Bahl, A. K. and B. S. Pomeroy. 1977. Experimental exposure of Franklin's Gulls (Larus pipixcan) and Mallards (Anas platyrhynchos) to a turkey influenza A virus A/Turkey/Minn/BF/72 (Hav 6 Neq 2). J. Wildl. Dis. 13: 420-426.

Burger, J. 1977b. Role of visibility in nesting behaviour of Larus gulls. J. Comp. Physiol. Psychol. 91: 1347-1348.

Carrolan, T. 1977a. Franklin's Gull on the St. Lawrence River. Kingbird 27: 86-87.

_____. 1977b. Franklin's Gull on the St. Lawrence River. Kingbird 27: 142.

Easterla, D. A. and D. L. Damman. 1977. Unusual food item of Franklin's Gull. Auk 94: 163.

Giezentanner, K. I. and W. H. Clark. 1977. First record of Franklin's Gull (Larus pipixcan) in Nevada. Southwest. Nat. 22: 141-142.

Hughes, R. A. 1977. Franklin's Gulls (Larus pipixcan) at Lake Titicaca, Peru. Biotropica 9: 52.

Lewis, B. and A. Lewis. 1977. Franklin's Gull at Huntington Beach State Park, S.C. Chat 41: 96-97.

1976

McColl, J. G. and J. Burger. 1976. Chemical inputs by a colony of Franklin Gulls nesting in cattails. Am. Midl. Nat. 96: 270-281.

Wierenga, H. L. 1976. Maryland's first Franklin's Gulls. Md. Birdlife 32: 113-114.

1975

Cooper, J. and A. J. Williams. 1975. Franklin's Gull in South Africa. Ostrich 46: 117.

LeGrand, H. E., Jr. 1975. Franklin's Gull in South Carolina. Chat 39: 92.

1974

Burger, J. 1974. Breeding adaptations of Franklin's Gull (Larus pipixcan) to a marsh habitat. Anim. Behav. 22: 521-567.

Houston, C. S. 1974. South American recoveries of Franklin's Gulls and Swainson's Hawks banded in Saskatchewan. Blue Jay 32: 156-157.

Taboada, P., D. A., S., E. Zarate., R., M. T. Valderrama. 1974. Determinacion de algunos helmintos parasitos do Larus pipixcan Wagler, 'Gavota de Franklin'. Rev. Peru. Biol. 1: 194-196.

1973

Bry, E. 1973. The Franklin's Gull. N. Dak. Outdoors 36: 2-3.

Burger, J. 1973a. Competition between American Coots and Franklin's Gulls for nest sites and egg predation by the coots. Wilson Bull. 85: 449-451.

_____. 1973b. Egg size and shell thickness in the Franklin's Gull. Auk 90: 423-426.

Campbell, R. W. and R. G. Foottit. 1973. The Franklin's Gull in British Columbia. Syesis 5: 137-167.

1972

Burger, J. 1972a. Breeding adaptations of Franklin's Gulls (Larus pipixcan) to a marsh habitat. Ph.D. thesis, Univ. Minnesota/Minneapolis, MN.

_____. 1972b. Dispersal and post-fledging survival of Franklin's Gulls. Bird-Banding 43: 267-275.

_____. 1972c. The use of a fish-eye lens to study nest placement in Franklin's Gulls. Ecology 53: 362-364.

Cowan, P. J. 1972. The contrast and coloration of sea-birds: an experimental approach. Ibis 114: 390-393.

Moos, L. M. 1972. Gull banding in Montana. Proc. Mont. Acad. Sci. 32: 20-23.

Rogers, M. J. 1972. Franklin's Gull in Sussex. Brit. Birds 65: 81-82.

1971

Billett, D. F. and P. J. Grant. 1971. Franklin's Gull in Hampshire: a species new to Britain and Ireland. Brit. Birds 64: 310-313.

Burger, J. 1971. A method for marsh-trapping breeding Franklin's Gulls. Bird-Banding 42: 123-124.

Peterson, R. T. and G. E. Watson. 1971. Franklin's Gull and Bridled Tern in southern Chile. Auk 88: 670-671.

1968

Guay, J. W. 1968. The breeding biology of Franklin's Gull (Larus pipixcan). Ph.D. thesis, Univ. Alberta/Edmonton, AB. 119 pp.

Sipe, J. P. 1968. Rare birds collected at Lake Saint Marys, Ohio. Ohio J. Sci. 68: 334.

1967

Schultz, Z. M. 1967. Sight records of Franklin's and Sabine's Gull in Seattle, Washington. Murrelet 48: 19.

1966

Fisher, D., J. Hubbard and P. DeBenedictis. 1966. First Michigan specimens of the Little Gull and Franklin's Gull. Jack-Pine Warbler 44: 50.

1965

McCaskie, G. and E. A. Cardiff. 1965. Notes on the distribution of the Parasitic Jaeger and some members of the Laridae in California. Condor 67: 542-544.

Swales, M. K. and R. C. Murphy. 1965. A specimen of *Larus pipixcan* from Tristan da Cunha. Ibis 107: 394.

Wells, L. A. and R. Wells. 1965. Franklin's Gull at Columbus. Oriole 30: 93-94.

1964

Medley, M. 1964. Observations on Laughing Gulls and Franklin's Gulls at St. Joseph, Michigan. Jack-Pine Warbler 42: 231.

1963

Burford, F. C. 1963. Franklin's Gull at Norfolk, Virginia. Raven 34: 52.

1962

Fisher, H. I. 1962. The hatching muscle in Franklin's Gull. Wilson Bull. 74: 166-172.

Williams, L. E., Jr. 1962. White-fronted Goose and Franklin Gull in Mississippi. Miss. Ornithol. Soc. Newsl. 7: 8.

1960

Rothweiler, R. A. 1960. Food habits, movements and nesting of gulls on a waterfowl area, Freezout Lake, Teton County, Montana. M.S. thesis, Montana St. Coll./Bozeman, MT. 29 pp.

1959

King, J. E. 1959. Franklin Gull in the central Pacific. Condor 61: 226.

Monroe, B., Jr. 1959. Franklin's Gull. Fla. Nat. 32: 95-96.

Moynihan, M. 1959. Notes on the behavior of some North American gulls. IV. The ontogeny of hostile behavior and display patterns. Behaviour 14: 214-239.

Stevenson, H. M. 1959d. Franklin's Gull (Larus pipixcan). Fla. Nat. 32: 146-147.

1957

Collias, E. C. and N. E. Collias. 1957. The response of chicks of the Franklin's Gull to parental bill-color. Auk 74: 371-375.

1956

Moynihan, M. 1956. Notes on the behavior of some North American gulls. I. Aerial hostile behavior. Behaviour 10: 126-178.

1954

Sooter, C. A. 1954. Franklin's Gulls riding whirlwind and feeding. Condor 56: 313.

1953

Pearse, T. 1953. Franklin's Gull on Pacific coast of British Columbia. Condor 55: 219.

1949

Jewett, S. G. 1949. The Franklin Gull in Oregon. Condor 51: 189-190.

1944

Cottam, C. 1944. Gulls as vegetarians. Condor 46: 127-128.

1943

Slipp, J. W. 1943. Further notes on the Franklin's Gull in the Pacific Northwest. Condor 45: 38-39.

1942

Slipp, J. W. 1942a. Franklin Gull in the state of Washington: a first record. Murrelet 23: 18.

_____. 1942b. Franklin Gull in Idaho. Condor 44: 226-227.

1941

DuMont, P. A. 1941. Relation of Franklin's Gull to agriculture on the Great Plains. Trans. N. Am. Wildl. Conf. 5: 183-189.

Low, J. B. 1941. Gadwall and Franklin's Gull nesting in Iowa. Iowa Bird Life 11: 31-32.

McClanahan, R. C. 1941. Franklin's Gull an addition to the Florida list. Auk 58: 405-406.

1940

Meade, G. M. 1940. Franklin's Gull in New York State. Auk 57: 251.

Saugstad, S. 1940. Feeding habits of the Franklin's Gull in North Dakota. N. Dak. Agric. Exp. Stn. Bimon. Bull. 2: 14-16.

1939

McLean, D. D. 1939. European Jack Snipe and Franklin Gull in California. Condor 41: 164.

Olsen, O. 1939. The occurrence of the fluke *Plagiorchis potanini* Skrjabin 1928 in Franklin's Gull (*Larus pipixcan* Wagl.) in North America. Proc. Helminthol. Soc. Wash. 6: 20.

1938

DuMont, P. A. 1938. Franklin's Gulls nesting on Sand Lake Refuge, South Dakota. Oologist 55: 3-5.

1936

Lowe, W. P. 1936. Franklin's Gull *Larus pipixcan* (olim *franklini*) in Devon. Ibis (13th Ser.) 6: 378-379.

1934

Bradshaw, F. 1934. Grasshoppers routed by gulls. Can. Field-Nat. 48: 68-69.

1932

Leopold, A. 1932. A flight of Franklin's Gulls in northwestern Iowa. Wilson Bull. 44: 116.

1928

Brodkorb, P. 1928. Franklin's Gull in Illinois. Auk 45: 91.

1927

Gardner, L. L. 1927. The relation of birds to an outbreak of locusts. Bird-Lore 29: 180-182.

Lewis, W. E. 1927. Franklin's Gulls in northwestern Oklahoma. Wilson Bull. 39: 109-110.

Rowan, W. 1927. Banding Franklin's Gulls in Alberta. Wilson Bull. 39: 44-49.

1926

Bailey, A. H. and R. J. Niedrach. 1926. The Franklin Gull in Colorado. Condor 28: 44-45.

Hall, J. W. 1926. Franklin's Gulls as insect destroyers in the North Platte Valley of Nebraska. Wilson Bull. 38: 36-37.

1924

Stone, W. 1924. Franklin's Gull at Philadelphia--a correction. Auk 41: 468.

1921

Morse, A. P. 1921. Franklin's Gull in New England. Bull. Essex Co. Ornithol. Club 1921: 68-69.

1915

Law, J. E. 1915. Franklin Gull: a new record for California. Condor 17: 96.

1912

Conover, F. L. 1912. Franklin's Gull in Wisconsin. Auk 29: 388.

Stone, W. 1912. Franklin's Gull (*Larus franklini*) at Phildelphia. Auk 29: 99-100.

1910

Job, H. K. 1910. The Franklin's Gull. Bird-Lore 12: 124.

1902

Smyth, E. A. 1902. Franklin's Gull in the Virginia Mountains. Auk 19: 74-75.

1900

Roberts, T. S. 1900. An account of the nesting habits of Franklin's Rosy Gull (*Larus franklinii*), as observed at Heron Lake in southeastern Minnesota. Auk 17: 272-283.

1886

Preston, J. W. 1886. Breeding of Franklin's Gull in Minnesota. Ornithol. Oolog. 11: 54-55.

1885

Willard, S. W. 1885. The occurrence of *Chroicocephalus franklini* in Wisconsin. Auk 2: 222.

1878

Aughey, S. 1878. Notes on the nature of the food of the birds of Nebraska. Appendix II. Pp. 13-62 *in* U.S. Entomol. Comm. Annu. Rep. 1877. GPO, Washington, D.C.

Adult Bonaparte's Gull in winter plumage. Photograph by Clayton Taylor.

BONAPARTE'S GULL

(*Larus philadelphia*)

[DU: Kleine Kokmeeuw, NW: Kanadisk Hettemake]

GENERAL DISTRIBUTION

North America Bonaparte's Gulls breed inland in western and central Alaska and in Canada from the MacKenzie Delta, Northwest Territories, and central Yukon south to the Fraser River Valley, British Columbia, and east across forested areas of Alberta, Saskatchewan, Manitoba, and Ontario to James Bay (Godfrey 1966).

These gulls migrate south along the Pacific coast and through the Great Lakes (AOU 1957) south along the Atlantic coast. In the west they winter from Washington to southern Baja California. In the east they winter commonly along the southeastern Atlantic coast from southeastern Virgina (Virginia Society of Ornithology 1979) south to Florida (AOU 1957) and the Greater Antilles (Bond 1974), as well as along the Gulf of Mexico from Florida through Texas (Map 3) to the Yucatan (AOU 1957). They winter in small numbers casually as far north as southern Ontario and New England in the east, and southern British Columbia in the west (AOU 1957).

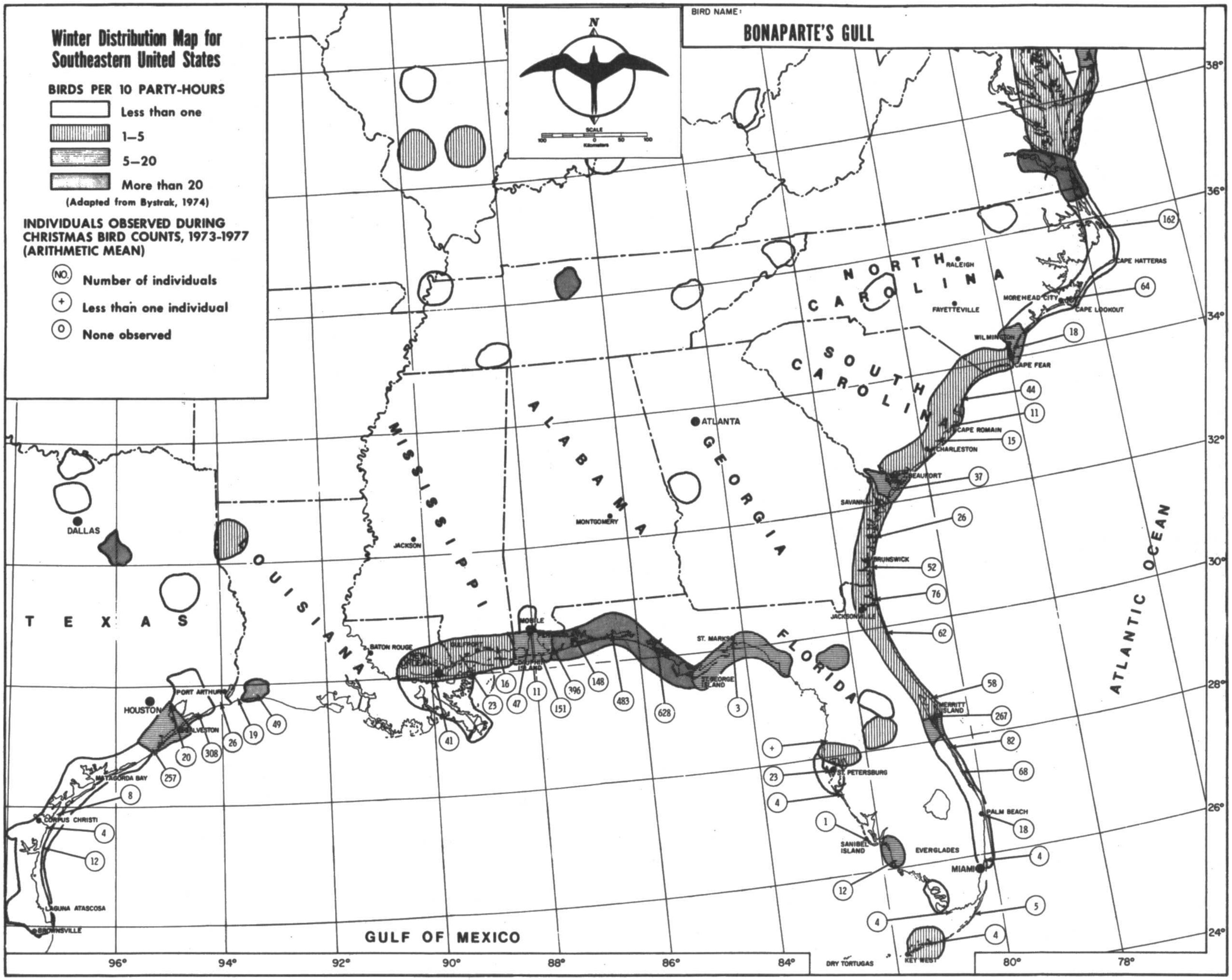
World Distribution Bonaparte's Gulls breed only in the Nearctic but have straggled both east and west. To the west, this gull has been reported from Hawaii (Berger 1972). To the east, it has been recorded from Greenland, France, Heligoland (AOU 1957), the Netherlands (Kist 1961), and Norway (Ree 1974). The species usually is reported once or twice a year in Britain and Ireland (Grant 1978). They have also been reported from the northern Lesser Antilles (Bond 1971) and Panama (Pujals 1973).

DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

Bonaparte's Gull is a species that is seldom mentioned in the seasonal reports appearing in *American Birds*. Thus, most of our regional information came from state bird books and may be out of date.

North Carolina Bonaparte's Gulls are common migrants and wintering birds on the North Carolina coast. Potter et al. (1980) regarded this species as erratic along the coasts of the Carolinas: usually fairly common to common, but sometimes abundant. Birds have been recorded in North Carolina from as early as 8 August to as late as May (Wray and Davis 1959). Peak concentrations of wintering birds are shown in Table 20.

South Carolina Bonaparte's Gull are locally common winter residents in South Carolina (Sprunt and Chamberlain 1949), usually present from October



Winter Distribution Map for Southeastern United States
BIRDS PER 10 PARTY-HOURS
Less than one
1–5
5–20
More than 20
(Adapted from Bystrak, 1974)
INDIVIDUALS OBSERVED DURING CHRISTMAS BIRD COUNTS, 1973-1977 (ARITHMETIC MEAN)
(NO.) Number of individuals
+ Less than one individual
0 None observed
BIRD NAME:
BONAPARTE'S GULL
N
SCALE
Kilometers
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI
LOUISIANA
TEXAS
FLORIDA
ATLANTIC OCEAN
GULF OF MEXICO
RALEIGH
FAYETTEVILLE
MOREHEAD CITY
CAPE HATTERAS
CAPE LOOKOUT
WILMINGTON
CAPE FEAR
CAPE ROMAIN
CHARLESTON
BEAUFORT
SAVANNAH
BRUNSWICK
JACKSONVILLE
MERRITT ISLAND
PALM BEACH
MIAMI
EVERGLADES
KEY WEST
DRY TORTUGAS
SANIBEL ISLAND
ST. PETERSBURG
ST. MARKS
ST. GEORGE ISLAND
ATLANTA
MONTGOMERY
JACKSON
MOBILE
BATON ROUGE
DALLAS
HOUSTON
PORT ARTHUR
GALVESTON
MATAGORDA BAY
CORPUS CHRISTI
LAGUNA ATASCOSA
BROWNSVILLE
162
64
18
44
11
15
37
26
52
76
62
58
267
82
68
18
4
5
4
4
12
1
4
23
+
3
628
483
148
396
151
11
47
23
16
41
49
19
26
308
20
257
8
4
12
38°
36°
34°
32°
30°
28°
26°
24°
96°
94°
92°
90°
88°
86°
84°
80°
78°

Map 3

through May. Occurrences on 20 August and 9 June were considered particularly early and late (Sprunt and Chamberlain 1949). According to Burton (1970), these birds are much more restricted to coastal areas than are Herring or Ring-billed Gulls.

Georgia Bonaparte's Gulls are erratically common winter visitors along the Georgia coast. Most occur in the state between 21 September and 25 May (Burleigh 1958, Denton et al. 1977), but one was seen as late as 20 June in the Savannah River Delta (Tomkins 1958). The seasonal distribution of this species in Georgia is probably similar to that in Florida, with the bulk of the wintering population arriving after mid-December.

Florida Sprunt (1954) called Bonaparte's Gulls common in winter, noting that few arrive in fall and that the main influx occurs in early or mid-winter. Kale (1979 ms a) considered them common winter residents from October to May along the Atlantic coast, and regular (1979 ms b) along the Gulf coast in varying numbers from October to March. Relatively low numbers are found along the Atlantic coast, and even fewer are found on the Gulf coast of the Peninsula. These gulls are most common along the Florida panhandle (Map 3), where they arrive earlier than elsewhere in the state. The Tampa-St. Petersburg area has many more Bonaparte's Gulls in January-March than in December (W. Hoffman, pers. comm.).

Alabama Imhof (1976b) regarded this species as uncommon to abundant on the Alabama Gulf coast, where extreme dates of occurrence are 1 October and 14 May. Winter concentrations in January and February often contain one to three thousand birds (Imhof 1976b, Table 20).

Mississippi Bonaparte's Gulls are common in small flocks in winter along the coast. Extreme dates of occurrence are 25 August (Jackson and Cooley 1978a) and 21 May (Burleigh 1944). Gulls seen 27 June and 23 July (Jackson and Cooley 1978a) may have been birds that summered south of the breeding range. The species evidently does not occur in as large concentrations in Mississippi as in neighboring Alabama (Table 20, Map 3).

Louisiana Bonaparte's Gulls winter regularly in small numbers in coastal Louisiana (Lowery 1974). Lowery listed extreme dates of occurrence to be from 29 August to 14 June, but indicated that peak numbers were present from mid-October to mid-April.

Texas Blacklock (1978 ms) considered this gull uncommon in winter on the coast, where they reach peak numbers in March. Oberholser (1974) reported that the primary period of occurrence is from early October to late April, but Blacklock (1978 ms) believed that most arrive in November.

Table 20. Peak concentrations of wintering Bonaparte's Gulls in the coastal southeastern United States.

Date seen		Number seen	Locality	Source
			NORTH CAROLINA	
1947	19 Dec.	3,500	Albemarle Sound	Chamberlain and Chamberlain 1948
1979	8 Apr.	5,000	Bird Shoal near Beaufort	LeGrand 1979d
1959	25 Apr.	21	Wilmington	Chamberlain 1959b
			GEORGIA	
1965	2 Jan.	5,000	off Sapelo Island	Parnell 1965b
			FLORIDA	
1961	28 Dec.	200	Panacea (Gulf)	Stevenson 1962b
1958	1 Jan.	450	Port Canaveral (Atlantic)	Stevenson 1958b
1967	18 Jan.	41	Key West (Keys)	Robertson 1967
1950	5 Jan.	2,500	Pensacola (Gulf)	Lowery 1950
1950	11-12 Jan.	2,000	Pensacola (Gulf)	Lowery 1950
1920	11 Feb.	1,500	Saint Andrews Bay (Gulf)	Howell 1932
1979	Feb.	500	Eastpoint (Gulf)	Stevenson 1979a
1964	10 Mar.	3,000	Pensacola (Gulf)	James 1964
1957	25 Mar.	6,000	near Pensacola (Gulf)	Newman 1957a
1948	28 Mar.	1,000	Pensacola (Gulf)	Weston 1948
			ALABAMA	
1972	22-23 Jan.	1,400	Fort Morgan to Gulf Shores	Imhof 1976b
1958	31 Jan.	1,200+	Alabama Point	Newman 1958b
1974	19 Feb.	2,750+	Gulf Shores	Imhof 1976b
1978	18 Mar.	20,000	Alabama Point	Imhof 1978
			MISSISSIPPI	
1980	20 Nov.	200+	Clermont Harbor	Jackson 1981
1977	3 Dec.	200	Ross Barnett Reservoir	Jackson and Cooley 1978a
1980	27 Dec.	214	Sardis Lake	Jackson 1981
1978	Jan-Feb.	to 160	Horn Island	Jackson and Cooley 1978a
1978	5 Mar.	250	Pascagoula River marsh	Jackson and Cooley 1978a

Table 20. Concluded.

Date seen		Number seen	Locality	Source
			LOUISIANA	
1932	31 Dec.	32	Calcasieu Lake	Oberholser 1938
1937	2 Apr.	50	Grand Isle	Oberholser 1938
			TEXAS	
1969	11 Jan.	100	Freeport jetties	Webster 1969b
1969	13 Jan.	300+	Gilchrist, Bolivar Peninsula	Webster 1969b
1967	11 Feb.	80	feeding along Port Aransas jetty	Webster 1967b
1968	14 Apr.	102	Port Aransas jetty	Webster 1968b

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

Breeding Bonaparte's Gulls breed in the interior of Alaska and northern Canada in the boreal forest zone.

Winter Most Bonaparte's Gulls winter along the Pacific coast from Washington south into Mexico, and on the Atlantic coast from New England to the Yucatan Peninsula. Because they arrive on the wintering ground well after the completion of the breeding season, Christmas Bird Counts may not reflect the true size of wintering populations. Recent Christmas Counts (Map 3) suggest that the largest wintering populations in the southeastern United States are found along the north coast of the Gulf of Mexico. Substantial numbers are also present on the Atlantic coast of Florida and North Carolina. In some years, large concentrations occur in the southeastern states (Table 20).

Migration Cooke (1915) remarked that most Bonaparte's Gulls winter to the east of the breeding range. Most of the birds that winter along the Atlantic coast follow the northern limit of tree growth through the Gulf of St. Lawrence, but others move south by Lake Winnipeg to the Great Lakes and thence to the coast. Cooke believed that only small numbers follow the Mississippi River south to the Gulf coast. Bonaparte's Gulls wintering along the Pacific coast were believed to migrate south across the Rocky Mountains to the coast of southern Alaska and thence south. Cooke (1915) suggested that the spring route basically retraced that taken in fall. Beardslee (1944) later pointed out that very large numbers follow the Niagara River where peaks of fall migration occur from early August through September and in November and December. A peak of spring migration takes place there from early April through early May. The fall migrants are largely adults, which led Beardslee to suggest that juveniles travel southward over another route.

Cooke (1915) remarked that the most notable characteristic of the fall migration of Bonaparte's Gull is its early beginning; birds are migrating in the northern portion of the range by late July. Arrival dates for localities along the Atlantic coast are from early August to mid-September, with progressively later dates at more southern localities. He noted that peak movements occur a month to six weeks later and that the species is most abundant off the New England coast in October. The latest dates of occurrence for birds wintering in the southeast listed by Cooke (1915) range from late March at New Orleans, Louisiana, to the first week of April in Florida, to the first two weeks of May in North and South Carolina.

HABITAT

Nesting Bonaparte's Gulls usually nest in spruce and other coniferous trees near lakes and muskegs of Canadian and Alaskan boreal forests (Bent 1921, Henderson 1926, Twomey 1934, Jehl and Smith 1970). Nests are usually from about 4-20 ft (1-6 m) above the ground (authors cited by Bent 1921, Henderson 1926). Symons (1968) recorded an atypical nest in a clump of bulrushes in a swamp in Saskatchewan. Others nests in Saskatchewan have been found in reeds in a marsh around a lake and one even was found on the mudflat of a temporary pothole (Lamont 1980).

Feeding Bonaparte's Gulls feed over marshy ponds in the interior (Bent 1921). Transient and wintering birds feed in a wide variety of habitats including freshwater marshes, rivers, lakes, estuaries, saltmarshes, beaches, bays, and open ocean. Tomkins (1958) reported that sewer mouths were favored as feeding areas in the Savannah River Delta area in Georgia. Bonaparte's Gulls wintering on Long Island, New York, prefer to feed over inlets, particularly at high tide (Lauro 1980).

Nonbreeding and Offshore In the southeastern United States, Bonaparte's Gulls use freshwater lakes, estuaries, and inlets, as well as the nearshore waters of the Gulf of Mexico and the Atlantic Ocean. They regularly roost on sandbars and beaches, but some birds stay offshore for extended periods. Those on Monterey Bay, California, primarily winter inshore and secondarily use offshore waters. They also occur inland along sloughs and rivers (Baltz and Morejohn 1977). In the northern Chesapeake Bight, wintering and migrant birds occur largely over shallow coastal waters (Rowlett 1980). Most of the Bonaparte's Gulls observed in the Bight were found within 20 km (12 mi) of shore, but one feeding flock of 300 birds was seen 44 km (27 mi) east of Ocean City, Maryland, on 4 December 1976. Bonaparte's Gulls have also been seen in the Gulf up to 40 mi (64 km) west of the Florida coast (Buhrman and Hopkins 1978).

FOOD AND FEEDING BEHAVIOR

Bonaparte's Gulls feed extensively by plunging for small fish (Wolf and Gill 1961). They are adept at hawking insects and occasionally forage on foot along beaches. Lauro (1980) suggested that most Bonaparte's Gulls wintering on Long Island prefer to feed either by sitting on the water and picking items from the surface or by seizing items at the surface while in flight. Gulls feeding at settling tanks in Baltimore, Maryland, prefer to seize food while in flight but also pick up items while sitting on the surface (R. Blum, pers. comm.). At this locality they seldom or never plunge for food.

Migrants at Olsen Creek, Prince William Sound, Alaska, feed on drift eggs of salmon (*Oncorhynchus* spp.) by briefly landing on the water and diving for them (Moyle 1966). In the western Lake Erie region, migrating Bonaparte's Gulls congregate in the thousands during the fall to feed on emerald shiners (*Notropis atherinoides*) in the harbor at Put-In-Bay (Ligas 1952). There, they dive for fish, submerging completely, and often feed on insects either by seizing them while flying or by picking them from the surface of the water.

King (1973) reported "foot-paddling" to disturb small marine organisms in tidal pools. Bonaparte's Gulls have been observed robbing Dunlins (*Calidris alpina*) of earthworms in Michigan (Payne and Howe 1976), and a bird collected in New Jersey had eaten a large quantity of walnut meat (Frohling 1967). In Florida, they often feed on schooling baitfish. At times they feed on the schools in flocks with Horned Grebes (*Podiceps auritus*) (Dusi 1968; W. Hoffman, pers. comm.). Others seen with Red-breasted Mergansers (*Mergus serrator*) at Blackburn Bay, Florida, fed on items stirred up by feeding ducks (Stedman and Stedman 1979). Insects are the major items of diet on the nesting grounds, as are marine organisms in winter (Bent 1921).

Information on the diet based on the examination of stomach contents is scanty. Seventy-eight stomachs taken by the Biological Survey contained about one-third insects, "about one-half fishes, and the remainder small snails and crustaceans" (Howell 1932). Four stomachs of seven Bonaparte's Gulls collected on the Bass Islands in Western Lake Erie contained only insects, the rest only emerald shiners (Ligas 1952). Stinkbugs were the insect found most frequently, but small beetles, flies, and spiders were also eaten. Ligas reported that an adult Bonaparte's Gull held captive for 40 days subsisted entirely on shiners and ate from 63.0-147.7 g/day (2.2-5.2. oz/day) (mean = 95.6 g [3.4 oz]). The captive bird weighed 176 g (6.2 oz) at the end of the experiment.

The stomach contents of 23 migrant Bonaparte's Gulls that were collected in August and September near Deer Island, New Brunswick, were examined by Braune and Gaskin (1982a) who reported that these birds had fed mostly on euphausiid crustaceans (*Meganyctiphanes norvegica*, *Thysanoessa inermis*) and insects from a variety of orders. Representatives of both groups occurred in equal frequency, but euphausiids constituted a majority of the diet by weight. Small herring (*Clupea harengus*), pollock (*Pollachius virens*), and rainbow smelt (*Osmerus mordax*) were also significant in the diet.

Stomachs of 12 Bonaparte's Gulls wintering on Monterey Bay, California, contained invertebrates (93.1% by frequency) and small fish (6.9%) (Baltz and Morejohn 1977). Bonaparte's Gull had the most varied diet of any of the six species of gulls examined. Two hundred insect pupae (47.6% of all food items found), 62 crab megalops (16.9%), 40 unidentified nereids (9.5%), and 30 euphausiid crustaceans (*Thysanoessa spinifera* - 7.1%) were the food items most frequently found. Foods identified to either species or genus were *Thysanoessa*, rockfish (*Sebastes* spp. - 3.8%), small crustaceans (*Euphausia* sp. - 3.1%; *Pasiphaea pacifica* - 1.4%; *Hyale* sp. - 1.2%; *Idothea* spp. - 0.9%), and the northern anchovy (*Engraulis mordax* - 1.7%). One each of three benthic species of fish (plainfin midshipman [*Porichthys notatus*], red brotula [*Brosmophycis marginata*], and spotted cusk-eel [*Chilara taylori*]) was also identified in the stomach contents.

IMPORTANT BIOLOGICAL PARAMETERS

The breeding biology of Bonaparte's Gull is virtually unstudied. As Henderson (1926) indicated, the habit of breeding noncolonially, or in very dispersed colonies in blackfly-infested muskeg swamps, has deterred most ornithologists from observing their habits.

Egg Laying Nesting has been reported in late May in Saskatchewan (Symons 1968), late May to early June in Alberta (Henderson 1926, Farley 1931, Twomey 1934), and mid- to late June in Manitoba (Jehl and Smith 1970).

Mean Clutch Size Few data are available on mean clutch size (Table 21). Most nests contain three eggs, although some contain only two. Clutches of four are rarely found (Bent 1921).

Table 21. Mean clutch sizes reported for the Bonaparte's Gull.

Mean clutch size	Number of clutches	Locality and period of observation	Source
2.83	6	Alberta, near Athabasca Landing	Henderson 1926
3.00	4	Saskatchewan, near Meota	Symons 1968
2.95	20	Manitoba, Churchill, 1964-1967	Jehl and Smith 1970

Incubation Period Jehl and Smith (1970) reported an incubation period of 23-24 days.

Hatching Success At Churchill, Manitoba, 16 of 38 eggs hatched, a rate of 42% (Jehl 1971).

Age at Fledging Unknown.

Fledging Success Unknown.

Mortality of Eggs and Young Most (96%) of the eggs lost from nests of the Bonaparte's Gull at Churchill, Manitoba, were lost to inclement weather; eggs were blown out of the nests by high winds (Jehl 1971).

Renesting Henderson (1926) described one clutch as an apparent replacement clutch.

Age at First Breeding Age at first breeding has not been determined. Bonaparte's Gulls apparently gain full breeding plumage at two years of age (Dwight 1925) and they may breed then.

Maximum Natural Longevity No data are available.

Weight Gross (1937) reported the weight of an unsexed late migrant taken in the Magdalen Islands in June as 201 g (7.1 oz). Weights of four breeding males taken near Napaskiak, Alaska, in June ranged from 182 to 202 g (6.4-7.1 oz), and the weight of a single breeding female was 169 g (6.0 oz) (Williamson 1957). The mean weight of five Bonaparte's Gulls, all evidently wintering birds taken at Monterey Bay, California, was 176.8 g (6.2 oz) (Baltz and Morejohn 1977).

SUSCEPTIBILITY TO OIL POLLUTION

There are few records of oiled Bonaparte's Gulls. Kramer and Kramer (1945) found three dead, oiled birds of this species among 92 birds of 11 species found dead, most oiled, in a 10-mile stretch of beach in New Jersey. DuMont (1977) saw an oil-stained bird among a group of 150 gulls at Ocean City, Maryland. Phillips (1974) saw a bird in Cornwall, England, that was oiled on the lower belly and vent. Five days later this bird was clean and apparently suffering no ill effects. Phillips believed that this cleaning resulted from preening, but Mather (1974) expressed skepticism about gulls' ability to clean their plumage solely through preening and suggested that the clean appearance may have been due to molt.

Bonaparte's Gulls occur in large numbers in the southeastern United States, sometimes in large concentrations, both near the shore and well out from it. They frequently alight on the water and feed from the surface. However, they tend to occur in scattered flocks, and numbers present in any area vary considerably from year to year. Consequently, a major oil spill probably would have little effect on the total population. Long-term chronic oil pollution of the coast might have more serious consequences, but more information on the numbers and status of this gull, both within the southeast and elsewhere, is needed to evaluate adequately the potential effects of oiling.

BIBLIOGRAPHY

1982

Braune, B. M. and D. E. Gaskin. 1982a. Feeding ecology of nonbreeding populations of larids off Deer Island, New Brunswick. Auk 99: 67-76.

_____. 1982b. Feeding methods and diving rates of migrating larids off Deer Island, New Brunswick. Can. J. Zool. 60: 2190-2197.

1980

Lamont, S. M. 1980. Atypical nest of Bonaparte's Gull. Blue Jay 38: 44-45.

Lauro, A. J. 1980. The winter ecology of Bonaparte's Gull on the south shore of Long Island. Linn. Newsl. 34(1): 1-3.

1979

Braune, B. M. 1979. Feeding ecology of migrating populations of Bonaparte's Gulls, Common Terns, and Arctic Terns. M.S. thesis, Univ. Guelph/Guelph, ON.

Britton, D. 1979. Identification of Bonaparte's Gull. Brit. Birds 72: 339-340.

Stedman, S. and A. Stedman. 1979. Feeding association between Bonaparte's Gull and Red-breasted Mergansers. Fla. Field Nat. 7: 27.

1978

Grant, P. J. 1978. Field identification of west Palearctic gulls. Brit. Birds 71: 145-176.

Grow, R. 1978. A kleptoparasitic action by Bonaparte's Gulls on Yellowlegs. Indiana Audubon Q. 56: 178-179.

Ryder, R. A. 1978. Gulls in Colorado: their distribution, status, and movements. Proc. 1977 Conf. Colonial Waterbird Group 1: 3-9.

1977

Baltz, D. M. and G. V. Morejohn. 1977. Food habits and niche overlap of seabirds wintering on Monterey Bay, California. Auk 94: 526-543.

Vermeer, K. 1977. Some observations on Arctic Loons, Brandt's Cormorants and Bonaparte's Gulls at Active Pass, British Columbia. Murrelet 58: 45-47.

1976

Payne, R. B. and H. F. Howe. 1976. Cleptoparasitism by gulls of migrating shorebirds. Wilson Bull. 88: 349-351.

1974

Mather, J. R. 1974. [Comment on] Oiled seabirds successfully cleaning their plumage. Brit. Birds 67: 483-484.

Phillips, J. 1974. Oiled seabirds successfully cleaning their plumage. Brit. Birds 67: 483.

Ree, V. 1974. Kanadisk hettemake observert i Norge. [Bonaparte's Gull observed in Norway.] Sterna 13: 109-115. [In Norwegian with English summary.]

1973

King, B. 1973. Bonaparte's Gull in Cornwall "foot-paddling" to disturb organisms. Brit. Birds 66: 447.

Pujals, J. J. 1973. First photograph of Bonaparte's Gull in Panama. Am. Birds 27: 840.

Raines, R. J. 1973. Bonaparte's Gull off Birkenhead. Cheshire Bird Rep. 1973: 26-27.

1972

Alsop, F. J., III. 1972. Bonaparte's Gull in Great Smoky Mountains National Park. Migrant 43: 72-73.

Seymour, N. R. 1972. Success of three gull species feeding on swarming ants in Antigonish County, Nova Scotia. Can. Field-Nat. 86: 391-392.

1971

Jehl, J. R. 1971. Patterns of hatching success in subarctic birds. Ecology 52: 169-173.

1970

Jehl, J. R. and B. A. Smith. 1970. Birds of the Churchill region, Manitoba. Manit. Mus. Man Nat. Spec. Publ. 1. 86 pp.

1968

Burger, J. and R. Brownstein. 1968. The status of Bonaparte's Gull in New York State. Kingbird 18: 9-20.

Dusi, J. L. 1968. Feeding interaction between Bonaparte's Gulls and Horned Grebes. Auk 85: 129.

Parkin, D. T. and P. Parkin. 1968. Bonaparte's Gull in Sutherland. Scott. Birds 5: 175.

Rusk, M. S. and F. G. Scheider. 1968. Additions to Bonaparte's Gull records, Region 5. Kingbird 18: 84.

Symons, R. D. 1968. Atypical nesting of Bonaparte's Gull in Saskatchewan. Blue Jay 26: 70-74.

1967

Burger, J. 1967. Notes on the roosting behavior of Bonaparte's Gull. Kingbird 17: 213.

Frohling, R. C. 1967. Bonaparte's Gull feeding on walnut meat. Wilson Bull. 79: 341.

1966

Moyle, P. 1966. Feeding behavior of the Glaucous-winged Gull on an Alaskan salmon stream. Wilson Bull. 78: 175-190.

1965

Schmidt, G. D. 1965. Corynosoma bipapillum sp. n. from Bonaparte's Gull Larus philadelphia in Alaska, with a note on C. constrictum Van Cleave, 1918. J. Parasitol. 51: 814-816.

1964

Post, P. W. 1964. On the reluctance of Bonaparte's Gulls to fly under objects. Kingbird 14: 91.

1961

Kist, J. 1961. Waarnemingen van de Kleine Kokmeeuw, Larus philadelphia (Ord), bij Scheveningen. [Larus philadelphia, new to the Dutch list.] Limosa 34: 220-224. [In Dutch with English summary.]

Wolf, L. L. and F. B. Gill. 1961. Flock feeding behavior in migrant Bonaparte's Gulls. Wilson Bull. 73: 389-390.

1956

Bard, F. G. 1956. Bonaparte's Gull. Blue Jay 14: 80.

Little, B. 1956. Bonaparte's Gull in Northumberland. Brit. Birds 49: 324-325.

Moynihan, M. 1956. Notes on the behavior of some North American gulls. I. Aerial hostile behavior. Behaviour 10: 126-178.

1954

Moule, G. W. H. 1954. Bonaparte's Gull in Dorset. Brit. Birds 47: 272-273.

1953

Taber, W. 1953. Winter status of the Bonaparte's Gull in Maine. Bull. Maine Audubon Soc. 9: 35-36.

1952

Harber, D. D. 1952. Bonaparte's Gull in Sussex. Brit. Birds 45: 333.

1948

Brackbill, H. 1948. Bonaparte's Gull and American Pipit in winter. Md. Nat. 18: 14-15.

1944

Beardslee, C. S. 1944. Bonaparte's Gull on the Niagara River and eastern Lake Erie. Wilson Bull. 56: 9-14.

1940

Cruickshank, A. D. 1940. Albinism in gulls. Proc. Linn. Soc. N.Y. 50-51: 31-32.

Nichols, D. G. 1940. Feeding habit of Bonaparte Gull. Gull 22: 41.

1936

Munro, J. A. 1936. Nesting of the Bonaparte Gull in British Columbia. Condor 38: 60-61.

1934

Twomey, A. C. 1934. Breeding habits of Bonaparte's Gull. Auk 51: 291-296.

1931

Bunyard, P. F. 1931. [On the eggs of _Tringa americana_ and _Larus philadelphia_ from Alberta.] Bull. Br. Ornithol. Club 51: 9-12.

Farley, F. L. 1931. Nesting of Bonaparte's Gull (_Larus philadelphia_) in central Alberta. Can. Field-Nat. 45: 138-139.

1930

Murray, J. J. 1930. Bonaparte's Gull at Lexington, Virginia. Auk 47: 72.

1929

Saunders, W. E. 1929. Bonaparte's Gulls in unusual numbers. Oologist 46: 2.

1928

Stubbs, A. P. 1928. Summering Bonaparte's Gull at Lynn, Mass. Auk 45: 91-92.

1927

Nichols, J. T. 1927. Brown Pelican and summering Bonaparte's Gulls at Newport, R.I. Auk 44: 555.

1926

Bunyard, P. F. 1926. [Note on the nest and eggs of *Larus philadelphia* and *Ereneutes pusillus*.] Bull. Br. Ornithol. Club 46: 108-112.

Henderson, A. D. 1926. Bonaparte's Gull nesting in northern Alberta. Auk 43: 288-294.

Rowan, W. 1926. On the breeding of the Bonaparte Gull. Bull. Br. Oologic. Assoc. 1: 112-116.

1924

Urner, C. A. 1924. Bonaparte's Gull summering near Perth Amboy, N.J. Auk 41: 149.

1910

Seguin-Jard, E. 1910. Premiere capture d'un *Larus philadelphia* sur les cotes de la Vendee. Nantes Bull. Soc. Sci. Nat. 10: 97-100.

1902

Eifrig, G. 1902. Remarkable flight of gulls at Cumberland, Md. Auk 19: 75.

1901

Loomis, L. M. 1901. On the southern limit of the winter range of Bonaparte's Gull (*Larus philadelphia*). Auk 18: 104-105.

RING-BILLED GULL

(Larus delawarensis)

[GE: Ringschnabelmowe, SP: Apipizca pinta]

GENERAL DISTRIBUTION

North America Ring-billed Gulls breed almost entirely in the interior of North America from northeastern California, central Oregon, and central Washington east through the northern Great Basin (south to Colorado) and the Rocky Mountain States, north in the western Great Plains to northern Alberta, Saskatchewan, south central Manitoba, and the Great Lakes, and locally along the St. Lawrence River, to northeastern Newfoundland and New Brunswick, southern and southeastern Labrador, and south to Lake Champlain in New York (AOU 1957, Godfrey 1966, Southern 1980a). They have been reported breeding along James Bay, but this needs confirmation (Godfrey 1966). Recently, they were found breeding on the Washington coast (Penland and Jeffries 1977) and on Lake Calumet in Illinois (Kleen 1975).

Ring-billed Gulls that breed west of 96° W winter on the Pacific coast (Southern 1974a) south from southern British Columbia (AOU 1957, Godfrey 1966) commonly to northern Baja California, but are rare farther south (AOU 1957, Southern 1980a). Populations from the Great Lakes and eastern Canada winter primarily on the Atlantic and Gulf coasts, although some winter in the Great Lakes wherever open water remains (Southern and Moore 1974).

The major migration route is east through the Great Lakes to staging areas on Lakes Erie and Ontario, east through Pennsylvania and New York to the Atlantic coast, then south to Florida and the Gulf of Mexico (Southern 1967a, 1974a). Most of the birds wintering on the Atlantic coast and eastern Gulf of Mexico apparently follow this route. Birds wintering in the western Gulf of Mexico, however, probably move south through the plains and the Mississippi Valley from the Canadian Prairie Provinces and the northern Plains States. Birds from the Great Lakes occasionally wander outside their normal range west and northwest to the Yukon, British Columbia, Saskatchewan, James Bay, Quebec, Oregon, California, and Colorado (Southern 1974b, Southern and Moore 1974).

World Distribution Ring-billed Gulls occur almost solely in North America. Some winter regularly in the Greater Antilles, and others occur casually south to Trinidad (ffrench 1973), Aruba (Voous 1977), Honduras (Southern 1974b, Brown and Monroe 1974, Southern and Moore 1974), Panama (Wetmore 1965, Southern 1974b, Southern and Moore 1974), and Colombia (Southern 1974b, Southern and Moore 1974). They wander to Hawaii (Berger 1972) and the Line Islands (King 1955). In the Old World, Ring-billed Gulls have been reported in Britain (Hume 1973, P. J. Grant 1979), Ireland (Mullarney 1980), Spain (Southern 1974b, Southern and Moore 1974), and central Germany (Berndt and Rahne 1968). At least 64 were recorded in Britain and Ireland through 1980 (Rogers et al. 1982).

DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

Although the occurrence of rare marine birds in the southeast is usually well documented, the presence of common transient or wintering species is usually poorly reported. The Ring-billed Gull is no exception. American Birds, which reports seasonal observations of birds, made only a few scattered references to Ring-billed Gulls in the south during a period of 10 years, although this gull occurs there in the thousands during the winter. Consequently, we have little detailed information on its status in these waters.

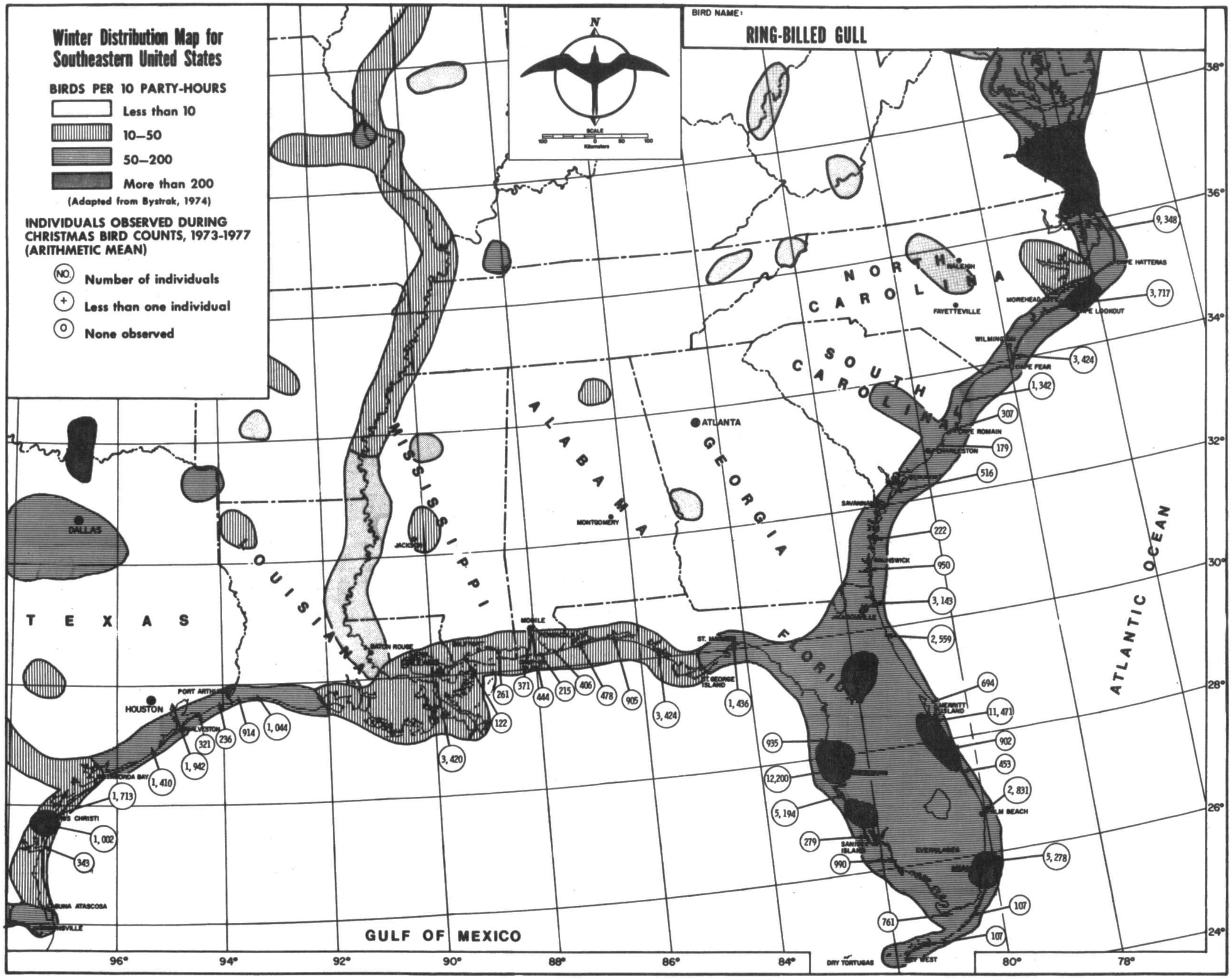
North Carolina Ring-billed Gulls are abundant in winter along the coast and are regular as nonbreeders in summer (Pearson et al. 1942). According to Southern (1974a), most of the Great Lakes Ring-billed Gulls pass through North Carolina on fall migration. However, Christmas Count data (Map 4) indicate that large numbers, as many as 16,000 per coastal count, may remain to winter.

South Carolina Sprunt and Chamberlain (1949) regarded Ring-billed Gulls as abundant in winter in South Carolina but much less common in summer. Forsythe (1973) found that the number of Ring-billed Gulls in the Charleston metropolitan area ranged from under 100 birds in summer to over 3,500 during the period from late November through mid-April. In December and February, somewhat lower numbers (but still several thousand) were present.

Forsythe (1972) examined South Carolina band recoveries of Ring-billed Gulls and found most of them to be from the Great Lakes region; a few were from northeastern Atlantic areas. Most recoveries were of first-year (53%) and second-year birds (17%). Forsythe's (1973) analysis of Christmas Counts showed that populations of this species had increased in the Charleston area from 1957 through 1972. Our summary of recent Christmas Count data (Map 4) suggests that far fewer Ring-billed Gulls winter in South Carolina than in North Carolina; the averages for four coastal counts were all below 1,500.

Georgia Denton et al. (1977) stated that Ring-billed Gulls are abundant on the Georgia coast in fall, winter, and spring, and that a few nonbreeding birds are present in summer. Norris (1939) found this species much more abundant in June at St. Simons Island than the resident Laughing Gull. Most (ca. 80%) of the Ring-billed Gulls seen by him were immatures. At the northern border of the state, Ring-billed Gulls arrive in October, but begin to return north in late April (Tomkins 1958); most are gone by early May (Burleigh 1958).

Florida The status of the Ring-billed Gull in Florida has changed markedly in this century. Howell (1932) called the species a common winter resident in only the northern part of the state, and indicated that it was less common than the Herring Gull. He had no records for the Florida Keys. He also noted that the bulk of the population arrived in late October and November. Sprunt (1954) noted that the Ring-billed Gull had become more common and widespread, and occurred all the way to Key West. Band recoveries (Kadlec and Drury 1968a,


Winter Distribution Map for Southeastern United States
BIRDS PER 10 PARTY-HOURS
Less than 10
10–50
50–200
More than 200
(Adapted from Bystrak, 1974)
INDIVIDUALS OBSERVED DURING CHRISTMAS BIRD COUNTS, 1973-1977 (ARITHMETIC MEAN)
NO.
Number of individuals
+
Less than one individual
O
None observed
BIRD NAME:
RING-BILLED GULL
N
TEXAS
LOUISIANA
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
SOUTH CAROLINA
NORTH CAROLINA
ATLANTIC OCEAN
GULF OF MEXICO
DALLAS
HOUSTON
PORT ARTHUR
BATON ROUGE
JACKSON
MOBILE
MONTGOMERY
ATLANTA
ST. GEORGE ISLAND
SAVANNAH
BRUNSWICK
RALEIGH
FAYETTEVILLE
WILMINGTON
CAPE HATTERAS
CAPE LOOKOUT
CAPE FEAR
CAPE ROMAIN
CHARLESTON
MERRITT ISLAND
PALM BEACH
SANIBEL ISLAND
EVERGLADES
DRY TORTUGAS
KEY WEST
LAGUNA ATASCOSA
9,348
3,717
3,424
1,342
307
179
516
222
950
3,143
2,559
694
11,471
902
453
2,831
5,278
107
107
761
990
279
5,194
12,200
935
1,436
3,424
905
478
406
215
444
371
261
122
3,420
1,044
914
236
321
1,942
1,410
1,713
1,002
343
38°
36°
34°
32°
30°
28°
26°
24°
96°
94°
92°
90°
88°
86°
84°
80°
78°

Map 4

Southern 1974a) indicate that Florida is now the main wintering area for Great Lakes Ring-billed Gulls. Southern's data show that 68% of all February recoveries and 54% of all January recoveries of Great Lakes Ring-billed Gulls were from Florida. In addition, 73% of the southeastern recoveries of juveniles banded at Rogers City, Michigan, were in Florida. Southern also noted that a majority (up to 62%) of the Florida encounters occurred on the Atlantic coast.

Florida - Atlantic Coast The Ring-billed Gull is an abundant winter resident along the Florida Atlantic coast, where Kale (1979 ms a) considered it the most numerous wintering gull. Flocks of several thousand are seen and many congregate near garbage dumps, fishing vessels, and inlets (Kale 1979 ms a). Averages for eight coastal Atlantic Christmas Counts ranged from about 450 to over 11,000. Five of these counts averaged over 1,000 gulls (Map 4).

Florida - Keys Hundley and Hames (1960-62) described the extension of the wintering range into the Florida Keys. The first Florida Keys record mentioned was in 1941, but by the late 1950's Ring-billed Gulls were more common at Key West than were Herring Gulls. The Key Largo/Plantation Key and Lower Keys Christmas Counts average about 100 Ring-billed Gulls a year. The expansion of the Ring-billed Gull's winter range in South Florida and the Keys parallels both the remarkable growth of the Great Lakes breeding populations and the commercial development of South Florida, which has increased the habitat available to commensal gulls.

Florida - Gulf Coast Ring-billed Gulls are abundant in winter on the Florida Gulf coast, particularly near garbage dumps (Kale 1979 ms b), and are much more common than on the Atlantic coast (Schreiber and Schreiber 1977). The averages for ten Gulf Coast Christmas Counts range from a few hundred to over 12,000. The highest counts are from the Tampa Bay and Sarasota areas (Map 4), which are the most urban areas on this coast. About 43,000 Ring-billed Gulls were present at St. Petersburg during the winter of 1976-1977 (Kale 1979 ms b).

Alabama Ring-billed Gulls are abundant on the Alabama coast, especially in winter. Most of 61 banded Ring-billed Gulls recovered in Alabama had come from the Great Lakes, but one each had come from North Dakota and Saskatchewan (Imhof 1976b). Recent Christmas Counts give average counts in the low hundreds for four coastal Alabama area counts (Map 4).

Mississippi Ring-billed Gulls are common winter residents on the Mississippi coast, and small flocks are found there from early October to late April. From June until September only small numbers are present (Burleigh 1944). Few quantitative data are available on winter populations. Recent Jackson County Christmas Counts averaged 261 Ring-billed Gulls (Map 4), suggesting that winter populations may be in the low thousands.

Louisiana Oberholser (1938) and Lowery (1974) both considered Ring-billed Gulls abundant in winter, but rare in summer. Lowery (1974) indicated that migrants arrive in numbers in October and depart mostly by 1 May. Recent New Orleans and Sabine Christmas Counts average 3,420 and 1,044 Ring-billed Gulls, respectively.

Texas Ring-billed Gulls are common to abundant in winter on the Texas coast, and uncommon in summer (Oberholser 1963 ms, 1974). Apparently few Great Lakes birds reach Texas. Southern (1967a) reported no Texas recoveries among 376 recoveries of juvenile and yearling gulls from a Michigan colony; he had 78 recoveries elsewhere in the southeast. A more recent analysis (Southern 1980a), based on nearly 21,500 recoveries for Ring-billed Gulls banded throughout their range, shows that this species is fairly common on the Texas coast in winter. Most of the Ring-billed Gulls in Texas and Louisiana probably come directly from the Plains colonies. Recent Christmas Counts average about 200-2,000 Ring-billed Gulls per count; the highest counts tend to come from urban areas.

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

Breeding Ring-billed Gulls breed in maritime Canada, throughout the Great Lakes, across the Prairie Provinces of Canada, and in the northern Great Plains, the Rocky Mountains, and the Great Basin of the western United States. Some figures are available for the eastern populations. Ludwig (1974) estimated the Great Lakes population in 1967 as 335,000 breeding pairs. On the U.S. portion of the Great Lakes there were about 90,000 breeding pairs in 1976, and about 103,000 breeding pairs in 1977 (Scharf 1978). In 1977, Lakes Michigan, Ontario, and Huron supported most of the population (33.3%, 31.9%, and 25.1%, respectively); much smaller proportions nested on Lake Erie (6.8%) and Lake Superior (2.9%). The Canadian portion of Lake Ontario and the upper St. Lawrence River held a breeding population of about 45,700 pairs in 1976 (Blokpoel 1977). Most (ca. 75%) bred at two sites: on Gull Island in Presqu'ile Bay (ca. 23,700 pairs), and at Leslie Spit, the Eastern Headland of the Toronto Outer Harbor (ca. 10,400 pairs). Populations in this area have been increasing since 1967 (Blokpoel 1977). About 62,000 Ring-billed Gulls nested on the Eastern Headland in 1979 (Courtney and Blokpoel 1980a).

About 36,600 pairs of Ring-billed Gulls were found nesting in Alberta during a partial census of the province in 1976-1977 (Weseloh et al. 1978). About half were found in seven colonies in the short-grass prairie region, and the rest in four colonies in aspen parkland; figures for colonies in the boreal forest region were not available. The number breeding in the short-grass area was no different from that found during a census in 1968 (Weseloh et al. 1978), but the number in aspen parkland was more than double that found during the earlier survey. Most of this increase was due to a tenfold increase in the number breeding at Miquelon Lake. Weseloh et al. (1978) suggested that the increase at this colony may have been due to the gulls' discovery of the food resources provided by garbage dumps at Edmonton, approximately 35 mi (56 km) from the colony.

The number of Ring-billed Gulls nesting in the western United States prior to 1930 was small, perhaps on the order of 4,700-6,700 birds, but it has increased substantially since that time (Conover and Conover 1981). About 17,500 Ring-billed Gulls bred in Washington in 1977 (Conover et al. 1979b). Recent population estimates for birds breeding in other western states are unavailable.

In summary, incomplete information on breeding populations of Ring-billed Gulls suggests that the total world breeding population is at least a half million birds.

Winter The western populations winter mainly on the Pacific coast of North America. Young from western Alberta winter mostly in southern California and along the west coast of Mexico (Vermeer 1970). The Great Lakes population winters on the Atlantic and Gulf coasts, although a few remain in the interior. Florida has the largest wintering concentrations in the east. Smaller numbers winter in the Bahamas and the Greater Antilles. Many of the birds in the Gulf of Mexico evidently come from the northern Great Plains.

Migration Ring-billed Gulls nesting in western North America migrate south or southwest in fall, while those from the Great Lakes primarily move south or southeast. Young banded on the north shore of the Gulf of St. Lawrence dispersed widely after fledging with some moving northeast to Labrador and others wandering up the St. Lawrence River (Lewis 1941). Most moved down the Atlantic coast in October, reaching North Carolina by November, and Florida by December.

Departure from the breeding colonies in the Great Lakes region begins in mid-July and August; by January most of the birds are on the wintering grounds. Spring migration begins in late February and peaks in March and April. Ring-billed Gulls often arrive at colonies as early as late March in the Great Lakes (Southern 1980a) and as early as April in western Alberta (Vermeer 1970).

HABITAT

Nesting Ring-billed Gulls nest primarily on islands and occasionally peninsulas (Baird 1976) in large freshwater lakes (Southern 1980a). A few colonies are on oceanic islands in maritime Canada (Southern 1980a), or in coastal situations in Washington (Penland and Jeffries 1977). Colonies are usually located in low vegetation rather than on a bare substrate. This species frequently nests in mixed colonies with other larids, including Herring Gulls and Califoria Gulls (*Larus californicus*).

Ring-billed Gulls at several lakes in Montana nested near low, sparse vegetation; mean heights of the surrounding vegetation ranged from 17.0 to 135.5 cm (6.7-53.3 in), and mean vegetative cover ranged from 59.9% to 86.4% (Baird 1976). Nest density at three colonies on the Freezeout Peninsula and Arod Island varied from 0.246 nests/sq m (2.3 nests/100 sq ft) to 0.539 nests/sq m (5.0 nests/100 sq ft), but Baird found no significant correlation between nest density or distance to the nearest neighbor and height of vegetation or amount of cover.

Ring-billed Gulls on two islands in Miquelon Lake, Alberta, prefer to nest in flat, elevated, sparsely vegetated areas near the center of colonies they share with California Gulls (Vermeer 1970). Vermeer (1970) and Blokpoel and Courtney (1980) pointed out that nest-site selection is related to nest location from the previous year. Blokpoel and Courtney noted that changes in nest-site location from year to year were less than 6 m (20 ft) in 13 of 24 cases. They also reported that the tendency of a breeding bird to return to its former colony increases with age. Southern (1977) reported that 90% of the birds banded as adults at one colony were subsequently recaptured there, but indicated that young are much less likely to return to the natal colony.

The presence of other seabirds may also determine nest-site selection by Ring-billed Gulls. Vermeer (1970) remarked that the presence of California Gulls in Ring-billed Gull colonies limited the choice of nest sites for the latter. When the two species nest together, the California Gulls nest close to the water at the periphery of the colony and the Ring-billed Gulls nest in the interior. When the California Gulls no longer nest in an area they formerly occupied, Ring-billed Gulls move into these areas and then nest closer to the water.

Lewis (1941) reported that Ring-billed Gulls on the northern shore of the Gulf of St. Lawrence in Quebec nested mostly on small to moderately sized rocky islands 20-60 ft (6-18 m) high. Most of these islands were sparsely vegetated and treeless, and grassy areas were often used as nest sites.

Feeding Ring-billed Gulls feed in plowed fields and pastures (Sprunt and Chamberlain 1949, Hailman 1960a, Kirkham and Morris 1979), on tidal flats in salt marshes, along the shore, along beaches, and in shallow coastal waters. Ring-billed Gulls breeding at Freezeout Lake, Montana, foraged at a mean distance of 10.8 km (6.7 mi) from the center of the colony; 918 of 1,029 (89.2%) birds seen foraging were within 15 km (9 mi) of the colony, but a few were seen feeding as much as 31 km (19 mi) away (Baird 1976). The gulls at Freezeout Lake preferred to feed on irrigated rather than dry farmlands. In previous studies at Freezeout Lake, Rothweiler (1960) observed 7 marked birds feeding at distances ranging from 4 to 20 mi (6-32 km) from the colony.

Nonbreeding and Offshore Most Ring-billed Gulls wintering in the southeastern United States occur on or near the coast but some winter inland on reservoirs, lakes, ponds, and streams (Sprunt 1954, Lowery 1974, Imhof 1976b, Oberholser 1974). Near Charleston, South Carolina, Ring-billed Gulls occur inland more often than other species of gulls; they are found up to 30 mi (48 km) from the ocean or rivers in "sanitary fills, golf courses, shopping centers, and short grass fields" (Forsythe 1973). On the coast they frequent bays, estuaries, beaches, mudflats, and the nearshore waters of the Atlantic Ocean and Gulf of Mexico. They roost on exposed sandbars and islands, and do not often sleep on the water. Ring-billed Gulls are often common around wharves, docks, and harbors (Burleigh 1958), and they are much less pelagic than other gulls wintering in the southeast. They are uncommon in offshore waters of the northern Chesapeake Bight in fall migration and winter (Rowlett 1980), although then abundant in inshore areas. Most of Rowlett's offshore observations of Ring-billed Gulls were from November through April and were within the 10-fathom line (at about 19 km [12 mi]). His maximum counts, 21 within 15 km (9 mi) of shore in late April, and 15 within 10 km (62 mi) of shore in early December, were made when these gulls were undoubtedly present in the thousands onshore and thus emphasize the scarcity of this gull in pelagic waters.

FOOD AND FEEDING BEHAVIOR

During the breeding season, Ring-billed Gulls feed extensively on insects, grains, and small fish. Small rodents, earthworms, and refuse may also be important in the diet. Wintering Ring-billed Gulls feed on fish (Tomkins 1964, Leck 1971), marine invertebrates, insects, and enormous quantities of carrion and garbage (Forsythe 1974b; W. Hoffman, pers. comm.). They also eat the fruit of the cabbage palmetto (Sabal palmetto) in Florida (Nicholson 1948c, Cruickshank 1950, Harper 1950). A flock of about 65 was seen eating the ripe fruit of the date palm (Phoenix dactylifera) in California (G. Grant 1979). The gulls fed on dates beneath the trees, landed in the trees to pick fruit, or seized fruit while on the wing.

Ring-billed Gulls feed primarily during the day but will feed at night if there is sufficient light. Leck (1971) saw about 250 Ring-billed Gulls feeding on fish under mercury-vapor lights along the Chesapeake Bay Bridge, Virginia, in October; Nunnally et al. (1979) saw them feeding on bait fish at a lighted pier at Wrightsville Beach, North Carolina, in December. Kirkham and Morris (1979) reported two peaks of feeding for chicks at Gull Island, Ontario during the summer of 1977; each lasted about two hours. The first occurred shortly after sunrise, and the second just before sunset.

Ring-billed Gulls hawk for flying ants and other insects (Alcorn 1943, Sheppard 1945, Trautman and Trautman 1945, Pettingill 1958a, Burton 1960, Mueller and Berger 1965, Tolonen 1970, Seymour 1972, Jarvis and Southern 1976, Kirkham and Morris 1979). They forage extensively in pastures and plowed fields (Kirkham and Morris 1979; R. Clapp, pers. observ.), where they pick up arthropods and earthworms. Some of the ground squirrels eaten are probably scavenged along roads (Munro 1936, Vermeer 1970), although the gulls are known to hunt and kill voles. Scavenging along beaches, in parks, and at garbage dumps may be the main way of foraging by Ring-billed Gulls wintering in the southeastern United States.

Ring-billed Gulls also kleptoparastize (steal food) from other species. Gulls at a dump in New Jersey stole food from Starlings (Sturnus vulgaris) (Burger and Gochfeld 1981a). Adults and subadults were more successful at stealing food than were young birds. Ring-billed Gulls have also been seen stealing food from other Ring-billed Gulls (Payne and Howe 1976, Elston et al. 1978), Bonaparte's Gulls, Dunlins (Calidris alpina) (Payne and Howe 1976), Common Goldeneyes (Bucephala clangula), Buffleheads (Bucephala albeola), Lesser Scaup (Aythya affinis) (Siegfried 1972, Grace 1980), Canvasbacks (Aythya valisineria) (Grace 1980), Common Mergansers (Mergus merganser) (Lamore 1953), Red-breasted Mergansers (Mergus serrator) (Bunker 1946), Pied-billed Grebes (Podilymbus podiceps) (Scott 1977), and American Coots (Fulica americana) (Bartlett

1957, Hardin 1971, Grace 1980). They have been seen attempting to steal food from Mallards (Anas platyrhynchos) (Grace 1980), and Common Egrets (Casmerodius albus)(Leck 1973).

Grace (1980) reported that Ring-billed Gulls obtain food from waterfowl by one of two methods. Most frequently (ca. 90% of the time), a gull resting on the water flies toward a feeding duck and forces it to dive, subsequently settling on the the water to seize the dropped food. Less frequently, Ring-billed Gulls in flight sweep down on a feeding duck and alight on the water to seize a discarded fish. Fish were obtained on 13.3% of all attempts.

Other feeding techniques include: (a) foot-paddling---a gull standing in water stamps its feet up and down on the substrate to uncover or flush small invertebrates (Buckley 1966); and (b) skimming---the bird runs through shallow water with its beak open and partially immersed in the water, seizing prey on contact (Tomkins 1964, Tolonen 1970)(1).

Ring-billed Gulls eat a variety of vertebrates, aside from fish, including the eggs (Courtney 1979b) and young (Hunter 1976 in Courtney and Blokpoel 1980a) of Common Terns, duck eggs (Vermeer 1970), as well as young Franklin's Gulls, Black-crowned Night-Herons (Nycticorax nycticorax) (Wolford 1966 in Vermeer 1970), Double-crested Cormorants (Phalacrocorax auritus), American Avocets (Recurvirostra americana) (Bent 1921), Spotted Sandpipers (Actitis macularia) (Blokpoel and Haymes 1979a), and Canada Geese (Branta canadensis) (Munro 1936). Passerines reported as food items included warblers (Oporornis sp.) (Blokpoel and Haymes 1979a), and possibly young Red-winged Blackbirds (Agelaius phoeniceus)(Jarvis and Southern 1976), and several species of sparrows: Savannah Sparrow (Passerculus sandwichensis), White-throated Sparrow (Zonotrichia albicollis), Song Sparrow (Melospiza melodia), and Chipping Sparrow (Spizella passerina) (Blokpoel and Haymes 1979a). Ring-billed Gulls have also been found scavenging the remains of Western Meadowlarks (Sturnella neglecta) (Vermeer 1970).

Mammals eaten include voles (Microtus spp.) (Vermeer 1970, Jarvis and Southern 1976, Blokpoel and Haymes 1979a), especially meadow voles (Microtus pennsylvanicus) (Vermeer 1970, Blokpoel and Haymes 1979a), deer mice (Peromyscus maniculatus) (Haymes and Blokpoel 1978b), Peromyscus sp. (Rothweiler 1960, Vermeer 1970), house mice (Mus musculus) (Anderson 1965), short-tailed shrews (Blarina brevicauda) (Blokpoel and Haymes 1979a), Richardson's ground squirrel (Spermophilus richardsonii) (Komarek 1929, Munro 1936), northern pocket gophers (Thomomys talpoides) (Vermeer 1970), and rabbits (Leporidae) (Anderson 1965).

Few detailed accounts of food habits of Ring-billed Gulls are available, and we know of none from the southeastern United States. We summarize some of the important studies by area below.

Alberta Munro (1936) examined 37 pellets regurgitated by gulls at Bittern Lake in May 1933 and June 1934. While some may have been regurgitated

(1) Tolonen termed this behavior "ploughing", reserving the term "skimming" for similar manuevers conducted while in flight.

by California Gulls (Larus californicus), the vast majority were undoubtedly from Ring-billed Gulls. Items occurring most frequently in the pellets were wheat (Triticum aestivum - in 57.6% of the pellets), miscellanous vegetable debris (51.5%), oats (Avena sativa - 27.3%), fly pupae (Diptera - 24.2%), cowhair (30.3%), miscellaneous insects (15.2%), wild oats (Avena sp. - 12.1%), and voles (12.1%). Munro suggested that the cowhair was ingested when dipterid pupae were scavenged from carrion, and indicated that the most important food items, in order of importance, were grain, Richardson's ground squirrels, carrion, ground beetles (Carabidae), and mice [= voles, probably Microtus sp.].

Vermeer (1970) reported that Ring-billed Gulls at Miquelon Lake in 1965 fed mostly on plant material in May, insects in June, and refuse in July. Plants made up 68% of the total volume of food for adult gulls in May but were not eaten in July. Arthropods made up 54% of the adult diet and 50% of the diet of chicks in June, but were of negligible importance in July. Refuse made up 76% and 66% of the total volume of food for adults and chicks, respectively, in July, but made up no more than 16% of the diet for either age class during the two preceding months. Small mammals, particularly meadow voles, were also important; they made up 10-29% of the total bulk of the diet for adult gulls from May through July, and were evidently important in April as well. Arthropods most frequently eaten were ground beetles (Carabidae) found in 48% of 25 esophagi and regurgitations examined, and damsel fly naiads (Coenagrionidae), found in 32%. Plant foods taken were chiefly grains. Vermeer (1970) also examined food eaten at other colonies in Alberta, and discovered that rodents were of considerable importance in southeastern Alberta but were replaced by fish in more northern parts of the province.

Ontario Haymes and Blokpoel (1978b) analyzed 147 samples collected at Leslie Spit in Toronto Outer Harbor in 1977. Each sample consisted of the food regurgitated by five Ring-billed Gull chicks less than 10 days old. As reported in the study by Kirkham and Morris (1979), most of the food consisted of fish, arthropods, and earthworms. Fish made up about 50% of the diet (by volume) throughout the season. Arthropods were as important as fish early in the season, but became less important later on. Earthworms were most important during the mid- and late breeding season, when they made up 23% and 28% of the diet, compared to only 8% earlier in the season. Birds, mammals, and refuse also were ingested but formed an insignificant portion of the diet.

Most of the food (77%) taken was from aquatic habitats early in the season, but foods of terrestrial origin became progressively more important later on and made up 42% and 51% of the diet in mid- and late season, respectively. The fish most frequently identified were alewife (Alosa pseudoharengus) and rainbow smelt (Osmerus mordax). Smelt were more important early in the breeding season and alewives were taken more often in mid- and late season. Small numbers of shiners (Notropis sp.) and yellow perch (Perca flavescens) were also identified (Haymes and Blokpoel 1978b).

Haymes and Blokpoel (1978b) reported that at least 95 families and 13 orders of arthropods were represented with midges (Chironomidae) and leaf-hoppers (Cicadellidae) making up more than 50% of the individual insects eaten during the season. Non-insect arthropods eaten included spiders (Arachnida), centipedes (Chilopoda), millipedes (Diplopoda), and isopods (Crustacea).

Kirkham and Morris (1979) reported that foods fed to young Ring-billed Gulls at Gull Island in Presqu'ile Provincial Park during the summer of 1977 were primarily fish, insects, and earthworms. Chicks up to five days old were fed insects more frequently than older chicks, but all age classes were fed fish more frequently than any other food. Food items fed to chicks also varied with the progress of the breeding season. Insects were the dominant food item in May and fish were the sole food in July. Earthworms were fed to the young sporadically through May and June, but more frequently after periods of high humidity or rain.

California The stomach contents of 29 adult Ring-billed Gulls collected in June and July 1963 at Honey Lake Waterfowl Management Area in Lassen County, consisted, by volume, mainly of insect fragments (33.3%), meadow mice (Microtus sp. - 28.2%), garbage (9.9%), leaves of grasses (Graminaea - 7.6%), and fish bones and remains (6.9%) (Anderson 1965).

Michigan Ludwig (1966) found that fish, especially alewives and smelt, and insects were the two most important types of food on Lakes Huron and Michigan in 1963-1965 (1). Alewives were found in 70% of the 372 food samples obtained, and smelt were found in 18% of the samples. Six other species of fish (yellow perch, gizzard shad [Dorosoma cepedianum], brook sticklebacks (Culaea inconstans), ninespine sticklebacks [Pungitius pungitius], rock bass [Ambloplites rupestris], and white suckers [Catostomus commersoni]) were the other species of fish identified.

Jarvis and Southern (1976) analyzed the contents of regurgitations obtained at a mainland colony at Rogers City and at two island colonies in Lake Michigan and Lake Huron during the breeding seasons in 1964 and 1971. A great variety of food items was eaten in 1964, but fish (76%) and insects (22%) predominated. Insects were most important in May and June, but fish made up a greater proportion of the volume of the food as the season progressed. Earthworms were important in May, forming 26% of the food at that time, but were of little or no importance later. Insects most important in the diet at Rogers City in 1964 were cicadas (Okanagana rimosa, Cicadidae - 19% by volume), Ephemoptera (15%), and leaf-hoppers (Cicadellidae - 12%). The most important fish were yellow perch (11%), ninespine sticklebacks (4%), and alewives (4%).

Samples taken in 1971 at the Rogers City colony, a colony at Ile aux Galets in Lake Michigan, and a colony on Bird Island in Lake Huron, revealed that fish (75.5%) and insects (ca. 23.5%) again formed the bulk of the diet. Cicadas, mayflies (Ephemeroptera), and chironomid midges were the most important insect foods. Smelt, alewives, and sticklebacks were the most important fish. Earthworms (Annelida) were also a major source of food in May for birds nesting at the Rogers City colony.

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(1) Some of Ludwig's material may have been obtained on the Canadian portion of these two lakes.

Montana Twenty-five stomachs collected in August 1958 and from May to September 1959 at Freezeout Lake contained vegetation and most contained insect remains; two stomachs contained the remains of small mammals (Rothweiler 1960). Rothweiler indicated that "wheat and barley [Hordeum vulgare] kernels and stems were the most common plant items found" in the stomachs of the three species of gulls examined. Insects most frequently found in the stomachs of Ring-billed Gulls were grasshoppers (Acrididae--found in 32% of the stomachs) and beetles (Carabidae in 32%, and Curculionidae in 28%). Some flies (Tabanidae, Muscidae), moths (Phalaenidae), crickets (Oryllidae), and other beetles (Elateridae, Tenebrionidae, Scarabeidae) were also eaten. Earthworms (Oligochaeta in 32%) were also frequently found in the stomachs.

IMPORTANT BIOLOGICAL PARAMETERS

Egg Laying Most eggs are laid in May but the timing varies slightly from colony to colony; birds in southern colonies initiate laying earlier than those in more northern areas. In 1971 Ring-billed Gulls at Kaginaw Lake, Manitoba, laid eggs from the last two weeks of May through the first two weeks of June, with a peak 22-28 May (Vermeer 1973c). In 1964 and 1965 in Alberta, the peak of laying was in early May (Vermeer 1970). In 1977 laying in the Toronto Outer Harbor began in mid-April and continued into July (Haymes and Blokpoel 1980). In 1973 on Lake Superior, laying occurred from early May to early June, and peaked in mid-May (Ryder 1975). In 1959 and 1974-75 in Montana eggs were first laid in the last week of April or the first week of May (Rothweiler 1960, Baird 1976).

A number of factors influence the initiation of laying. Vermeer (1970) reported that a delay in laying at colonies in Alberta was related to decreased mean air temperature and suggested that human disturbance can also delay the onset of laying. Egg laying may also vary from area to area within a colony and with the age of the parent. Ryder and Ryder (1981a) reported that peak laying in 1977 in the center of the colony at Granite Island in northern Lake Superior occurred 6-10 May, about a week earlier than laying at the periphery of the colony. Three-year-old and older birds at Leslie Spit in 1977 had mean dates of clutch initiation from the last five days of April through the first five days of May. Two-year-old birds, however, had a mean date of clutch initiation about 21 May; nests of the latter age class were also farther from the center of the colony than were those of older birds (Haymes and Blokpoel 1980).

Mean Clutch Size Ring-billed Gulls lay one to four eggs, but the modal clutch size reported by most studies is three eggs (Vermeer 1970, Dexheimer and Southern 1974, Ryder 1975, Baird 1976, Ryder and Ryder 1981a). One to eight eggs have been found in nests in northern Lake Superior (Ryder and Ryder 1981a, Kovacs and Ryder 1981). Nests at Miquelon Lake in Alberta contained 2-4 eggs in 1964 and 1-5 eggs in 1965 (Vermeer 1970), but the majority of females laid three eggs (Table 22). Nests at colonies on the Freezeout Peninsula and Arod Island, Montana, held 1-6 eggs (Baird 1976), as did those at Honey Lake, California (Johnston and Foster 1954). Ryder and Somppi (1979) and Conover et al. 1979a) believe that the larger clutches (5-8 eggs) are laid by pairs of females.

Table 22. Mean clutch sizes reported for the Ring-billed Gull (a).

Mean clutch size	Number of clutches	Locality and year of observation	Source
		ALBERTA	
2.92	265	Miquelon Lake, 1964 (3-86%)	Vermeer 1970
2.85	435	Miquelon Lake, 1965 (3-79%)	Vermeer 1970
		ONTARIO	
2.80 (b)	147	Granite Island, 1973 (3-56%)	Ryder 1975
2.86 (c)	107	Granite Island, 1973 (3-55%)	Ryder 1975
2.79 (d)	33	Granite Island, 1973 (3-67%)	Ryder 1975
2.00 (e)	7	Granite Island, 1973 (2-43%)	Ryder 1975
3.19 (f)	325	Granite Island, 1977	Ryder and Ryder 1981a
3.08 (g)	80	Granite Island, 1977	Ryder and Ryder 1981a
2.86 (h)	204	Toronto Outer Harbor, 1977 (3-85%)	Haymes and Blokpoel 1978a
2.88 (i)	9	Toronto Outer Harbor, 1977	Haymes and Blokpoel 1980
2.95 (j)	76	Toronto Outer Harbor, 1977	Haymes and Blokpoel 1980
2.78 (k)	23	Toronto Outer Harbor, 1977	Haymes and Blokpoel 1980
3.00 (l)	13	Toronto Outer Harbor, 1977	Haymes and Blokpoel 1980
		CALIFORNIA	
2.85 (m)	717	Honey Lake, 1953 (3-71%)	Johnston and Foster 1954
		MICHIGAN	
2.9	20	Green Island, 1953	Emlen 1956
2.96	6700	Lakes Huron and Michigan, 1960-65	Ludwig 1966
2.83	80	Rogers City, 1972	Dexheimer and Southern 1974
2.73	102	Thunder Bay, 1972	Dexheimer and Southern 1974
2.71	1680	South Manitou Island, 1972	Shugart 1977b
2.72	5230	South Manitou Island, 1973	Shugart 1977b
2.96	5400	South Manitou Island, 1974	Shugart 1977b
2.74	5175	South Manitou Island, 1975	Southern et al. 1980
2.83	5317	Rogers City, 1975	Patton 1979
2.58	3935	South Manitou Island, 1976	Southern et al. 1980
2.79	6452	Rogers City, 1976	Patton 1979
2.89	2686	South Manitou Island, 1977	Southern et al. 1980
2.83	7246	Rogers City, 1977	Patton 1979
2.61	2919	South Manitou Island, 1978	Southern et al. 1980
2.69	4928	Rogers City, 1978	Patton 1979
2.53	1931	South Manitou Island, 1979	Southern et al. 1980
2.68 (n)	5625	Rogers City, 1979	Southern and Southern 1982a

Table 22. Concluded.

Mean clutch size	Number of clutches	Locality and year of observation	Source
		MICHIGAN (CONT.)	
2.64 (o)	1415	Rogers City, 1979	Southern and Southern 1982a
2.61 (n)	6495	Rogers City, 1980	Southern and Southern 1982a
2.64 (o)	1242	Rogers City, 1980	Southern and Southern 1982a
		MONTANA	
2.63 (p)	647	Freezeout Peninsula, 1973 (3-62%)	Baird 1976
2.07 (p)	43	Freezeout Peninsula, 1974 (3-38%)	Baird 1976
2.41 (p)	76	Arod Island, 1974 (2-42%)	Baird 1976

(a) Some of these figures are derived from counts of contents of nests made during short-term visits. They do not adequately represent clutch size for the population since some proportion of the birds may still have been laying eggs and other nests may have lost eggs before the colony was visited by the observers. In yet other nests, no eggs may have ever been laid (Ryder 1976). Where possible, we listed in parentheses the most frequently observed clutch size and the percentage of nests that contained this number of eggs.
(b) Clutch size for all pairs calculated from data in Table 2 of cited source. "Clutches" of 5, 6, and 7 are excluded from these figures and for the next three figures listed.
(c) Data for pairs in which both birds had mature plumage.
(d) Data for pairs in which one bird had immature plumage.
(e) Data for pairs in which both birds had immature plumage.
(f) Clutch size at nests in center of colony.
(g) Clutch size at nests at periphery of colony.
(h) Clutch size for all nests studied.
(i) Early nests (egg laying begun on or before 1 May) with parents 3 years old or younger.
(j) Early nests with at least one parent 4 years old or older.
(k) Late nests (egg laying begun after 1 May) with at least one parent 3 years old or younger.
(l) Late nests with at least one parent 4 years old or older.
(m) Figures are derived from a single count of nest contents and include nests that contained eggs and young, or young.
(n) Clutch size at nests in unaltered breeding habitats.
(o) Clutch size at nests in area that was covered with fill and graded during the fall of 1979.
(p) Figures for percent of modal clutch size are approximated from figures 5-1 and 5-2 of the cited source.

Mean clutch sizes reported for Ring-billed Gulls vary from year to year both within and between colonies (Table 22). Ryder and Ryder (1981a) reported that the mean clutch size at the periphery of the colony is not significantly different from the mean clutch size in the center. Southern and Southern (1982a) reported that mean clutch size did not differ between nests from areas that had been bulldozed and areas in unaltered nesting habitat. Mean clutch size increases with the age of the parent up to about four years (Haymes and Blokpoel 1980, Table 22), suggesting that nests farther from the colony center have smaller clutches. Ryder (1975) also reported that larger clutches are laid by older birds.

Incubation Period Vermeer (1970) reported that incubation of the third egg in 64 clutches took 23-28 days (mean = 25.0) in Manitoba in 1964. All but three eggs took 24 to 26 days to hatch. During the following year, when the colony was disturbed more by humans and nocturnal predators, the only two incubation periods recorded were 28 and 29 days. Baird (1976) reported a range of incubation periods of 26-27 days for Ring-billed Gulls nesting in Montana.

Hatching Success Rates of hatching success vary widely (Table 23) and depend on a number of factors. Hatching success decreased as the nesting season progressed in 1977 at Granite Island (Ryder and Ryder 1981a). Three-egg clutches had the highest hatching success at Granite Island in both 1973 (Ryder 1975) and 1977 (Ryder and Ryder 1981a), and at Arod Lake and the Freezeout Peninsula, Montana, in 1974 (Baird 1976). Hatching success decreased in late nests in 1977 at Leslie Spit in the Toronto Outer Harbor, but increased with the age of the parents to a maximum of 90.9% for 5-year-old birds (Haymes and Blokpoel 1980). This is consistent with Ryder's (1975) report that hatching success is higher in pairs of mature-plumaged birds than in pairs in which at least one bird has immature plumage. In another study (Ryder 1976), more eggs hatched in nests begun by adults early in the nesting season than in nests started later, but Ryder noted that this relationship does not hold for nests initiated by young pairs. Dexheimer and Southern (1974) reported higher hatching success for nests in the center of the colony than for nests at the periphery for two colonies in Michigan (Table 23), but Ryder and Ryder (1981a) found no difference in hatching success for peripheral and central nests at Granite Island.

Hatching success in supernormal clutches (those with 5 to 8 eggs) is much lower than in nests with normal clutches. Hatching success at Granite Island in 1978 for 37 supernormal clutches was only 8.2% (Ryder and Somppi 1979), compared to a hatching success of 80-90% for normal clutches (Somppi 1978 in Ryder and Somppi 1979). Conover et al. (1979a) reported that fertility in clutches of 5 to 6 eggs at three colonies in Washington was much lower (65.9% and 69.9%, respectively) than in smaller clutches (ca. 90%).

Age at Fledging Vermeer (1970) reported an average age at first flight as 37.2 days (range 34-41). Mean age at fledging at Gull Island, Ontario, was similar (36.4 ± 2.36 days; n = 28) (Kirkham and Morris 1979).

Table 23. Rates of hatching success reported for the Ring-billed Gull (a).

Percent of eggs laid that hatched		Number of eggs	Locality and year of observation	Source
86		---	Miquelon Lake, 1964	Vermeer 1970
43.4	(b)	412	Granite Island, 1973	Ryder 1975
51.6	(b)	306	Granite Island, 1973	Ryder 1975
22.8	(b)	92	Granite Island, 1973	Ryder 1975
0.0	(b)	14	Granite Island, 1973	Ryder 1975
59.5	(c)	1037	Granite Island, 1977	Ryder and Ryder 1981a
58.5	(c)	246	Granite Island, 1977	Ryder and Ryder 1981a
48.1-89.5	(d)	---	Toronto Outer Harbor, 1977	Haymes and Blokpoel 1978a
96.2	(e)	26	Toronto Outer Harbor, 1977	Haymes and Blokpoel 1980
88.4	(f)	224	Toronto Outer Harbor, 1977	Haymes and Blokpoel 1980
73.4	(g)	64	Toronto Outer Harbor, 1977	Haymes and Blokpoel 1980
84.6	(h)	39	Toronto Outer Harbor, 1977	Haymes and Blokpoel 1980
91		---	Lakes Huron and Michigan, 1960-65	Ludwig 1966
48.6	(i)	288	Lake Huron, 1972	Dexheimer and Southern 1974
76.5	(j)	230	Lake Huron, 1972	Dexheimer and Southern 1974
64.4		149	South Manitou Island, 1972	Shugart 1977b
73.3		375	South Manitou Island, 1973	Shugart 1977b
70.1		364	South Manitou Island, 1974	Shugart 1977b
60.2	(k)	14174	South Manitou Island, 1975	Southern et al. 1980
15.0	(k)	10163	South Manitou Island, 1976	Southern et al. 1980
61.5		7756	South Manitou Island, 1977	Southern et al. 1980
37.0	(k)	7629	South Manitou Island, 1978	Southern et al. 1980
18.1	(k)	4591	South Manitou Island, 1979	Southern et al. 1980

(a) Number of eggs is calculated from the number of nests and mean clutch size or eggs per pair for all papers except those by Dexheimer and Southern (1974) and Southern et al. (1980). Miquelon Lake is in Alberta, Granite Island and the Toronto Outer Harbor in Ontario, and South Manitou Island in Michigan.

(b) Hatching success for all pairs as calculated from Table 2 of cited source. Data for "clutches" of 5, 6, and 7 are excluded from the figures. First is an overall average; the next three figures listed are, respectively, for pairs in which both birds had mature plumage, one had immature plumage, and both had immature plumage.

(c) The first figure is for nests at the center of the colony; the second for nests at the periphery.

(d) Range of values for eight study plots.

(e) Early nests with at least one parent 3 years old or younger.

(f) Early nests with at least one parent 4 years old or older.

(g) Late nests with at least one parent 3 years old or younger.

Table 23. Concluded.

(h) Late nests with at least one parent 4 years old or older.
(i) Data for fringe nests at two colonies combined from Table 1 of cited source.
(j) Data for central nests at two colonies combined from Table 1 of cited source.
(k) These figures are for years in which the colony was affected by predation by resident red foxes (Vulpes vulpes); the colony was not visited by foxes during incubation in 1977.

Fledging Success Fledging success, like hatching success, varies widely. In 1964, 34.3% of the eggs laid resulted in fledged young at colonies in Alberta, but no young fledged the following year (Vermeer 1970). Vermeer (1970) also reported that late clutches fledge fewer young than early ones. Haymes and Blokpoel (1978a) reported fledging successes of 22.6-31.8% per egg laid in 1977 for two study plots at the Toronto Outer Harbor where Ring-billed Gulls nest with Common Terns. At four study plots occupied only by Ring-billed Gulls, fledging success per egg laid ranged from 11.1% to 57.9%. Survival of young at a colony at Rogers City, Michigan, was not significantly different for nests at the center and periphery of the colony (Dexheimer and Southern (1974); at a colony in Thunder Bay, survival of young was significantly greater at central nests. The difference in survival at the Thunder Bay colony may have been because this colony was subject to flooding whereas the colony at Rogers City was not (Dexheimer and Southern 1974).

Figures for productivity (Table 24) reveal similar variation from area to area and from colony to colony.

Mortality of Eggs and Young Vermeer (1970) reported that 13.8% and 84.0% of the eggs failed to hatch at colonies in Alberta in 1964 and 1965, respectively. In both years, infertility or embryonic death and the disappearance of eggs accounted for most of the lost eggs. Vermeer attributed the much greater loss in 1965 to a combination of bad weather and increased nocturnal predation. Predation has been reported as a major cause of egg loss elsewhere as well. Emlen et al. (1966) reported that nocturnal disturbance by a raccoon (Procyon lotor) indirectly led to the loss of many eggs and small young at Rogers City, Michigan. Red fox (Vulpes vulpes) predation on the gull colony on South Manitou Island, Michigan, reduced hatching rates for Ring-billed Gulls to 60%, 15%, 37%, and 18% in 1975, 1976, 1978, and 1979, respectively, and no or very few young fledged (Southern et al. 1980). Red foxes also reduced chick production at this colony in 1974 (Shugart 1977b). Most of the reduction in nesting success was not attributed to predation by foxes for food, but mortality apparently resulted either from eggs chilling when gulls fled their nests, or as a result of the foxes killing more prey than they could eat. Nocturnal disturbance by Great Horned Owls (Bubo virginianus) resulted in chick deaths and in eggs being knocked out of nests at Rogers City in 1978 (Southern and Southern 1979). An estimated 18% of the eggs in 841 nests failed to produce young as a result of this disturbance. As with the fox predation, the

Table 24. Productivity in Ring-billed Gull colonies.

Number of young produced per pair (or nest)		Locality and year of observation	Source
		ALBERTA	
1.0		Miquelon Lake, 1964	Vermeer 1970
		ONTARIO	
1.03	(a)	Granite Island, 1977	Ryder and Ryder 1981a
1.06	(b)	Granite Island, 1977	Ryder and Ryder 1981a
0.27-1.76	(c)	Toronto Outer Harbor, 1977	Haymes and Blokpoel 1978a
0.64-1.20	(d)	Toronto Outer Harbor, 1977	Haymes and Blokpoel 1978a
		MICHIGAN	
1.74		Lakes Huron, Michigan, 1960-65	Ludwig 1966
0.67		Green Island, 1952	Emlen 1956
1.89	(a)	Rogers City, 1972	Dexheimer and Southern 1974
1.21	(b)	Rogers City, 1972	Dexheimer and Southern 1974
1.83	(a)	Thunder Bay, 1972	Dexheimer and Southern 1974
0.68	(b)	Thunder Bay, 1972	Dexheimer and Southern 1974
1.56		South Manitou Island, 1972	Schugart 1977b
1.65		South Manitou Island, 1973	Schugart 1977b
1.36		South Manitou Island, 1974	Schugart 1977b
0.07	(e)	South Manitou Island, 1975	Southern et al. 1980
0.01	(e)	South Manitou Island, 1976	Southern et al. 1980
1.54		South Manitou Island, 1977	Southern et al. 1980
0.00	(e)	South Manitou Island, 1978	Southern et al. 1980
0.00	(e)	South Manitou Island, 1979	Southern et al. 1980

(a) Nests at the center of the colony.
(b) Nests at the periphery of the colony.
(c) Range of values for four study plots occupied only by Ring-billed Gulls.
(d) Range of values for two study plots occupied by Ring-billed Gulls and Common Terns.
(e) These figures are for years when production was affected by a resident population of red foxes and was less than 0.1 in 1978 and 1979. .

direct effect of predation by the Great Horned Owl was much less than the indirect effect.

Other suggested or known mammalian predators of eggs or young include coyotes (Canis latrans) (Vermeer 1970, Baird 1976), long-tailed weasels (Mustela frenata) (Baird 1976), mink (Mustela vison) (Conover and Miller 1979), and striped skunks (Mephitis mephitis) (Southern and Southern 1979). Common garter snakes (Thamnophis sirtalis) have been observed seizing and eating newly hatched chicks at Mugg's Island in Toronto Harbor (Fetterolf 1979a), but predation by snakes is uncommon.

Vermeer (1970) listed several sources of mortality for Ring-billed Gull chicks. Disappearance for unknown reasons accounted for 58% and 63% of the chick mortality at Miquelon Lake, Alberta, in 1964 and 1965, respectively. The principal known cause of loss of chicks was attacks by neighboring Ring-billed Gulls and predation by California Gulls (Larus californicus). Other minor forms of loss were known or suspected predation by Great Horned Owls (Bubo virginianus) and Red-tailed Hawks (Buteo jamaicensis), death from chilling following storms or disturbance, and disease. Emlen (1956) reported that most mortality of chicks in 1952 at a colony on Green Island, Michigan was the result of attacks by neighboring adults; some young were also lost to predation by Herring Gulls. Foxes killed more chicks than they ate during visits to gull colonies at South Manitou Island, Michigan, but chilling was the major cause of fox-related mortality (Patton 1979).

Human disturbance of gull colonies can be a primary source of nesting failure in Ring-billed Gulls (Burger 1981a). Fetterolf (1981), in a preliminary report on reproductive success in minimally disturbed Ring-billed Gull colonies, noted that young fledged at a rate of 2.10 to 2.53 per pair, a rate considerably higher than any listed in Table 24.

Renesting Some Ring-billed Gulls relay after loss of a nest. The proportion that does so is not known but is probably small. Vermeer (1970) found that only one of 154 pairs of Ring-billed Gulls relaid when their clutches were removed during the peak of laying.

Age at First Breeding Ludwig (1966) reported that nearly half of the two-year-old birds at colonies in the Great Lakes breed and that all Ring-billed Gulls breed before their fourth year. Southern (1977) reported that most Ring-billed Gulls at a stable colony near Rogers City, Michigan breed for the first time as three-year-olds. Ludwig's observations were made during a period of rapid population growth; most Ring-billed Gulls probably wait until age three in stable or space-limited colonies.

Maximum Natural Longevity A young bird banded in Ontario was found dead in the same area 25 years later (Clapp et al. 1982a).

Weight Weights of breeding adult Ring-billed Gulls vary from about 375-650 g (0.8-1.4 lb); males are heavier than females (Table 25).

Table 25. Weights (in grams) of Ring-billed Gulls (a)

Mean weight	Range	Number weighed	Sample and season	Area	Source
533	------	19	ad. males, summer	Alberta	Vermeer 1970
566	482-650	48	ad. males, May-June	Ontario	Ryder 1978
511	------	1	ad. male, May	California	Moffitt 1942
499	------	1	ad. male, Feb.	Alabama	Stewart and Skinner 1967
464	------	1	imm. male, Feb.	Alabama	Stewart and Skinner 1967
463	------	20	ad. females, summer	Alberta	Vermeer 1970
471	379-563	51	ad. females, May-June	Ontario	Ryder 1978
432	------	1	imm. female, Feb.	Alabama	Stewart and Skinner 1967
377	260-503	30	fledging young	Alberta	Vermeer 1970
35.5	34.3-37	3	ca. day-old young	California	Moffitt 1942
38.5	------	39	newly hatched young	Alberta	Vermeer 1970
34.6	26.6-42.6	--	newly hatched young	Michigan	Dawson et al. 1976
53.9	46.5-61.4	24	fresh eggs	Ontario	Ryder et al. 1977
53.4	45.3-61.5	28	fresh eggs	Ontario	Ryder et al. 1977

(a) Range figures from Dawson et al. (1976), Ryder et al. (1977) and Ryder (1978) are the mean $\pm$ 2 SD. The first set of figures from Ryder et al. (1977) is for three-egg clutches from the center of the colony; the second is for three-egg clutches at the periphery.

SUSCEPTIBILITY TO OIL POLLUTION

Ring-billed Gulls are not particularly susceptible to oiling, but reports in the Bird Banding Laboratory, Laurel, Maryland, suggest death as a result of oiling in North and South Carolina, Florida, and Louisiana, and also in more northern localities. Oil-smeared Ring-billed Gulls are fairly common at garbage dumps in Florida (W. Hoffman, pers. comm.), but they probably come into contact with waste oil in the dumps. King and Sanger (1979) considered this species as one with low risk from oiling in the Pacific Northwestern states. A majority of the population winters in the southeastern United States, but they do not occur offshore in any great abundance; they usually roost on land rather than on the water, and tend to occur inland with greater frequency than other gulls. Consequently, this species is probably not at any great hazard from development of petroleum resources in the southeast and the effect of offshore oil spills on the species will be negligible.

BIBLIOGRAPHY

1983

Southern, L. K. and W. E. Southern. 1983. Responses of Ring-billed Gulls to cannon-netting and wing-tagging. J. Wildl. Manage. 47: 234-237.

1982

Blokpoel, H. and P. A. Courtney. 1982. Immigration and recruitment of Ring-billed Gulls and Common Terns on the lower Great Lakes. Can. Wildl. Serv. Prog. Notes 133. 12 pp.

Blokpoel, H. and D. V. Weseloh. 1982. Status of colonial waterbirds nesting on Little Galloo Island, Lake Ontario. Kingbird 32: 149-157.

Bos, E. and P. de Heer. 1982. Ring-billed Gulls on Canary Islands in March 1982. Dutch Birding 4: 90-91.

Cade, M. 1982. Plumage variability of immature Common and Ring-billed Gulls. Brit. Birds 75: 580.

Cooper, C. R., A. P. Gilman and H. Blokpoel. 1982. Ring-billed Gulls nesting on the Ottawa River near Ottawa. Ont. Field Biol. 36: 11-15.

Hayward, J. L. 1982a. Effects of nest habitat, behavior, and volcanic ash on reproductive success in Ring-billed and California Gulls. Ph.D. thesis, Univ. Washington/Pullman, WA.

_____. 1982b. A simple egg-marking technique. J. Field Ornithol. 53: 173.

Hayward, J. L., D. E. Miller and C. R. Hill. 1982. Mount St. Helens Ash: its impact on breeding Ring-billed and California Gulls. Auk 99: 623-631.

Heinz, F. A. 1982. Growth and development of Ring-billed Gull chicks related to nest placement in a colony. (Abstract only.) Colonial Waterbirds 5: 177.

Hoogendoorn, W. 1982. Ring-billed Gull in Morocco in August 1982. Dutch Birding 4: 91-92.

King, B. 1982. American Coot and Ring-billed Gull feeding on duck droppings. Fla. Field Nat. 10: 80.

Mullarney, K. 1982. Mystery photographs. [Ring-billed Gull.] Dutch Birding 4: 20-22.

Southern, L. K. and W. E. Southern. 1982a. Effect of habitat decimation on Ring-billed Gull colony- and nest-site tenacity. Auk 99: 328-331.

_____. 1982b. Mate fidelity in Ring-billed Gulls. J. Field Ornithol. 53: 170-171.

_____. 1982c. Short-term effects of cannon-netting and wing-tagging on breeding Ring-billed Gulls. (Abstract only.) Colonial Waterbirds 5: 179.

Southern, L. K., S. R. Patton, and W. E. Southern. 1982. Nocturnal predation on _Larus_ gulls. Colonial Waterbirds 5: 169-172.

Southern, W. E. and L. K. Southern. 1982. Intensification of adult Ring-billed Gull aggression during reproduction and its possible consequences. Colonial Waterbirds 5: 2-10.

Wong, P. L. and R. C. Anderson. 1982a. Redescription of _Pectinospirura argentata_ Wehr, 1933 (Nematoda: Acuariodea) from _Larus delawarensis_ Ord (Laridae). Can. J. Zool. 60: 1940-1944.

_____. 1982b. The transmission and development of _Cosmocephalus obvelatus_ (Nematoda: Acuarioidea) of gulls (Laridae). Can. J. Zool. 60: 1426-1440.

1981

Burger, J. 1981a. Effects of human disturbance on colonial species, particularly gulls. Colonial Waterbirds 4: 28-36.

Burger, J. and M. Gochfeld. 1981a. Age-related differences in piracy behaviour of four species of gulls, _Larus_. Behaviour 77: 242-267.

Conover, M. R. and D. O. Conover. 1981. A documented history of Ring-billed Gull and California Gull colonies in the western United States. Colonial Waterbirds 4: 37-43.

Conover, M. R. and D. E. Miller. 1981. Elicitation of vocalizations and pecking in Ring-billed Gull chicks. Behaviour 77: 268-286.

Fetterolf, P. M. 1981. Reproductive performance of minimally disturbed Ring-billed Gulls. (Abstract only.) Colonial Waterbirds 4: 68.

King, B. 1981. Caspian Terns sun-bathing with Ring-billed Gulls. Brit. Birds 74: 181.

Kovacs, K. M. and J. P. Ryder. 1981. Nest site tenacity and mate fidelity in female-female pairs of Ring-billed Gulls. Auk 98: 625-627.

Petokas, P. J. 1981. Snapping Turtle predation on Ring-billed Gulls. Bull. Md. Herpetol. Soc. 17: 111-115.

Ryder, P. L. and J. P. Ryder. 1981a. Reproductive performance of Ring-billed Gulls in relation to nest location. Condor 83: 57-60.

_____. 1981b. Minimum inter-nest distance, is it a useful paramater in predicting breeding success? (Abstract only.) Colonial Waterbirds 4: 200.

Scharf, W. C. 1981. The significance of deteriorating man-made island habitats to Common Terns and Ring-billed Gulls in the St. Mary's River, Michigan. Colonial Waterbirds 4: 155-159.

Southern, L. K. 1981. Sex-related differences in territorial aggression by Ring-billed Gulls. Auk 98: 179-181.

Southern, L. K. and W. E. Southern. 1981. The influence of habitat alterations on site tenacity in Ring-billed Gulls. (Abstract only.) Colonial Waterbirds 4: 201.

Southern, W. E. and L. K. Southern. 1981. Colony census results as indicators of pre-hatching perturbations. Colonial Waterbirds 4: 143-149.

Weber, J. W. 1981. The _Larus_ gulls of the Pacific Northwest's interior, with taxonomic comments on several forms. (Part II--conclusion). Continental Birdlife 2: 74-91.

Weseloh, D. V. 1981. A probable Franklin's X Ring-billed Gull pair nesting in Alberta. Can. Field-Nat. 95: 474-476.

Weseloh, D. V. C. and M. T. Myres. 1981. Seasonal fluctuations in gull numbers at Calgary, Alberta, Canada and a model for estimating their numbers. Colonial Waterbirds 4: 132-137.

1980

Blokpoel, H. 1980. Status of the Ring-billed Gull on the Canadian Lower Great Lakes. (Abstract only.) Pac. Seabird Group Bull. 7: 57.

Blokpoel, H. and P. Courtney. 1980. Site tenacity in a new Ring-billed Gull colony. J. Field Ornithol. 51: 1-5.

Bull, J. 1980. Notes on a Ring-billed Gull. Linn. Newsl. 34: 3.

Burger, J., M. Fitch, G. Shugart, and W. Werther. 1980. Piracy in *Larus* gulls at a dump in New Jersey. Proc. 1979 Conf. Colonial Waterbird Group 3: 87-98.

Conover, M. R. and D. E. Miller. 1980. Daily activity patterns of breeding Ring-billed and California Gulls. J. Field Ornithol. 51: 329-339.

Conover, M. R., R. Klopfer, F. Dudley and D. E. Miller. 1980. Stimulus features of chicks and other factors evoking parental protective behaviour in Ring-billed Gulls. Anim. Behav. 28: 29-41.

Courtney, P. A. and H. Blokpoel. 1980a. Behavior of Common Terns nesting near Ring-billed Gulls. Can. Field-Nat. 94: 336-338.

Evans, R. M. 1980. Development of individual recognition in young Ring-billed Gulls (*Larus delawarensis*): an effect of feeding. Anim. Behav. 28: 60-67.

Grace, J. W. 1980. Kleptoparasitism by Ring-billed Gulls of wintering waterfowl. Wilson Bull. 92: 246-248.

Haymes, G. T. and H. Blokpoel. 1980. The influence of age on the breeding biology of Ring-billed Gulls. Wilson Bull. 92: 221-228.

Koonz, W. H. 1980. Large clutches of Ring-billed Gulls in Manitoba. Blue Jay 38: 46-47.

Lauro, A. J. and B. J. Spencer. 1980. A method for separating juvenal and first winter Ring-billed Gulls (*Larus delawarensis*) and Common Gulls (*Larus canus*). Am. Birds 34: 111-117.

Mullarney, K. 1980. Ring-billed Gulls in Co. Mayo. A species new to Ireland. Irish Birds 1: 517-525.

Ryder, J. P. 1980. A preliminary investigation of the secondary sex-ratio of Ring-billed Gulls on Granite Island, 1978-79. (Abstract only.) Proc. 1979 Conf. Colonial Waterbird Group 3: 256.

Southern, L. K. and W. E. Southern. 1980. Philopatry in Ring-billed Gulls. Proc. 1979 Conf. Colonial Waterbird Group 3: 27-32.

Southern, W. E. 1980a. Comparative distribution and orientation of North American gulls. Pp. 449-498 *in* J. Burger, B. C. Olla and H. E. Winn (eds.). Behavior of Marine Animals. Vol. 4: Marine Birds. Plenum Press NY. xvii and 515 pp.

______. 1980b. The impact of fox predation on gull breeding success, Sleeping Bear Dunes National Lakeshore. Pp. 111-129 *in* Proc. 2nd Conf. Sci. Res. Natl. Parks, Vol. 12: Terrestrial Biology: Zoology. Natl. Park Serv., Washington, D. C.

Southern, W. E., S. R. Patton and L. A. Hanners. 1980. Differential response of Ring-billed Gulls and Herring Gulls to fox predation. Proc. 1979 Conf. Colonial Waterbird Group 3: 119-127.

1979

Blokpoel, H. and G. T. Haymes. 1979a. Small mammals and birds as food items of Ring-billed Gulls on the Lower Great Lakes. Wilson Bull. 91: 623-625.

_____. 1979b. Origins of Ring-billed Gulls at a new colony. Bird-Banding 50: 210-215.

Burger, J. and M. Gochfeld. 1979. Age differences in Ring-billed Gull klepto-parasitism on Starlings. Auk 96: 806-808.

Conover, M. R. and D. E. Miller. 1979. Reaction of Ring-billed Gulls to predators and disturbances at their breeding colonies. Proc. 1978 Conf. Colonial Waterbird Group 2: 41-47.

Conover, M. R., D. E. Miller and G. L. Hunt, Jr. 1979a. Female-female pairs and other unusual reproductive associations in Ring-billed and California Gulls. Auk 96: 6-9.

Conover, M. R., B. C. Thompson, R. E. Fitzner and D. E. Miller. 1979b. Increasing populations of Ring-billed and California Gulls in Washington State. West. Birds 10: 31-36.

Courtney, P. A. 1979b. Effects of a rabbit on nesting Common Terns. Can. J. Zool. 57: 2457-2460.

Fetterolf, P. M. 1979a. Common Garter Snake predation on Ring-billed Gull chicks. Can. Field-Nat. 93: 317-318.

_____. 1979b. Nocturnal behaviour of Ring-billed Gulls during the early incubation period. Can. J. Zool. 57: 1190-1195.

Grant, G. S. 1979. Ring-billed Gulls feeding on date fruits. Condor 81: 432-433.

Grant, P. J. 1979. Field identification of west Palearctic gulls. Part 2. Common, Mediterranean, Ring-billed, Laughing and Franklin's Gulls. Brit. Birds 72: 142-182.

Hogg, R. H. 1979. Ring-billed Gull in Aberdeenshire. Scott. Birds 10: 275-276.

Kirkham, I. R. and R. D. Morris. 1979. Feeding ecology of Ring-billed Gull (*Larus delawarensis*) chicks. Can. J. Zool. 57: 1086-1090.

Miller, D. E. and M. R. Conover. 1979. Differential effects of chick vocalizations and bill-pecking on parental behavior in the Ring-billed Gull. Auk 96: 284-295.

Nunnally, S., D. Nunnally, R. Needham and R. Lennon. 1979. Nocturnal feeding of gulls at a lighted pier. Chat 43: 63.

Patton, S. R. 1979. Short and long term effects of Red Fox nocturnal predation on the nesting success of colonial breeding Herring and Ring-billed Gulls. M.S. thesis, N. Ill. Univ./Dekalb, IL. vi and 107 pp.

Ryder, J. P. 1979. Possible origins and adaptive value of female-female pairing in gulls. Proc. 1978 Conf. Colonial Waterbird Group 2: 138-145.

Ryder, J. P. and P. L. Somppi. 1979. Female-female pairing in Ring-billed Gulls. Auk 96: 1-5.

Southern, L. K. and W. E. Southern. 1979. Absence of nocturnal predator defense mechanisms in breeding gulls. Proc. 1978 Conf. Colonial Waterbird Group 2: 157-162.

Weseloh, D. V. and H. Blokpoel. 1979. Hinterland Who's Who: Ring-billed Gull. Environ. Can. Wildl. Serv. Cat. CW69-4/63. 4 pp.

1978

Bishop, M. M. 1978. Imprinting of a Ring-billed Gull. Auk 95: 196-197.

Blokpoel, H. and P. M. Fetterolf. 1978. Colonization by gulls and terns of the Eastern Headland, Toronto Outer Harbour. Bird-Banding 49: 59-65.

Blokpoel, H. and G. B. McKeating. 1978. Fish-eating birds nesting in Canadian Lake Erie and adjacent waters. Can. Wildl. Serv. Prog. Notes 87. 12 pp.

Brackbill, H. 1978. Play by Ring-billed Gulls. Bird-Banding 49: 282-283.

Chardine, J. W. 1978. Seasonal variation in the reproductive biology of the Ring-billed Gull (*Larus delawarensis*). M.S. thesis, Brock Univ./St. Catharines, ON. 102 pp.

Conover, M. R. and D. E. Miller. 1978. Acoustical properties of the swoop-and-soar call of the Ring-billed Gull. Auk 95: 599-602.

Elston, S. F., C. D. Rymal and W. E. Southern. 1978. Intraspecific kleptoparasitism in breeding Ring-billed Gulls. Proc. 1977 Conf. Colonial Waterbird Group 1: 102-109.

Haymes, G. T. and H. Blokpoel. 1978a. Reproductive success of larids nesting on the Eastern Headland of the Toronto Outer Harbour in 1977. Ont. Field Biol. 32: 1-17.

_____ . 1978b. Food of Ring-billed Gull chicks at the Eastern Headland of the Toronto Outer Harbour in 1977. Can. Field-Nat. 92: 392-395.

Kinkel, L. K. and W. E. Southern. 1978. Adult female Ring-billed Gulls sexually molest juveniles. Bird-Banding 49: 184-186.

Moulton, M. and M. Ports. 1978. Piracy by Ring-billed Gull on Common Goldeneye. Bull. Kansas Ornithol. Soc. 29: 18.

Patton, S. R. and W. E. Southern. 1978. The effect of nocturnal Red Fox predation on the nesting success of colonial gulls. Proc. 1977. Conf. Colonial Waterbird Group 1: 91-101.

Ryder, J. P. 1978. Sexing Ring-billed Gulls externally. Bird-Banding 49: 218-222.

Ryder, R. A. 1978. Gulls in Colorado: their distribution, status, and movements. Proc. 1977 Conf. Colonial Waterbird Group 1: 3-9.

Somppi, P. L. 1978. Reproductive performance of Ring-billed Gulls in relation to nest location. M.S. thesis, Lakehead Univ./Thunder Bay, ON.

Southern, W. E. 1978a. Ring-billed Gull pair with 2 nests. Wilson Bull. 90: 299-301.

_____. 1978b. Orientation responses of Ring-billed Gull chicks: a re-evaluation. Pp. 311-317 in K. Schmidt-Koenig and W. T. Keeton, (eds.). Proceedings in Life Sciences, Animal Migration, Navigation and Homing. Springer-Verlag, Berlin.

Weseloh, D. V., S. Brechtel and R. D. Burns. 1978. Recent population changes in Double-crested Cormorants and California and Ring-billed Gulls in Alberta, Canada, with a note on White Pelicans. Proc. 1977 Conf. Colonial Waterbird Group 1: 10-18.

1977

Allen, L. J. 1977. The comparative feeding ecology relative to population dynamics of the Herring and Ring-billed Gulls (*Larus argentatus* and *L. delawarensis*) and some comparisons with the Caspian Tern. M.S. thesis Queens Univ./Kingston, Ontario. 196 pp.

Blokpoel, H. 1977. Gulls and terns nesting in northern Lake Ontario and the upper St. Lawrence River. Can. Wildl. Serv. Prog. Notes 75. 12 pp.

Evans, R. M. 1977. Auditory discrimination-learning in young Ring-billed Gulls (Larus delawarensis). Anim. Behav. 25: 140-146.

Fetterolf, P. M. and H. Blokpoel. 1977. Terns and gulls nesting on Toronto's eastern headland. Ont. Field Biol. 31: 51-52.

Gollop, J. B. 1977. White Ring-billed Gull at Saskatoon. Blue Jay 35: 166.

Hall, R. F., D. G. Waldhalm, W. A. Meinershagen and D. A. Dubose. 1977. Isolation of Salmonella spp. from dead gulls (Larus californicus and Larus delawarensis) from an Idaho irrigation reservoir. Avian Dis. 21: 452-454.

Lauro, A. J. 1977. Gull predation on an ant swarm. Kingbird 27: 87-88.

Penland, S. T. and S. J. Jeffries. 1977. New breeding records for the Ring-billed Gull in Washington. Murrelet 58: 86-87.

Ryder, J. P., D. E. Orr and G. H. Saedi. 1977. Egg quality in relation to nest location in Ring-billed Gulls. Wilson Bull. 89: 473-475.

Ryder, J. P. and L. Somppi. 1977. Growth and development of known-age Ring-billed Gull embryos. Wilson Bull. 89: 243-252.

Schreiber, E. A. and R. W. Schreiber. 1977. Gulls wintering in Florida: Christmas Bird Count analysis. Fla. Field Nat. 5: 35-40.

Scott, C. M. 1977. Food stealing behavior in the Ring-billed Gull. Bull. Okla. Ornithol. Soc. 10: 33.

Shugart, G. W. 1977a. A method for externally sexing gulls. Bird-Banding 48: 118-121.

_____. 1977b. Resident Red Fox predation upon an island gull colony. Jack-Pine Warbler 55: 199-205.

Sileo, L., L. Karstad, R. Frank, M. V. H. Holdrinet, E. Addison and H. H. Braun. 1977. Organochlorine poisoning of Ring-billed Gulls in southern Ontario. J. Wildl. Dis. 13: 313-322.

Southern, W. E. 1977. Colony selection and colony site tenacity in Ring-billed Gulls at a stable colony. Auk 94: 469-478.

Southern, W. E., W. L. Jarvis and L. Brewick. 1977. Food habits and foraging ecology of Great Lakes region Ring-billed Gulls. Proc. Symp. Fisheating Birds of the Great Lakes & Environmental Contaminants 1977: 100-144.

Stevens, V. J. and F. D. Klopfer. 1977. Interocular transfer of conditioning and extinction in birds. J. Comp. Physiol. Psychol. 91: 1074-1081.

Voous, K. H. 1977. Northern gulls in Aruba, Netherlands Antilles. Ardea 65: 80-82.

1976

Baird, P. A. 1976. Comparative ecology of California and Ring-billed Gulls (*Larus californicus* and *L. delawarensis*). Ph.D. thesis, Univ. Montana/ Missoula, MT. x and 183 pp.

Dawson, W. R., A. F. Bennett and J. W. Hudson. 1976. Metabolism and thermoregulation in hatchling Ring-billed Gulls. Condor 78: 49-60.

Hunter, R. A., H. A. Ross and A. J. S. Ball. 1976. A laboratory simulation of predator-induced incubation interruption using Ring-billed Gull eggs. Can. J. Zool. 54: 628-633.

Jarvis, W. L. and W. E. Southern. 1976. Food habits of Ring-billed Gulls breeding in the Great Lakes region. Wilson Bull. 88: 621-631.

Morris, R. D. and R. A. Hunter. 1976. Factors influencing desertion of colony sites by Common Terns (*Sterna hirundo*). Can. Field-Nat. 90: 137-143.

Payne, R. B. and H. F. Howe. 1976. Cleptoparasitism by gulls of migrating shorebirds. Wilson Bull. 88: 349-351.

Ryder, J. P. 1976. The occurrence of unused Ring-billed Gull nests. Condor 78: 415-418.

Shugart, G. W. 1976. Effects of Ring-billed Gull nesting on vegetation. Jack-Pine Warbler 54: 50-53.

Southern, W. E. 1976a. Migrational orientation in Ring-billed Gull chicks. Auk 93: 78-85.

_____. 1976b. Retraction of longevity records for Ring-billed Gulls. Auk 93: 213.

1975

Cuthbert, F. J. and W. E. Southern. 1975. A method for marking young gulls for individual recognition. Bird-Banding 46: 252-253.

Evans, R. M. 1975. Responsiveness to adult mew calls in young Ring-billed Gulls (*Larus delawarensis*): effects of exposure to calls alone and in the presence of visual imprinting stimuli. Can. J. Zool. 53: 953-959.

Hanzely, L., W. E. Southern and D. Molsen. 1975. Ultrastructure of the Ring-billed Gull eye pecten. Cytobios 12: 191-201.

Harrington, B. A. 1975. Pelagic gulls in winter off Southern California. Condor 77: 346-350.

Harris, J. T. and S. W. Matteson. 1975a. Gulls and terns as indicators of man's impact upon Lake Superior. Univ. Wis. Sea Grant College Program Tech. Rep. No. 227. 45 pp.

_____. 1975b. Gulls and terns on Wisconsin's Lake Superior shore. Passenger Pigeon 37: 99-110.

_____. 1975c. Gulls and terns nesting at Duluth. Loon 47: 70-77.

Kleen, V. M. 1975. The changing seasons; the nesting season: June 1-July 31, 1975; Middlewest Prairie Region. Am. Birds 29: 978-982.

Miller, D. E. and J. T. Emlen. 1975. Individual chick recognition and family integrity in the Ring-billed Gull. Behaviour 52: 124-144.

Ryder, J. P. 1975. Egg-laying, egg size, and success in relation to immature-mature plumage of Ring-billed Gulls. Wilson Bull. 87: 534-542.

Southern, W. E. 1975a. Longevity records for Ring-billed Gulls. Auk 92: 369.

_____. 1975b. Orientation of gull chicks exposed to Project Sanguine's electromagnetic field. Science 189: 143-145.

Waide, R. B., and J. P. Hailman. 1975. Different head-scratching attempts in a one-legged gull and parrot. Condor 77: 350.

<u>1974</u>

Citron, J. D. 1974. Gulls steal fish from Common Mergansers. Delmarva Ornithol. 9: 71-72.

Dexheimer, M. and W. E. Southern. 1974. Breeding success relative to nest location and density in Ring-billed Gull colonies. Wilson Bull. 86: 288-290.

Forsythe, D. M. 1974a. An ecological study of gull populations to reduce the bird/aircraft strike hazard at Charleston Air Force Base. Air Force Weapons Lab. Tech. Rep. 73. 142 pp.

_____. 1974b. Gulls, solid waste disposal, and the bird-aircraft strike hazard. Pp. 17-25 <u>in</u> S. A. Gauthreaux, Jr. (ed.). A conference on the biological aspects <u>of</u> the bird/aircraft collision problem. Clemson University, Clemson, SC, 5-7 February 1974. xi and 513 pp.

Freitag, R., J. P. Ryder and P. Wanson. 1974. Mite (acarina) populations in Ring-billed Gull nests. Can. Entomol. 106: 319-327.

Janssen, R. B. 1974. Ring-billed Gull nesting at the Port Terminal, Duluth. Loon 46: 175-176.

Ludwig, J. P. 1974. Recent changes in the Ring-billed Gull population and biology in the Laurentian Great Lakes. Auk 91: 575-594.

Merilees, W. J. 1974. Ring-billed and California Gull nesting colony in south central British Columbia. Can. Field-Nat. 88: 484-485.

Ponshair, J. F. 1974. Ring-billed Gulls nesting in Muskegon County. Jack-Pine Warbler 52: 194-195.

Ryder, J. P. 1974. Organochlorine and mercury residues in gulls' eggs from western Ontario. Can. Field-Nat. 88: 349-352.

Southern, W. E. 1974a. Florida distribution of Ring-billed Gulls from the Great Lakes region. Bird-Banding 45: 341-352.

_____. 1974b. Seasonal distribution of Great Lakes region Ring-billed Gulls. Jack-Pine Warbler 52: 155-179.

_____. 1974c. The annual range of Ring-billed Gulls in the eastern United States: with comments on potential bird/aircraft collision problems. Pp. 149-190 _in_ S. A. Gauthreaux, Jr. (ed.). A conference on the biological aspects _of_ the bird/aircraft collision problem, Clemson University, Clemson, SC, 5-7 February 1974. xi and 513 pp.

_____. 1974d. The effects of superimposed magnetic fields on gull orientation. Wilson Bull. 86: 256-271.

_____. 1974e. Copulatory wing-flagging: a synchronizing stimulus for nesting Ring-billed Gulls. Bird-Banding 45: 210-216.

Southern, W. E. and F. R. Moore. 1974. Range extremes for Ring-billed Gulls from the Great Lakes region. Inl. Bird Banding News 46: 83-87.

1973

Briggs, D. 1973. Gull island. Pac. Discovery 26: 22-25.

Cuthbert, F. J. and W. E. Southern. 1973. Ring-billed Gull relocates nest as a result of egg displacement. Bird-Banding 44: 225-227.

Evans, R. M. 1973. Differential responsiveness of young Ring-billed Gulls and Herring Gulls to adult vocalizations of their own and other species. Can. J. Zool. 51: 759-770.

Forsythe, D. M. 1973. Gull populations at Charleston, S.C., June 1971 to June 1972. Chat 37: 57-62.

Grant, P. S. 1973. Field identification of Ring-billed Gulls. Brit. Birds 66: 115-118.

Hume, P. A. 1973. Ring-billed Gull in Glamorgan: a species new to Britain and Ireland. Brit. Birds 66: 509-512.

Leck, C. F. 1973. Attempts of gulls to rob a Common Egret and an Osprey. Cassinia 54: 32.

Vermeer, K. 1973c. Comparison of egg-laying chronology of Herring and Ring-billed Gulls at Kawinaw Lake, Manitoba. Can. Field-Nat. 87: 306-308.

Vinicombe, K. E. 1973. A second Ring-billed Gull in Glamorgan. Brit. Birds 66: 513-517.

1972

Dwernychuk, L. W. and D. A. Boag. 1972. Ducks nesting in association with gulls--an ecological trap? Can. J. Zool. 50: 559-563.

Forsythe, D. M. 1972. Ring-billed and Herring Gull recoveries from South Carolina. Bird-Banding 43: 276-281.

Gibson, D. D. 1972. Sight records of two birds new to interior Alaska. Murrelet 53: 31-32.

Miller, D. E. 1972. Parental acceptance of young as a function of incubation time in the Ring-billed Gull. Condor 74: 454-461.

Moos, L. M. 1972. Gull banding in Montana. Proc. Mont. Acad. Sci. 32: 20-23.

Ryder, J. P. and D. J. Chamberlain. 1972. Congenital foot abormality in the Ring-billed Gull. Wilson Bull. 84: 342-344.

Seymour, N. R. 1972. Success of three gull species feeding on swarming ants in Antigonish County, Nova Scotia. Can. Field-Nat. 86: 391-392.

Siegfried, W. R. 1972. Ring-billed Gulls robbing Lesser Scaup of food. Can. Field-Nat. 86: 86.

Southern, W. E. 1972a. Magnets disrupt the orientation of juvenile Ring-billed Gull. BioScience 22: 476-479.

_____. 1972b. Influence of disturbances in the earth's magnetic field on Ring-billed Gull orientation. Condor 74: 102-105.

_____. 1972c. Use of the cannon-net in Ring-billed Gull colonies. Inl. Bird Banding News 44: 83-93.

Southern, W. E. and F. J. Cuthbert. 1972. Ring-billed Gull chick (*Larus delawarensis*) with head deformities. Jack-Pine Warbler 50: 92-93.

1971

Brackbill, H. 1971. Herring and Ring-billed Gulls paired or courting in Maryland in January and February. Auk 88: 438-440.

Hardin, W. D. 1971. Ring-billed Gull steals fish from coot. Bull. Okla. Ornithol. Soc. 4: 5-6.

Ivanovs, M. 1971. Nesting of Ring-billed and Herring Gulls at Mille Lacs Lake, 1970. Loon 43: 58-59.

Leck, C. F. 1971. Nocturnal habits of Ring-billed Gulls (Larus delawarensis) at Thimble Shoal, Virginia. Chesapeake Sci. 12: 188.

Parmalee, D. F. 1971. Nesting of Ring-billed Gulls on Leech Lake, Cass County, Minnesota. Loon 43: 72-74.

Southern, W. E. 1971. Evaluation of a plastic wing-marker for gull studies. Bird-Banding 42: 88-91.

1970

Evans, R. M. 1970. Imprinting and control of mobility in young Ring-billed Gulls (Larus delawarensis). Anim. Behav. Monogr. 3: 193-248.

Southern, W. E. 1970. Orientation in gulls: effect of distance, direction of release, and wind. Living Bird 9: 75-95.

Tolonen, K. E. 1970. Ring-billed Gull and Laughing Gull catch fish by "ploughing" and "skimming". Wilson Bull. 82: 222-223.

Vermeer, K. 1970. Breeding biology of California and Ring-billed Gulls: a study of ecological adaptation to the inland habitat. Can. Wildl. Serv. Rep. Ser. 12. 52 pp.

1969

Emlen, J. T. and D. E. Miller. 1969. Pace-setting mechanism of the nesting cycle in a Ring-billed Gull colony. Behaviour 33: 237-261.

Southern, W. E. 1969a. Orientation behavior of Ring-billed Gull chicks and fledglings. Condor 71: 418-425.

_____. 1969b. Gull orientation behavior: influence of experience, sex, age, and group releases. Jack-Pine Warbler 47: 34-43.

_____. 1969c. Sky conditions in relation to Ring-billed and Herring Gull orientation. Trans. Ill. State Acad. Sci. 62: 342-349.

Vermeer, K. 1969a. Egg measurements of California and Ring-billed Gull eggs at Miquelon Lake, Alberta, in 1965. Wilson Bull. 81: 102-103.

_____. 1969b. Endoparasitic variation between California Gulls and Ring-billed Gulls Larus californius and L. delawarensis. Ibis 111: 393-395.

1968

Berndt, R. and U. Rahne. 1968. Erstnachweiss der Ringschabelmowe (Larus delawarensis) in Europa. J. Ornithol. 109: 438-440. [In German.]

Kadlec, J. A. and W. H. Drury. 1968a. Structure of the New England Herring Gull population. Ecology 49: 644-676.

Ludwig, J. P. 1968. Dynamics of Ring-billed Gull and Caspian Tern populations of the Great Lakes. Ph.D. thesis, Univ. Michigan/Ann Arbor, MI.

Rabinowitch, V. E. 1968. The role of experience in the development of food preferences in gull chicks. Anim. Behav. 16: 425-428.

Southern, W. E. 1968. Age composition of a breeding Ring-billed Gull population. Inl. Bird Banding News 40: 166-167.

1967

Dick, J. A. 1967. An albino Ring-billed Gull from Ontario. Can. Field-Nat. 81: 224-225.

Hart, J. A. 1967. Ring-billed Gulls summer in western Minnesota. Loon 39: 139.

Ludwig, J. P. 1967. Band-loss--its effect on banding data and apparent survivorship in the Ring-billed Gull population. Bird-Banding 38: 309-323.

Ryder, R. A. 1967. Migration and movements of some gulls from Colorado. Colo. Field Ornithol. 2: 16-20.

Southern, W. E. 1967a. Dispersal and migration of Ring-billed Gulls from a Michigan population. Jack-Pine Warbler 45: 102-111.

_____. 1967b. Colony selection, longevity, and Ring-billed Gull populations: preliminary discussion. Bird-Banding 38: 52-60.

_____. 1967c. The role of environmental factors in Ring-billed and Herring Gull orientation. Ph.D. thesis, Cornell Univ./Ithaca, NY.

Vermeer, K. 1967. A study of two species of gulls, Larus californicus and L. delawarensis, breeding in an inland habitat. Ph.D. thesis, Univ. Alberta/Edmonton, AB. 128 pp.

1966

Bendell, J. F. 1966. An unusual number of dead Ring-billed Gulls. Can. Field-Nat. 80: 62.

Buckley, P. A. 1966. Foot-paddling in four American gulls, with comments on its possible function and stimulation. Z. Tierpsychol. 23: 395-402.

Emlen, J. T., D. E. Miller, R. M. Evans and D. H. Thompson. 1966. Predator-induced parental neglect in a Ring-billed Gull colony. Auk 83: 677-679.

Evans, R. M. 1966. The development of mobility and approach responses in young Ring-billed Gulls. Ph.D. thesis, Univ. Wisconsin/Madison, WI.

Hickey, J. J., J. A. Keith and F. B. Coon. 1966. An exploration of pesticides in a Lake Michigan ecosystem. J. Appl. Ecol. 3 (suppl.): 141-154.

Ludwig, J. P. 1966. Herring and Ring-billed Gull populations of the Great Lakes 1960-65. Great Lakes Res. Div., Univ. Mich. Publ. 15: 80-89.

Ryder, R. A. 1966. Some movements of Ring-billed Gulls color-marked in Colorado. Blue Jay 24: 73-75.

1965

Anderson, W. 1965. Waterfowl production in the vicinity of gull colonies. Calif. Fish Game 51: 5-15.

Holroyd, G. L. 1965. Ring-billed Gulls on a Lake Erie colony. Ont. Bird Banding 2: 19-33.

Le Febvre, E. 1965. Ring-billed Gull nesting records for Minnesota. Loon 37: 79.

Ludwig, J. P. 1965b. Ring-billed Gull nesting within Caspian Tern colony. Jack-Pine Warbler 43: 61.

Meyerriecks, A. J. 1965. Ring-billed Gulls gorge on fiddler crabs. Wilson Bull. 77: 402-403.

Mueller, H. C. and D. D. Berger. 1965. Ring-billed Gulls feed on flying ants. Auk 82: 504.

1964

Hiemenz, N. M. 1964. Ring-billed Gull nesting in Minnesota. Loon 36: 133.

Tomkins, I. R. 1964. The Ring-billed Gull "skimming" on foot. Oriole 29: 62.

1963

Hanson, W. C. 1963. Census of Ring-billed and California Gull colonies in eastern Washington. Condor 65: 163-164.

Holroyd, G. L. 1963. Dispersal of young Ring-billed Gulls from Mohawk Island. Ont. Field Biol. 17: 27-29.

1962

Ludwig, J. P. 1962b. A survey of the gull and tern populations of Lakes Huron, Michigan, and Superior. Jack-Pine Warbler 40: 104-119.

1961

Broadbrooks, H. E. 1961. Ring-billed Gulls nesting on Columbia River Islands. Murrelet 42: 7-8.

Dickerman, R. W. and E. Le Febvre. 1961. Ring-billed Gull nesting in Minnesota. Flicker 33: 23.

Eastman, W. 1961. Ring-billed Gulls feeding on blueberries. Flicker 33: 57.

Nero, R. W. 1961. Dry land gull colony. Blue Jay 19: 166-168.

1960

Burton, D. E. 1960. Ring-billed Gulls flycatching. Ont. Field Biol. 14: 31.

Hailman, J. P. 1960a. Ring-billed Gulls following the plow. Raven 31: 109.

Rothweiler, R. A. 1960. Food habits, movements and nesting of gulls on a waterfowl area, Freezeout Lake, Teton County, Montana. M.S. thesis, Montana St. College/Bozeman, MT. 29 pp.

Turcotte, W. H. 1960. Ring-billed Gulls. Miss. Ornithol. Soc. Newsl. 5: 2.

1959

Janssen, R. B. 1959. Ring-billed Gull abundance. Flicker 31: 136.

Moynihan, M. 1959. Notes on the behavior of some North American gulls. IV: The ontogeny of hostile behavior and display patterns. Behaviour 14: 214-239.

1958

Moynihan, M. 1958a. Notes on the behavior of some North American gulls. II: Non-aerial hostile behavior of adults. Behaviour 12: 95-182.

Moynihan, M. 1958b. Notes on the behavior of some North American gulls. III. Pairing behavior. Behaviour 13: 112-130.

Pettingill, O. S., Jr. 1958a. Ring-billed Gulls hawking may-flies. Jack-Pine Warbler 36: 154.

_____. 1958b. Nesting of the Caspian Tern within a Ring-billed Gull colony. Jack-Pine Warbler 36: 183-184.

Sedwitz, W. 1958. Five year count of the Ring-billed Gull (Larus delawarensis) on western Long Island. Proc. Linn. Soc. N.Y. 66-70: 71-76.

1957

Bartlett, L. M. 1957. Ring-billed Gull steals food from Coot. Wilson Bull. 69: 182.

Thiessen, G. J. and E. A. G. Shaw. 1957. Acoustic irritation threshold of Ring-billed Gulls. J. Acoust. Soc. Am. 29: 1307-1309.

1956

Emlen, J. T., Jr. 1956. Juvenile mortality in a Ring-billed Gull colony. Wilson Bull. 68: 232-238.

Moynihan, M. 1956. Notes on the behavior of some North American gulls. I. Aerial hostile behavior. Behaviour 10: 126-178.

1955

Belknap, J. B. 1955. The expanding range of the Ring-billed Gull. Kingbird 5: 63.

Emlen, J. T., Jr. 1955. Ring-Bill City... Passenger Pigeon 17: 139-143.

1954

Johnston, D. W. and M. E. Foster. 1954. Interspecific relations of breeding gulls at Honey Lake, California. Condor 56: 38-42.

1953

Lamore, D. 1953. Ring-billed Gulls stealing fish from female American Mergansers. Wilson Bull. 65: 210-211.

Rapp, W. F., Jr. 1953. Field separation of the Herring, California and Ring-billed Gulls. Nebr. Bird Rev. 21: 32-33.

1952

Ganier, A. F. 1952. Ring-billed Gull in the Great Smoky Mountains National Park. Migrant 23: 30.

1951

Savile, D. O. 1951. The Ring-billed Gull at Ottawa, Ontario, and its field recognition. Can. Field-Nat. 65: 109-112.

1950

Cruickshank, A. D. 1950. Ring-billed Gulls and cabbage palmettos. Auk 67: 237.

Harper, S. A. 1950. Ring-billed Gulls feeding on fruit of cabbage palmetto. Auk 67: 236-237.

Imhof, T. A. 1950. Ring-billed Gull chases Great Blue Heron. Wilson Bull. 62: 210.

1949

Southam, H. H. 1949. Caspian Tern and Ring-billed Gull colonies, Green Island, Prince Edward County, Ont. Can. Field-Nat. 63: 115-116.

1948

Hyde, A. S. 1948. Breeding of the Ring-billed Gull in New York in 1936. Auk 65: 317.

Nicholson, D. J. 1948c. Berry-feeding of the Ring-billed Gull. Auk 65: 601.

1947

Cooke, M. T. 1947. Another transatlantic species. Bird-Banding 18: 170.

1946

Bunker, A. 1946. Gulls taking fish from mergansers. Can. Field-Nat. 60: 115.

Kutz, H. L. 1946. Breeding of the Ring-billed Gull in New York. Auk 63: 591.

1945

Norris-Elye, L. T. S. 1945. Symbiotic tendencies among birds. Can. Field-Nat. 59: 174.

Sheppard, R. W. 1945. Gulls and terns hawking flying insects. Wilson Bull. 57: 204.

Trautman, M. B. and M. A. Trautman. 1945. Ring-billed Gulls fly-catching. Wilson Bull. 57: 77.

1943

Alcorn, J. R. 1943. Flight-feeding of the Ring-billed Gull. Condor 45: 199-200.

Ludwig, F. E. 1943. Ring-billed Gulls of the Great Lakes. Wilson Bull. 55: 234-244.

1942

Moffitt, J. 1942. A nesting colony of Ring-billed Gulls in California. Condor 44: 105-107.

Shortt, T. M. 1942. Abnormal primary of Ring-billed Gull. Auk 59: 438.

1941

Brown, M. 1941. Gulls eat fruit of the cabbage palmetto. Auk 58: 579.

Lewis, H. F. 1941. Ring-billed Gulls of the Atlantic coast. Wilson Bull. 53: 22-30.

Lewis, H. F. and T. S. Hennessy. 1941. A nesting colony of Ring-billed Gulls (Larus delawarensis) in the St. Lawrence River near Gananoque, Ontario. Can. Field-Nat. 55: 77.

1939

Norris, R. 1939. Ring-billed Gulls at St. Simons Island during June. Oriole 4: 31.

1936

Munro, J. A. 1936. A study of the Ring-billed Gull in Alberta. Wilson Bull. 48: 169-180.

Thompson, M. 1936. Minnesota nesting record of the Ring-billed Gull. Flicker 8: 50.

1935

McCabe, T. T. and E. B. McCabe. 1935. Ring-billed Gull killed by a Canada Goose. Condor 37: 79-80.

1934

Bailey, A. M. 1934. Ring-billed Gull from Barrow, Alaska--a correction. Condor 36: 248.

Shelley, L. O. 1934. Gull notes from the New Hampshire and Maine coasts. Auk 51: 83.

1933

Tomkins, I. R. 1933. Ring-billed and Herring Gulls at the Savannah River mouth in July and August. Auk 50: 103.

1932

Shelley, L. O. 1932. Ring-billed Gull (*Larus delawarensis*) on the New Hampshire and Maine coasts in July. Auk 49: 476.

1929

Komarek, E. V. 1929. Strangulation of gulls. Wilson Bull. 41: 41.

1926

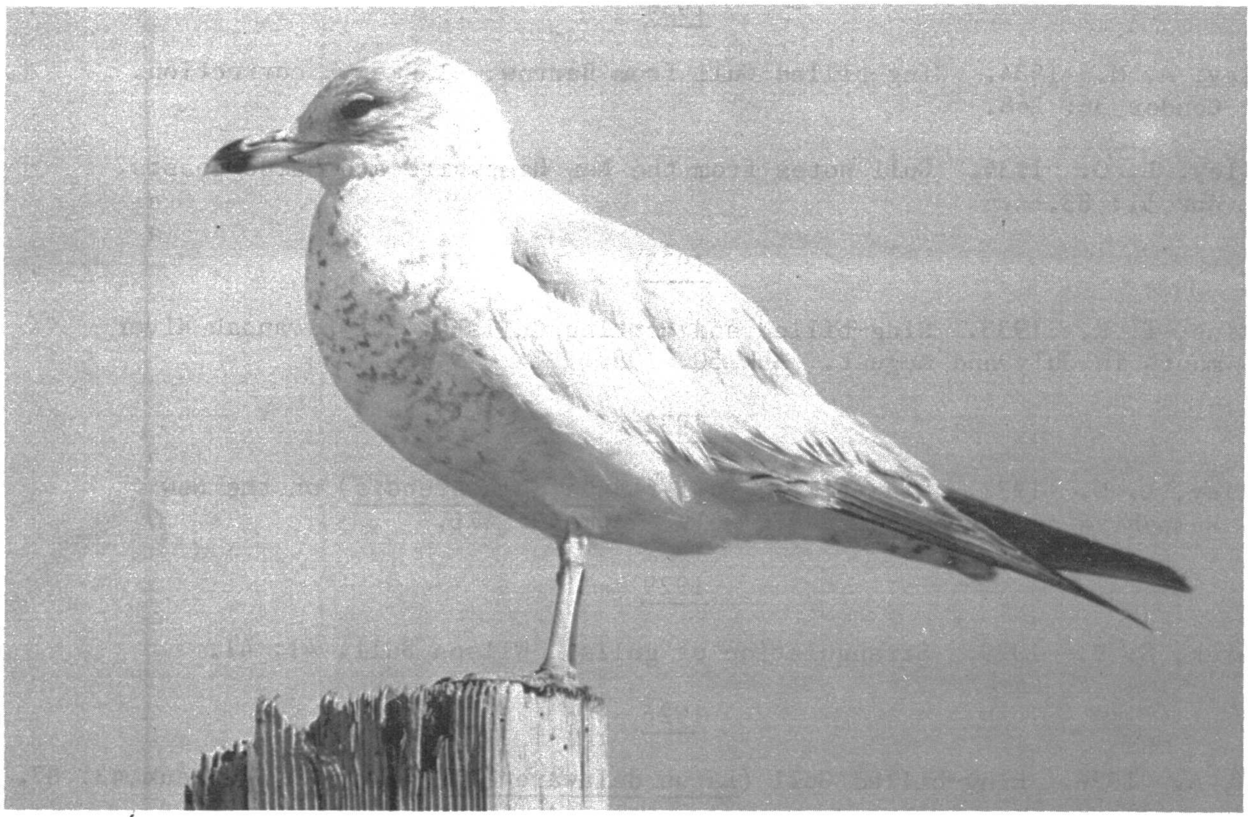
Lano, A. 1926. Ring-billed Gull (*Larus delawarensis*) in Arkansas. Auk 43: 87.

1910

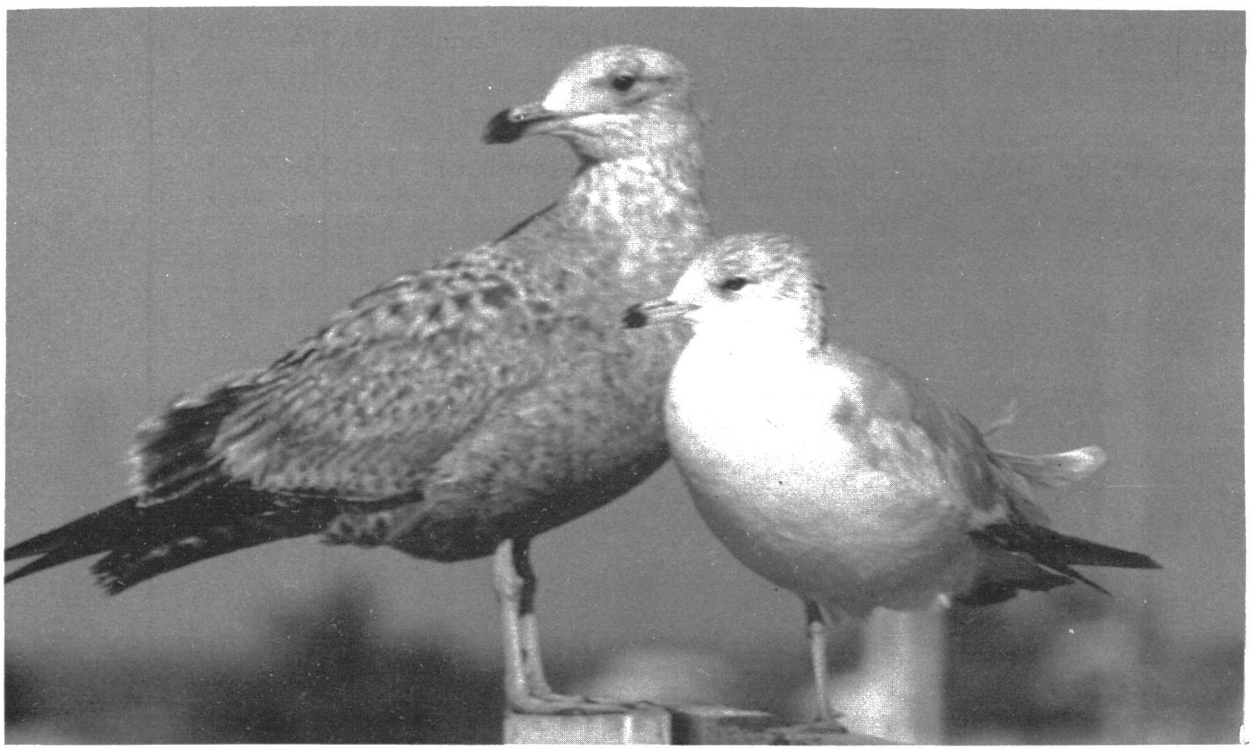
Bishop, L. B. 1910. *Larus canus*: a correction. Condor 12: 74.

1907

Saunders, W. E. 1907. Ring-billed Gull. Wilson Bull. 19: 73-74.



Second-winter Ring-billed Gull. Photograph by Roger B. Clapp.



Second-winter Herring and Ring-billed Gulls. Photograph by Roger B. Clapp.

HERRING GULL

(*Larus argentatus*)

[DA: Solvmage, DU: Zilvermeeuw, F: Harmaalokki, FR: Goeland argente, GE: Silbermowe, IC: Silfurmafur, IT: Gabbiano reale, JA: Seguro kamome, NW: Gramake, PO: Mewa srebrzysta, PR: Gaivota, RU: (Silver Gull), SP: Gaviota platena, SW: Gratrut]

GENERAL DISTRIBUTION

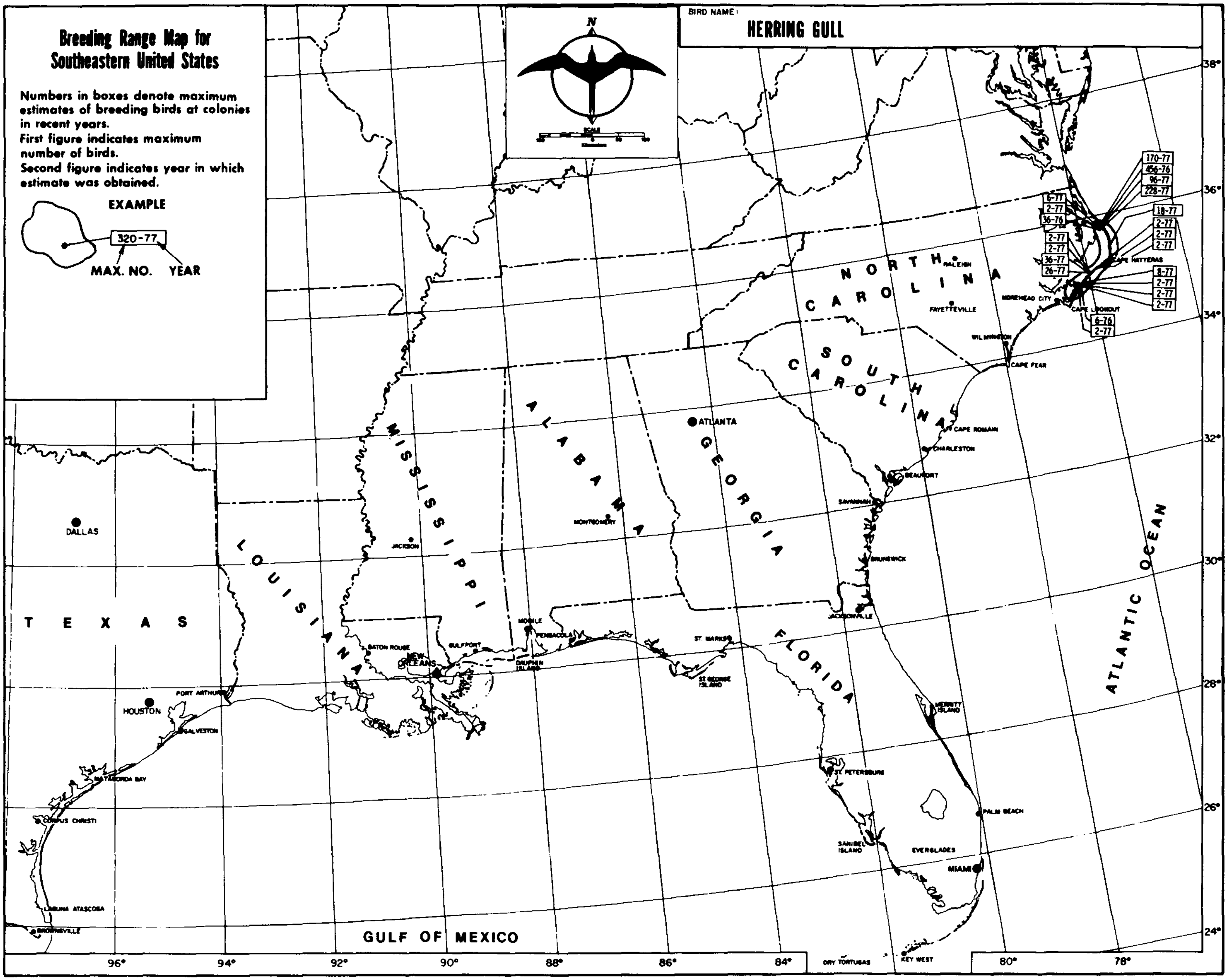
North America Herring Gulls breed casually on St. Lawrence Island and elsewhere in the Bering Sea (Sowls et al. 1978), inland in boreal Alaska (Patten and Weisbrod 1974), and across mainland northern Canada to the Atlantic Ocean. Inland they nest south on all five Great Lakes (Gilman et al. 1977, Shugart 1977b), and north to southern Baffin Island (Smith 1966). On the Atlantic coast this species breeds from Labrador south through the Maritime Provinces and New England to North Carolina (Map 5). They winter in their breeding range as far north as open water remains and south on the Pacific coast to Mexico (sparsely). They also are abundant on the Atlantic coast of the southern United States and common on the Gulf of Mexico to Vera Cruz. Some winter in small numbers south to Central America (Cooke 1940, Kadlec and Drury 1968a), but the species is accidental in northern South America (Donahue 1977).

World Distribution Herring Gulls breed across northern Eurasia from the Bering Sea to Norway and south to Lake Baikal, and the Caspian, Black, and Mediterranean Seas. They also breed on the Atlantic coast of Morocco and on the Canary and Azores islands (Vaurie 1965). The Eurasian subspecies are much more sedentary than the North American form, although eastern Siberian birds migrate south to Japan, China, and Korea, and occasionally straggle to the tropical Pacific (Clapp and Woodward 1968). Most European Herring Gulls winter within their breeding range.

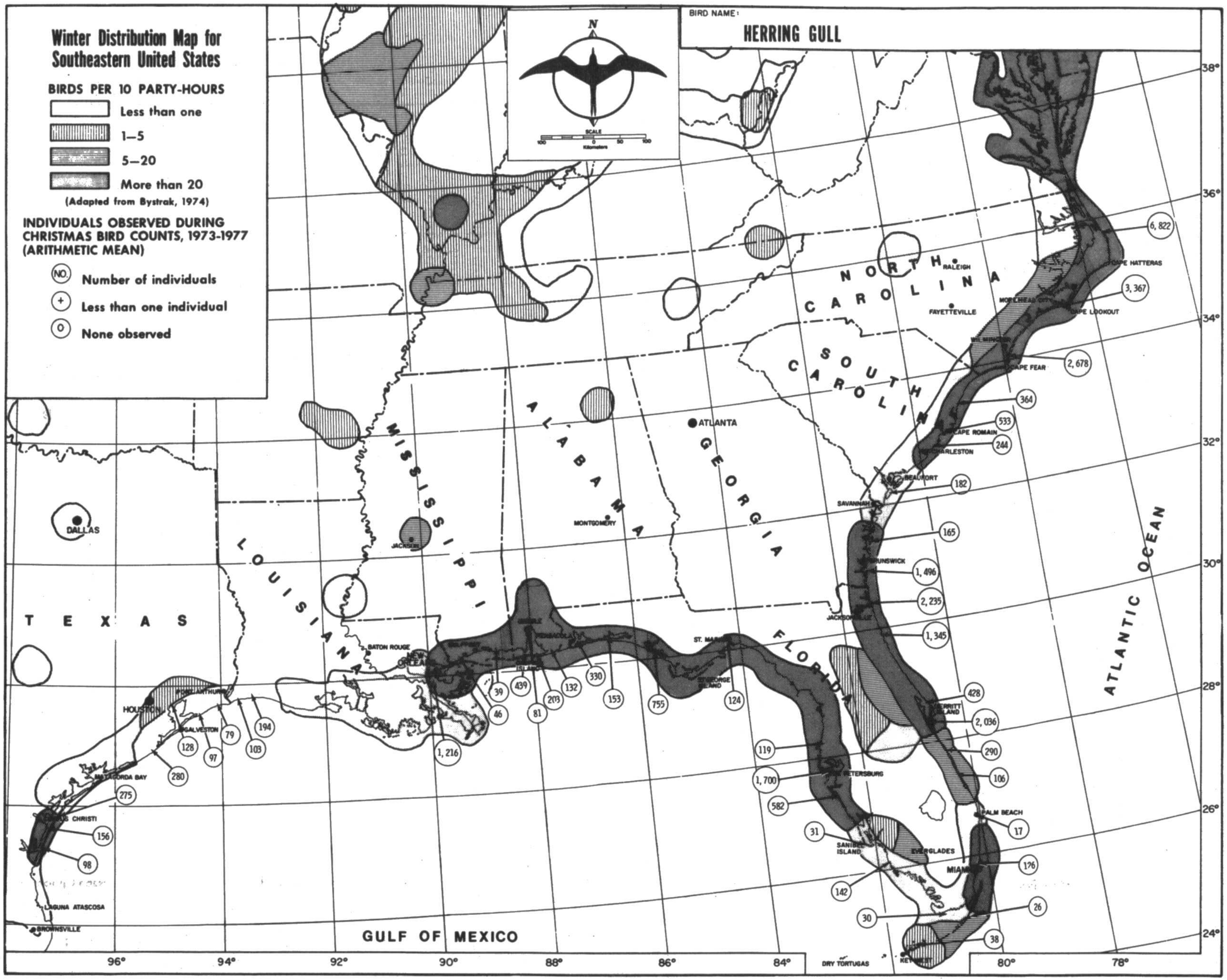
DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

North Carolina Herring Gulls are common in North Carolina from December to May (Wray and Davis 1959). Most occur on the coast, but they are also found inland along watercourses. Flocks of thousands of Herring Gulls are occasionally found on the Outer Banks in winter (LeGrand 1977a). Although total winter populations are unknown, data from a few Christmas Counts (Map 6) suggest that the wintering population now numbers at least in the tens of thousands.

Herring Gulls have bred regularly in North Carolina since about 1972; the growth of the breeding population is summarized in Table 26 and recent colony sites are shown in Map 5. Breeding populations of Herring Gulls in the cen-


Breeding Range Map for
Southeastern United States
Numbers in boxes denote maximum estimates of breeding birds at colonies in recent years.
First figure indicates maximum number of birds.
Second figure indicates year in which estimate was obtained.
EXAMPLE
320-77
MAX. NO.
YEAR
N
BIRD NAME:
HERRING GULL
170-77
456-76
96-77
228-77
6-77
2-77
36-76
18-77
2-77
2-77
2-77
2-77
2-77
36-77
26-77
8-77
2-77
2-77
2-77
6-76
2-77
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI
LOUISIANA
TEXAS
FLORIDA
ATLANTIC OCEAN
GULF OF MEXICO
RALEIGH
FAYETTEVILLE
MOREHEAD CITY
CAPE HATTERAS
CAPE LOOKOUT
WILMINGTON
CAPE FEAR
CAPE ROMAIN
CHARLESTON
BEAUFORT
SAVANNAH
BRUNSWICK
JACKSONVILLE
ATLANTA
MONTGOMERY
JACKSON
DALLAS
HOUSTON
PORT ARTHUR
GALVESTON
MATAGORDA BAY
CORPUS CHRISTI
LAGUNA ATASCOSA
BROWNSVILLE
BATON ROUGE
NEW ORLEANS
GULFPORT
MOBILE
PENSACOLA
DAUPHIN ISLAND
ST. MARKS
ST GEORGE ISLAND
MERRITT ISLAND
ST. PETERSBURG
PALM BEACH
SANIBEL ISLAND
EVERGLADES
MIAMI
DRY TORTUGAS
KEY WEST
38°
36°
34°
32°
30°
28°
26°
24°
96°
94°
92°
90°
88°
86°
84°
80°
78°

Map 5


Winter Distribution Map for Southeastern United States
BIRDS PER 10 PARTY-HOURS
Less than one
1—5
5—20
More than 20
(Adapted from Bystrak, 1974)
INDIVIDUALS OBSERVED DURING CHRISTMAS BIRD COUNTS, 1973-1977 (ARITHMETIC MEAN)
NO.
Number of individuals
+
Less than one individual
0
None observed
N
SCALE
Kilometers
BIRD NAME:
HERRING GULL
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI
LOUISIANA
TEXAS
FLORIDA
ATLANTIC OCEAN
GULF OF MEXICO
RALEIGH
FAYETTEVILLE
ATLANTA
MONTGOMERY
JACKSON
DALLAS
HOUSTON
BATON ROUGE
CAPE HATTERAS
MOREHEAD CITY
CAPE LOOKOUT
WILMINGTON
CAPE FEAR
CAPE ROMAIN
CHARLESTON
BEAUFORT
SAVANNAH
BRUNSWICK
JACKSONVILLE
ST. MARKS
ST. GEORGE ISLAND
PENSACOLA
MOBILE
MERRITT ISLAND
ST. PETERSBURG
PALM BEACH
SANIBEL ISLAND
EVERGLADES
MIAMI
KEY WEST
DRY TORTUGAS
PORT ARTHUR
GALVESTON
MATAGORDA BAY
CORPUS CHRISTI
LAGUNA ATASCOSA
BROWNSVILLE
6,822
3,367
2,678
364
533
244
182
165
1,496
2,235
1,345
428
2,036
290
106
17
176
26
38
30
142
31
582
1,700
119
124
755
153
330
132
203
81
439
39
46
1,216
194
103
79
97
128
280
275
156
98
38°
36°
34°
32°
30°
28°
26°
24°
96°
94°
92°
90°
88°
86°
84°
80°
78°

Map 6

tral Atlantic states have been increasing rapidly (AOU 1957, Armistead 1975, Burger 1977a). It is apparent that the North Carolina colonies continue to receive immigrants from the north because growth has been too fast to stem from a single colonization in the early 1960's. Most Herring Gulls begin nesting in Pamlico Sound (Map 5) in May; young are often still present into late August (Parnell and Soots 1979 ms).

Herring Gull colonies in North Carolina vary in size from small to moderately large, but they are smaller than those found further north (1) in North America. An average colony found in North Carolina in 1976 (Portnoy et al. 1981) contained 91 nests (n = 7, range = 16-462), but this figure probably overstates the mean; 20 colonies examined the following year held an average of 24 nests (range = 1-180)(Parnell and Soots 1979 ms). Fifteen of these colonies held less than 10 pairs and 10 had only one pair. The largest colonies in North Carolina in recent years were one on Herring Gull Island that held 462 nests in 1976 (Portnoy et al. 1981) and two on dredge-spoil islands in Roanoke Sound in 1977; one of these held 180 nests, the other 114 (Parnell and Soots 1979 ms).

South Carolina Herring Gulls are common to abundant migrants and winter residents in coastal South Carolina. They are common from October to May (Sprunt and Chamberlain 1949), and winter populations have been increasing steadily (Burton 1970). Although they apparently have not bred in the state, Herring Gulls recently have extended their breeding range south to the Cape Fear River, less than 50 km (30 mi) north of the South Carolina border (Parnell and Soots 1975). The species probably will be found breeding in South Carolina in the near future.

Judging from recent Christmas Counts (Map 6), Herring Gulls are less abundant in South Carolina in winter than they are in North Carolina. However, thousands winter in South Carolina. Forsythe (1973) indicated that winter populations near Charleston numbered over 2,500 birds in 1971/72. Band recovery data (Forsythe 1972) indicate that most of the wintering population originates from colonies in northeastern North America, particularly those in New Brunswick, Maine, Massachusetts, and Rhode Island. Only a small proportion of the birds wintering in South Carolina come from breeding populations in the Great Lakes. Most of the recoveries (77%) were young-of-the-year; only a small proportion (ca. 2%) were adults.

Georgia Denton et al. (1977) summarized the status of the Herring Gulls in Georgia, stating that they are "resident on coast, abundant except in summer, nonbreeding." Burleigh (1958) suggested that the largest numbers were present from about mid-October through early May. Recent Christmas Counts (Map 6) suggest that wintering populations are largest in the southern part of the state.

---

(1) The average number of nests found in colonies along the North Atlantic coast of the United States in 1977 was sometimes small, but there was an average of more than 100 nests per colony in all states surveyed except Delaware (Erwin 1979a, Korschgen 1979). Colonies containing the largest average number of nests were found in Rhode Island (401), Massachusetts (424), Maryland (459), and Long Island, New York (563) (Erwin 1979a).

Table 26. Herring Gulls nesting in North Carolina (a).

Year	Nests found	Number of nesting sites	Southernmost sites	Source
1962	2	1	Gull Island (35°28' N)	Hailman 1963
1963	1	1	Beacon Island (35°05.9' N)	Ames 1963
1972	81	2	lower Cape Fear River near Southport (ca. 34°00' N)	Parnell and Soots 1975
1973	98	6	lower Cape Fear River near Southport (ca. 34°00' N)	Parnell and Soots 1975
1976	640	7	Dump Island (34°53.5' N)	Portnoy et al. 1981
1977	490	23	Old Drum Inlet (34°53' N)	Parnell and Soots 1979 ms

(a) Only records for 1972, 1973, 1976, and 1977 may be assumed to be complete as there were no adequate surveys of coastal populations of nesting marine birds before that time.

Florida Herring Gulls are common winter residents on the Atlantic coast and in the Florida Keys (Sprunt 1954, Hundley and Hames 1960-1962); they are most abundant on the northern portion of the coast (Kale 1979 ms a; Map 6). Birds arrive in numbers in mid-October, and most are gone by mid-May. Herring Gulls are also common in winter and very rare in summer on the Florida Gulf coast. As on the Atlantic coast, populations are larger to the north (Map 6, Schreiber and Schreiber 1977). The largest concentrations in recent years have been in Pinellas County, primarily at the Toytown garbage dump. In mid-February 1978, this dump was used by 12,000-15,000 Herring Gulls (W. Hoffman, pers. comm.). A large proportion of the wintering population consists of young-of-the-year (Kadlec and Drury 1968a, Moore 1976).

Alabama Herring Gulls are common from October to April on the Alabama coast. A maximum concentration of 3,000 birds was noted on Dauphin Island in November 1970 (Imhof 1976b). Herring Gulls are also abundant inland in much of the state. Although some birds remain through the summer, none are known to breed. Band recoveries from Alabama reveal that birds wintering along the coast are mainly from Atlantic coast breeding populations, whereas most of those wintering inland come from colonies in the Great Lakes (Imhof 1976b); Michigan, New Brunswick, and Maine were the source of over a third of all recoveries listed by Imhof. A large proportion of wintering Herring Gulls recovered in Alabama (and Mississippi) were young birds, but an aerial census revealed that more adults are present than the numbers from recovery data suggest (Drury and Nisbet 1972). A majority of the recoveries in Alabama of birds banded in the Great Lakes are from colonies in the western portion of that area (Moore 1976).

Mississippi Burleigh (1944) considered the Herring Gull a common winter resident on the Mississippi coast from late September until late April. Most of the birds seen by Burleigh were immatures. These were sometimes seen in flocks of 200 birds or more. Recent Christmas Bird Counts in Jackson County recorded fewer than 100 Herring Gulls each year, suggesting that fewer birds winter inland than on the coast. Jackson and Cooley (1978b) also noted that the species is rare in summer in Mississippi.

Louisiana Herring Gulls are common on the coast, along coastal waterways, and along the Mississippi River from mid-November to late April (Lowery 1974). Some birds, mainly immatures, remain along the Gulf coast in the summer. An aerial census conducted by Kadlec and Drury (1968a) revealed larger wintering populations than were suggested by Christmas Counts because they surveyed the outer sandy islands of the Mississippi River Delta which are sparsely inhabited by humans. Kadlec and Drury noted particularly large concentrations on islands at the mouths of Atchafalaya, Caillou, Terrebonne and Timbalier Bays.

Texas Along the Texas coast the Herring Gull is common to uncommon; inland it is common to scarce (Oberholser 1974). The variable abundance may be either a matter of distribution by flocks or of annual variation. Wintering birds occur from September to April, and some nonbreeding birds remain through the summer.

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

Breeding Herring Gulls breed across the northern portions of both North America and Eurasia to about 80° N (Southern 1980a). In North America they breed south to the Great Lakes and along the Atlantic coast to southern North Carolina. Most of those breeding in eastern North America are found north of 35° N, but those in western North America breed mainly north of 48° N. Most of the North American breeding population is concentrated in northeastern Canada, the northeastern United States and around the Great Lakes (Southern 1980a). The range of the species in both North America and Europe has expanded in recent years. The overall size of the world population is unknown, but because the species is one of the most abundant gulls, the total population probably numbers in the low millions.

Kadlec and Drury (1968a) documented an increase from 4,000-8,000 breeding pairs in 1901 to 110,000-120,000 pairs in 1966 in New England (1). Approximately 89,900 pairs bred in an area extending from Maine to Long Island, New York, in 1972, and another 14,100 bred in the Grand Manan Archipelago the same year (Drury and Kadlec 1974). The former area contained approximately 78,800 breed-

(1) Kadlec and Drury's estimate apparently included not only New England but part of New York and north from Maine to the Grand Manan Archipelago, New Brunswick.

ing pairs in 1977; another 13,200 pairs nested from New Jersey to Virginia (Erwin 1979a, Korschgen 1979). Whether or not the results of the latter census indicate a decline in the breeding population is questionable. Increasing numbers have been seen on Christmas Counts and the breeding range of this species continues to expand southward.

In 1977, Herring Gulls were the most abundant breeding colonial waterbird from Maine to Virginia (Erwin 1979a). The bulk of the population was concentrated in Maine (26,000 pairs) (Korschgen 1979) and in Massachusetts (26,000 pairs), but substantial numbers (17,500 pairs) were found nesting on Long Island (Erwin 1979a).

Large numbers of Herring Gulls also breed in the Great Lakes region. Scharf (1978) reported that approximately 28,000 pairs bred in the vicinity of the U.S. Great Lakes in 1976-77, but the numbers breeding in the Canadian portion of Lake Ontario have decreased in recent years (Blokpoel and Fetterolf 1978). Scharf's (1979) 1976 census of colonial seabirds on the U.S. Great Lakes found a total of 26,719 nests. The five largest colonies, together containing a little more than one-fifth of the entire population, were as follows: Hat (800-1,000 nests) and Gull (1,426) Islands in Lake Michigan; Gull (1,510) and Black River (1,064) Islands in Lake Huron; and a colony near the mouth of Sandusky Bay (983) in western Lake Erie. We lack adequate information on the numbers of Herring Gulls breeding in Canada, but the total is probably substantial. Numbers nesting on the Alaskan coast are small, probably less than a few hundred birds (Sowls et al. 1978).

Large population increases have been reported in the Netherlands, Germany, Sweden, and Britain (Cramp et al. 1974, and references therein). About 333,000 pairs bred in Britain and Ireland in 1969-70 (Cramp et al. 1974), about 60,000 pairs bred in Denmark in 1970-72 (Salomonsen 1979), about 11,000 pairs bred on the north coast of Finland in 1980 (Kilpi et al. 1980), and at least 260,000 pairs bred along the Norwegian coast in 1970-74 (Brun 1979).

Winter Herring Gulls winter both in, and to the south of, their breeding range (Map 6). In North America, they are common south to Florida and Texas, less common south to Vera Cruz, Mexico, and casual south to Panama. Birds breeding in North Carolina probably winter in the southeast, but they must represent a minor fraction of the total wintering population of that region. In favorable localities, flocks of various species of gulls, including a large contingent of Herring Gulls, may contain several thousands (LeGrand 1977a). Kadlec and Drury (1968a) counted nearly 572,000 Herring Gulls wintering from Maine to Texas in 1965; the total population is undoubtedly larger now.

Maps of monthly recoveries plotted by Southern (1980a) showed that the most significant wintering ground (January-March) for North American Herring Gulls is on the North Atlantic coast between 42° and 36° N (from Boston, Massachusetts, to the Outer Banks of North Carolina). About a quarter of all recoveries obtained during this period were from this area.

Migration Recent banding studies documenting migration of young Herring Gulls from northern colonies have been conducted at Witless Bay, Labrador (Threlfall 1978), Cape Ann, Massachusetts (Dexter 1978), Chimon Island, Connecticut (DeWire 1981) and Jamaica Bay, New York (Burger 1981c). Most young from Witless Bay migrate south to winter in the northeastern United States, but those from Massachusetts, Connecticut, and New York largely winter locally and for relatively short distances to the south. Of 227 recoveries from Newfoundland, 5 first-winter birds were encountered in the Carolinas and only one was recovered farther south, in Cuba; a second-year bird was obtained in Florida. Only 3 of 126 birds banded at Cape Ann were recaptured in the Carolinas, and another was found on the Gulf Coast of Florida. Young banded in Connecticut wintered locally and south to New York and New Jersey, but a few were recovered in North and South Carolina, Georgia and Florida; individuals straggled to Mississippi and Vera Cruz, Mexico. Seven of 158 sightings of birds tagged at Jamaica Bay were recovered in the southeast, one in South Carolina, and three each in Georgia and Florida.

A great many early studies have provided information on movements from breeding colonies in the northeastern United States and the Great Lakes area (Lincoln 1928a; Eaton 1933, 1934a, 1934b; Hinchman 1934; Shelley 1934a; Gross 1940, 1944; Poor 1943; Paynter 1947a; Hofslund 1959; Smith 1959; Gillespie 1961; Ludwig and Ludwig 1961; Dennis and Pepper 1962; Ludwig 1962a; Drury 1963a, 1965a; Southern 1968; Kadlec and Drury 1968a; Drury and Nisbet 1972; Forsythe 1972; Moore 1973, 1976; Southern 1980a). These studies make it apparent that Great Lakes Herring Gulls winter predominantly along the Gulf coast and in Florida, more so than on the coasts of Georgia and the Carolinas. A large proportion of the migrants throughout the southeast are young birds, as adults tend to winter in the vicinity of their breeding colonies.

Southern (1980a) found that some Herring Gulls may leave their breeding colonies in late July, but others remain for some time in or near the nesting areas. These gulls may wander for several months thereafter, only gradually moving south, although some arrive in the south early in September. Most of the migrant populations reach the southernmost point of dispersal in January and February, and return to their breeding range in February and early March (Southern 1980a).

HABITAT

Nesting Herring Gulls nest in a wide variety of habitats, including sandy islands (Shugart 1977b), stabilized sand dunes (Tinbergen 1961, Harris 1964a), the margins of tundra lakes (Smith 1966), *Spartina* marshes (Burger 1977a), cliffs (Harris 1964a, Andrle 1976), wooded islands (Chamberlin 1975; Patten, pers. comm.), and even on buildings (Monaghan and Coulson 1977). In some areas such as New England, colonies are often situated near dumps or landfills that serve as the main source of food. The primary requirements for a nesting site may be freedom from terrestrial predators and proximity to food and water. Most Herring Gulls nest in exposed sites, but Chamberlin (1975) reported that some nest in cedar stands.

Herring Gulls prefer to nest in low sites and are often present on the slopes and domes of dredge-spoil islands. The nesting substrate may determine the nesting density. Nests at Gull Island, Newfoundland, were somewhat more densely packed on rock (3.98 nests/100 sq m [0.37 nests/100 sq ft]) than on grass (3.07 nests/100 sq m [0.29 nests/100 sq ft]). However, nest density was greatest (7 nests/100 sq m [0.65 nests/100 sq ft]) at the interface between these two substrates (Haycock and Threlfall 1975). Haycock and Threlfall also noted that nest density was lower in more open areas and that Herring Gulls on grassy slopes tended to place their nests at the base of emergent features such as boulders or stumps. At Gull Island no gulls nest among heavy shrubs, but a few nest up to 4 m (13 ft) inside open woods; the nests here are usually placed under a tree. Pierotti (1982) reported that nest density of Herring Gulls at Great Island is greatest in rocky areas where there is the most shelter.

Herring Gulls nesting in the open at Goose Island in northern Lake Huron were significantly farther apart (mean distance = 17.2 ft [5.2 m]) than were those in habitats dominated by northern white cedar (Thuja occidentalis) and red-osier dogwood (Cornus stolonifera) (mean distance = 10.1 ft [3.1 m]) (Chamberlin 1975).

Burger and Lesser (1980) examined colony- and nest-site selection for 28 Herring Gull colonies on salt-marsh islands in Barnegat Bay, New Jersey. The colonies were found on islands at least 5 ac (2 ha) in size, and most (85.7%) of the colonies were located in the center of the islands. Almost four-fifths of the colonies were found on islands with bushes (Iva, Baccharis). Islands with nests contained, on the average, 50% smooth cordgrass (Spartina alterniflora), 33% saltmeadow cordgrass (S. patens), 2% common reed (Phragmites australis), and 7% standing water. On these islands, Herring Gulls nested primarily in S. patens and under bushes (39% of the nests were found under bushes, although bushes made up only 5% of the vegetative cover). Gulls nesting in mainland colonies chose areas with similar vegetation and were found in sites separated from the mainland by small creeks. Additional information on sites used in New Jersey and the various factors involved in nest-site selection in that area is given by Burger (1977a, 1977b, 1980a), and Burger and Shisler (1978a, 1978b, 1979, 1980b).

All 1976 colonies of Herring Gulls in North Carolina were found on coastal islands that originated from dredge-spoil (Portnoy et al. 1981), and 99% and 97% of the population occupied dredge-spoil sites in 1973 (Soots and Parnell 1975a) and 1977 (Parnell and Soots 1979 ms), respectively. Nests are often found on drift adjacent to salt marshes and are almost always placed near or between large, tall clumps of vegetation (Soots and Parnell 1975a, Parnell and Soots 1979 ms). Herring Gulls nested in more heavily vegetated colonies (mean cover = 45%) than any other seabird studied except the Laughing Gull and Forster's Tern; the average height of nest cover (ca. 0.75 m [2.5 ft]) was also higher than for other species studied (Soots and Parnell 1975a). Plants most frequently found in Herring Gull colonies in North Carolina were seaside goldenrod (Solidago sempervirens), a panic grass (Panicum amarulum), and beach grass (Ammophila breviligulata) (Soots and Parnell 1975a).

Feeding Herring Gulls are opportunistic feeders in garbage dumps, around seafood-processing operations, in pastures and cultivated fields, on lawns, tundra, and beaches, and at sea. The one general requirement is that their feeding habitat be relatively open.

Drury (1963a) described feeding habitats in New England in some detail. Food of "natural" origin is obtained from sandy and rocky shores and shallow inshore waters. Inland, Herring Gulls feed on berries and invertebrates in fields. Food of man-made origin is obtained at the back of fishing boats, at fish-cleaning operations at piers and wharves, from trucks carrying waste fish to food and fertilizer plants, at pig farms, at sewer outflows, and at the many other places where organic wastes may be found. Herring Gulls in Maine forage primarily on dumps and tidal mudflats, but are also found in areas where wastes are discharged from sewers and food-processing plants, and along the shores in areas where mussels are particularly abundant (Hunt and Hunt 1973).

Drury (1963a) characterized the ideal dump for feeding as "an open treeless site with a large, flat loafing ground, and within half a mile of fresh water." He noted that the number of gulls using dumps increased with high tides, onshore winds, adverse weather conditions (such as wind and fog), and with the presence of ice on tidal flats. He also remarked that Herring Gulls feed only on fresh garbage and are attracted to dumps where bulldozers uncover material. Herring Gulls feeding in a dump in New Jersey fed largely where fresh garbage was deposited and to a lesser degree on a slope where this garbage was pushed by bulldozers (Burger 1981b); adults fed more often at the bottom of this slope than did younger gulls.

Drury and Nisbet (1972) marked 4,900 breeding Herring Gulls at colonies in Massachusetts to examine their foraging movements. They summarized their work by stating that Herring Gulls "went no farther than the nearest dependable food source but commuted readily as far as 40 km [25 mi] to a good food supply." They pointed out that foraging ranges from different colonies are very different and that there is little overlap in feeding ranges between colonies.

Nonbreeding and Offshore Winter habitats are essentially the same as those used during the breeding season for feeding, loafing and roosting. Herring Gulls are found primarily along the shore of the ocean or other bodies of water, concentrating on beaches and in areas where food is likely to be abundant (Oberholser 1974, Imhof 1976b). Herring Gulls also venture inland to garbage dumps and fields. Wintering birds roost on isolated sandbars, on protected waterways, and in isolated fields (Oberholser 1974)

Gulls regularly follow boats, particularly fishing boats, to feed on offal. Slightly north of our study area, Rowlett (1980) reported that chumming attracts large numbers of Herring Gulls from November through March; flocks reached maximum numbers near the edge of the Continental Shelf. Such flocks may be large. Rowlett reported as many as 20,000 around fishing vessels, 75 and 90 km [47 and 56 mi] east southeast of Ocean City, Maryland in early December 1977; Pimlott (1952) noted one flock of about 4,000 Herring Gulls feeding near the south shore of Deer Island, New Brunswick in late July 1949. During six hours of observation some 3,700 gulls were seen up to 120 km [75 mi] east of Ocean City in early February 1977 (Rowlett 1980).

FOOD AND FEEDING BEHAVIOR

Herring Gulls feed largely on animal matter, including small mammals, birds and bird eggs, amphibians, fish, and a great variety of invertebrates; they also eat berries and some fruit. Carrion is a major portion of the diet and in some areas or seasons garbage is very important. As Sprunt and Chamberlain (1949) stated, the Herring Gull "takes practically any animal food it can find."

The species is noted for its habit of dropping molluscs and other hard food onto beaches, roadways, roofs, or parking lots to shatter the food and obtain access to the soft interior. Tolonen (1976) noted that Herring Gulls obtain food from mussels by two other methods as well: (1) a gull may insert its beak into an open mussel and seize the flesh; or (2) the bird may force its way into a closed shell.

Several authors have studied the effect of age on foraging efficiency of North American Herring Gulls. Tolonen (1976) reported that adult Herring Gulls feeding at Conowingo Dam, Maryland, captured fish on a significantly higher proportion (93%) of their attempts than did immature birds (79%). Adults were also more successful than immatures at feeding on moonsnails (Naticidae), mussels and quahogs in Connecticut, and on clams in North Carolina.

Ingolfsson and Estrella (1978) reported that adults were more successful at feeding on mussels in southeastern Massachusetts than were younger birds. At a dump in New Jersey, Herring Gulls fed primarily by walking over the surface picking up food items and by turning over garbage (Burger 1981b). Most (67%) of the birds were young-of-the-year, but some adults and subadults (birds 16-18 months old) were also present.

Herring Gulls kleptoparasitize birds, stealing prey from their own (Tolonen 1976) and other species. In North America, Herring Gulls have been seen stealing food from Ring-billed Gulls, Great Black-backed Gulls (Tolonen 1976), Parasitic Jaegers (Stercorarius parasiticus)(Morrisson 1978), and Common Mergansers (Mergus merganser) (Lovell 1945). In the Old World Herring Gulls have been seen stealing food from Atlantic Puffins (Fratercula arctica) (Mylne 1960) and Common Eiders (Somateria mollissima) (Ingolfsson 1969a). They have been seen attempting to seize food from Great Blue Herons (Ardea herodias) in North America (Tolonen 1976, Quinney et al. 1981) and Grey Herons (Ardea cinerea) in the Old World (Karmborg 1979). Further information on other reported or potential victims of kleptoparasitism by Herring Gulls may be found in other papers cited in the terminal species bibliography (e.g., Steiniger 1952, Schmidt 1954, Duchrow 1958, Bergman 1960).

Herring Gulls also feed on birds and mammals. They frequently feed on the young of other members of their own species, as well as on the eggs and young of other larids nesting in association with them. Larids eaten by Herring Gulls in North America include eggs (Mendall 1935) and young of Common Terns (Mendall 1935, Crowell and Crowell 1946, Ligas 1952, Houde 1977b), young Roseate Terns (Houde 1977b), young Ring-billed Gulls (Emlen 1956, Fetterolf in Schnell 1981), and eggs and young of California Gulls (Larus californicus) (Nero 1961). Other nonpasserine avian prey recorded in the diet of North American Herring Gulls include eggs and young of Double-crested Cormorants (Phalacrocorax auritus) (Mendall 1935), Wilson's Storm-Petrel (Oceanites oceanicus) (Houde 1977b), Leach's Storm-Petrel (Oceanodroma leucorhoa) (Gross 1935), Oceanodroma storm-petrels (Houde 1977b), young Red-breasted Mergansers (Mergus serrator) (Braun et al. 1980), young Common Eiders (Minot in Braun et al. 1980), adult Oldsquaws (Clangula hyemalis) (Snell 1981), American Kestrels (Falco sparverius) (Houde 1977b), adult Spotted Sandpipers (Actitis macularia), adult Semipalmated Sandpipers (Calidris pusilla), young Black Guillemots (Cepphus grylle) (Mendall 1935), and Mourning Doves (Zenaida macroura) (Houde 1977b). Passerine prey eaten in North America include Blue Jays (Cyanocitta cristata) (Houde 1977b), Purple Martins (Progne subis) (Ligas 1952), Common Grackles (Quiscalus quiscula), Red-winged Blackbirds (Agelaius phoeniceus) (Ludwig 1966, Houde 1977b), Brown-headed Cowbirds (Molothrus ater), American Robins (Turdus migratorius), Gray Catbirds (Dumetella carolinensis), Starlings (Sturnus vulgaris) (Houde 1977b), adult Black-throated Green Warblers (Dendroica virens) (Mendall 1935), unidentified warblers (Dendroica sp.) (Houde 1977b), and Song Sparrows (Melospiza melodia) (Mendall 1935).

A partial list of birds reported eaten in the Old World, excluding those mentioned above, is as follows: adult and young Manx Shearwaters (Puffinus puffinus), eggs and/or young Northern Gannets (Sula bassanus) (Harris 1965), adult Mallards (Anas platyrhynchos) (Andersson 1970), young Shelducks (Tadorna tadorna) (van Dobben 1934 in Tinbergen 1953), fledgling Gadwall (Anas strepera) (Sabinevskii 1958 in Bianki 1967), Gray Partridge (Perdix perdix) (Spitzer 1976), young Coots (Fulica atra) (Lugovoi 1961 in Bianki 1967), eggs and/or young Northern Lapwings (Vanellus vanellus) (Harris 1965), young Oystercatchers (Haematopus ostralegus) (Harris 1965, Bianki 1967), Avocets (Recurvirostra avosetta), Ringed Plovers (Charadrius hiaticula), Kentish [= Snowy] Plovers (Charadrius alexandrinus) (Tinbergen 1953), eggs and/or young of Great Black-backed Gulls, Lesser Black-backed Gulls (Larus fuscus), and Black-headed Gulls (Larus ridibundus) (Harris 1965), eggs and young of Common Gulls (Larus canus)(Bianki 1967), young Black-legged Kittiwakes (Rissa tridactyla) (Belopol'skii 1957), eggs and young of Arctic Terns (Bianki 1967), Razorbills (Alca torda) and Common Murres (Uria aalge) (Harris 1965), young Meadow Pipits (Anthus pratensis) (Bianki 1967), Yellow Wagtails (Motacilla flava) (Spitzer 1976), Skylarks (Alauda arvensis) (Borodulina 1960), Redwings (Turdus musicus), and Blackbirds (Turdus merula)(Hobbs 1959).

Harris (1965) cited other authors for the eggs and/or young of Northern Fulmars (Fulmaris glacialis), Shovelers (Anas clypeata), Ring-necked Pheasants (Phasianus colchicus), Eurasian Curlews (Numenius arquata), Black-tailed Godwits (Limosa limosa) and Redshanks (Tringa totanus), and for fully grown Corn Crakes (Crex crex), Dunlin (Calidris alpina), and Barn Swallows (Hirundo rustica). Herring Gulls have also been seen attacking migrating Merlins (Falco columbarius) (Dyck 1969), Jays (Garrulus glandarius) (Edholm 1978), and thrushes (Turdinae) (Hobbs 1959, Karmborg 1979), as well as a variety of other migrants (MacDonald and Mason 1973, G. Taylor 1979). G. Taylor (1979) thought some of this behavior could be interpreted as play, rather than as serious attempts to obtain food.

Mammals eaten in North America include Norway rats (Rattus norvegicus), meadow voles (Microtus pennsylvanicus) (Ludwig 1966, Houde 1977b), red squirrels (Tamiasciurus hudsonicus) (Mendall 1939), and an unidentified insectivore (Mills 1957). Mammalian prey eaten in the Old World include moles (Talpa europaea) (Harris 1965), two weasels (Mustela nivalis, M. erminea), hares (Lepus europaeus) (authors cited in Harris 1965), rabbits (Oryctolagus cuniculus) (Harris 1965), common voles (Microtus arvalis), common hamsters (Cricetus cricetus) (Spitzer 1976), water voles (Arvicola terrestris), large-toothed red-backed voles (Clethrionomys rufocanus), root voles (Microtus oeconomus) (Bianki 1967), Norway lemmings (Lemmus lemmus) (Belopol'skii 1957, Bianki 1967), shrews (Melville 1974; Sorex sp. [A. Andersson 1970]), and mice (Melville 1974).

Other vertebrate prey eaten in North America include northern water snakes (Nerodia sipedon) (Goldman 1971) and mudpuppies (Necturus maculosus) (Ludwig 1966). Herring Gulls have also been reported eating frogs (Rana temporaria), toads (Bufo bufo), lizards (Lacerta sp.), and an Old World viper (Viperus berus) (Harris 1965 and authors cited therein).

We summarize below some of the extensive literature on the food habits of the Herring Gull in North America:

Manitoba Regurgitated food pellets obtained at Kawanaw Lake in May and June 1971 revealed that Herring Gulls fed largely on fish at this inland locality (Vermeer 1973b). Of 335 pellets, 94% contained fish remains. Of those fish that could be identified to genus, suckers (Catostomus and/or Moxostoma sp.) and yellow perch (Perca flavescens) were by far the most numerous. Northern pike (Esox lucius), walleye (Stizostedion vitreum), common carp (Cyprinus carpio), and brown bullheads (Ictalurus nebulosus) also were identified. Herring Gulls scavenged extensively on dead or dying suckers (Moxostoma macrolepidotum) from creeks. Voles (Microtus sp.) were also an important item of diet in May but became much less important later in the year.

Newfoundland Threlfall (1968a) reported food habits of gulls nesting on three islands south of St. Johns, basing his report on regurgitated pellets and on 401 stomachs collected from June to August 1966 and from May to September 1967. The Herring Gull stomachs contained mostly vegetation and fish; refuse, molluscs, and arthropods were less important. Threlfall specifically identified only a few food items, but noted that blue mussels (Mytilus edulis) were the most important item in the diet in May and June; capelin (Mallotus villosus) were eaten most of the summer. Pellets contained many remnants of Leach's Storm-Petrels and the eggs of Common Murres. The pellets were regurgitated by both Herring and Great Black-backed Gulls, and it is not clear from Threlfall's account whether one or both species were largely responsible for this predation. Haycock and Threlfall (1975) gave a more detailed account of the foods eaten by these gulls in a subsequent study (1969-71) made in the same area.

New Brunswick Pimlott's (1952) report on the food habits of Herring Gulls in the Grand Manan Archipelago in 1949 was based on field observations, food regurgitated by young birds, and food items found in the stomachs of adults. Of 12 stomachs, 9 held Atlantic herring (Clupea harengus) and one each contained Atlantic mackerel (Scomber scombrus), pollock (Pollachius virens), and shrimp. Of 40 regurgitations, 34 were herring, two each were mackerel and pollock, and one each contained insects and a rock gunnel (Pholis gunnellus). Other foods eaten by Herring Gulls in this area included fish offal used as fertilizer on fields and found dumped into harbors, crowberries (Empetrum nigrum), and sea urchins (Echinoidea).

Mills (1957) examined the stomach contents of 36 Herring Gulls collected over water in August and September 1956 in the Northumberland Strait between New Brunswick and Prince Edward Island. Food found most frequently in 31 stomachs that contained food were insects (in 67.7% of the stomachs), crustaceans (35.5%), and fish (25.8%). Four stomachs contained the remains of birds, two contained squid, and one contained a small mammal. Mills identified few of the stomach contents to species, reporting only one fish (Atlantic cod [Gadus morhua]). Insects eaten, in order of frequency of occurrence in the stomachs, were Coleoptera (45.1%), Diptera (16.1%), Hymenoptera (12.9%), and Lepidoptera (9.7%). Tolonen (1976) reported that Herring Gulls dropped and fed on snails (Buccinum undatum) near Black's Harbor.

Michigan Fish made up most of the diet of Herring Gulls on Lakes Huron and Michigan in 1963-1965 (Ludwig 1966). Ludwig estimated that alewives (Alosa pseudoharengus) made up 80% of the diet; rainbow smelt (Osmerus mordax) were also important. Other species of fish eaten (yellow perch, sunfish [Lepomis sp.], and rock bass [Ambloplites rupestris]) accounted for a small proportion of the diet. At Goose Island in northern Lake Huron, Chamberlin (1975) discovered that fish found near Herring Gull nests were largely smelt and alewives, although minnows, perch, bass, and bullheads were also found. Herring Gulls also gorged themselves on hatching mayflies (Ephemeroptera).

Maine Mendall (1935) reported on the stomach contents of 838 Herring Gulls collected along the coast of Maine in 1933-34. Mollusks, fish, and crustaceans were found most frequently; for both years combined these foods were found in 42.8, 36.3 and 26.8% of the stomachs, respectively. Vegetation, echinoderms, young lobsters, insects, and shrimp were found in more than 10% of the stomachs. Birds and waste were infrequently encountered. Few of the foods were identified to species, but Mendall (1935) remarked that most of the fish were herring and that a few pollock and mackerel were taken. Mendall also reported that Herring Gulls occasionally ate berries, primarily blueberries (Vaccinium sp.).

Mendall (1939) reported on the stomach contents of 62 Herring Gulls collected inland. Most of their food consisted of fish (76.9% by bulk); other animals, vegetable food, and refuse made up 6.9, 8.0, and 8.2% of the diet, respectively. The most important food fish were white perch (Morone americana), pumpkinseed (Lepomis gibbosus), redbreast sunfish (Lepomis auritus), and yellow perch, which together made up more than half of the diet. Other fish identified were smallmouth bass (Micropterus dolomieui), white suckers (Catosomus commersoni), fallfish (Semotilus corporalis), golden shiner (Notemigonus crysoleucas), common shiners (Notropis cornutus), and trout or salmon (Salmonidae).

Drury (1963a) reported that Herring Gulls in the Isles of Shoals area of Maine and New Hampshire fed primarily on small fish and invertebrates, and that incubating adults ate more garbage than their chicks did. Both adult and young Herring Gulls in the Penobscot Bay area fed mainly on refuse, which they obtained from dumps and chicken-processing plants close to their colonies (Hunt 1972a). These sources accounted for 42-61% (by volume) of all food brought to chicks in 1969-1970. Most of the refuse consisted of garbage, chicken remains, and fish wastes. Earthworms (Annelida) were important at one colony, but fish taken from the wild and fish of unknown origin also were important at all colonies studied.

Massachusetts Drury (1963a) summarized food habits at a number of colonies in Massachusetts, showing that foods eaten by adults and young varies considerably with locality. Adults at Cape Ann fed on a great variety of foods, but food brought to young was primarily wastes from human activitites. Fish fed to young in this area included mackerel, pollock, whiting or silver hake (Merluccius bilinearis), and ocean perch or redfish (Sebastes morinus). Gulls from this area fed more on starfish than those in other regions. Herring Gulls in Boston Harbor fed extensively on garbage from restaurants, whereas those at Muskeget Island fed more on natural foods, including a wide variety of marine invertebrates. Young birds in Boston were fed extensively on insects and earthworms. Young at colonies in Narragansett Bay were fed mostly on natural foods. Ingolfsson and Estrella (1978) described the shell-cracking behavior of Herring Gulls in southeastern Massachusetts noting that the most commonly eaten mussel was the bay scallop (Pecten irradians).

Connecticut Tolonen (1976) found that the main prey of Herring Gulls at Milford were fish in summer, crabs in fall, and molluscs in winter. Prey remains and regurgitated boli at Fort Trumbull from November through early December contained mostly crabs of the genus Cancer, but green crabs (Carcinus maenas), blue crabs (Callinectes sapidus) and beach crabs (Ovalipes ocellatus) were also represented. Molluscs eaten included pelecypods (quahogs [Mercenaria mercenaria], blue or edible mussels [Mytilus edulis], ribbed mussels [Modiolus demissus], razor clams [Ensis directus]), and gastropods (the northern and lobed moon shells [Lunatia heros and Polinices duplicatus], and the common and flat slipper shells [Crepidula forniculata and C. plana]) (Tolonen 1976). Modiolus was eaten extensively in winter, when gulls opened them by dropping them on ice. The soft-shelled clam (Mya arenaria) was also important. Gulls at Milford have been observed feeding on hermit crabs (Pagurus) and on the flesh of a dead cunner (Tautogolabrus adspersus). American eels (Anguilla rostrata) (Tolonen 1976) and starfish (Asterias forbesi) (Thomas and Thomas 1965) have also been recorded as prey items in Connecticut.

New York Houde (1977b) reported on the diet of Herring Gulls at Hicks Island, Long Island, in July 1975, basing his results on observed feedings regurgitated pellets, and stomach contents. A wide variety of avian prey and two mammals (see above) were found in the diet, in addition to three molluscs (oysters [Ostrea virginica], razor clams, and surf clams [Spisula solidissima]), two crabs (a mud crab [Panopeus herbstii] and a spider crab [Libinia emarginata]), and four fish (bluefish [Pomatomus saltatrix], northern sea robin [Prionotus carolinus], scup [Stenotomus chrysops], and American sand lance [Ammodytes americanus]). Houde thought that the bluefish and scup probably were obtained from local dumps or as offal discarded by fishermen.

New Jersey Food habits of Herring Gulls along the New Jersey coast varied with area and season (Tolonen 1976). In December 1970, naticid snails predominated in the diet at Sandy Hook State Park but were eaten uncommonly elsewhere. In the Point Pleasant area, Spisula solidissima was important; Mercenaria mercenaria was the primary prey item at the southern end of Long Beach Island. Four years later, Herring Gulls at Sandy Hook fed most commonly on Mercenaria, and Spissula was still the most important food in the Point Pleasant area. Mercenaria was replaced in importance at the south end of Long Beach Island by another pelecypod, the bay scallop (Aequipecten irradians).

Maryland Herring Gulls inland at Conowingo Dam on the Susquehanna River only ate fish. Identified prey consumed here included yellow perch, American eels (Anguilla rostrata), sunfish (Lepomis sp.), and bullhead catfish (Ictalurus spp.) (Tolonen 1976).

North Carolina Tolonen (1976) found that the wedge rangia (Rangia cuneata) was particularly abundant among the molluscs eaten by Herring Gulls in North Carolina. He pointed out that this clam and other molluscs are dropped in roadways in such abundance that in the late 1960's the state spent $18,000-20,000 annually to keep the highways clear of the discarded shells. In February 1971, Tolonen (1976) noted that Herring Gulls dropped shells on a stretch of road near Whalebone at a rate equal to 104 molluscs per hour per mile of road.

Florida Kent (1981) reported that the foods dropped and eaten by Herring Gulls at Turkey Point (Franklin County) in late winter 1979 consisted primarily of bivalves (77.1% by frequency); decapod crustaceans (13.9%) and echinoids (9.0%) were also eaten. The four most important foods were the bay scallop, the prickly cockle (Trachycardium egmontianum), a spider crab (Libinia dubia), and a sea urchin (Lytechinus variegatus) that made up 56.0, 15.7, 13.3, and 9.0% of the diet, respectively. Other foods eaten (none of which made up more than 2.4% of the diet) were four bivalves (the great heart cockle [Dinocardium robustum], Florida lucina [Lucina floridana], sunray venus [Macrocallista nimbosa], and the southern quahog [Mercenaria campechensis]) and the blue crab. Herring Gulls preferred the largest available bivalves; the shell length of the size classes of bay scallop and cockle taken most frequently were 6-8 cm (2-3 in) and 3-6 cm (1-2 in), respectively.

Tolonen (1976) presented extensive lists of food eaten by Herring Gulls and Great Black-backed Gulls along the Atlantic coast. The lists, however, do not distinguish which species ate which food. All the food reported from Florida probably was eaten by Herring Gulls. Prey items recorded at Mullet Key in late March 1970 were three gastropods (two whelks [*Busycyon spiratum*, *B. contrarium*] and the crown conch [*Melongena corona*]), two pelecypods (the southern quahog and an unidentified representative of the family Arcidae), and a spider crab (*Libinia dubia*). Tolonen (1976) also recorded Herring Gulls feeding on scrawled cowfish (*Lactophrys quadricornis*) at Mullet Key, Gulf Breeze and Highland View, as well as on dead batfish (*Ogcocephalus* sp.).

IMPORTANT BIOLOGICAL PARAMETERS

Egg Laying Various studies indicate that egg laying begins in mid- or late April or early May and continues until late May or June, or occasionally into July. Much of the late laying is apparently composed of birds initiating second clutches laid after the loss of the first one. Studies summarized by Erwin (1979a) indicate that peak laying along the U.S. Atlantic coast usually occurs from late April to early June, virtually the same period as in more northern portions of the range (Table 27).

Mean Clutch Size Herring Gulls may lay 1-4 eggs, but the majority usually lay 3 (Table 28). Most of the studies listed below give mean clutch sizes between 2.4 and 2.9. Various factors affect mean clutch size. Mean clutch size for Herring Gulls laying early in the season tends to be larger than for those laying later (Haymes and Blokpoel 1978a, Haycock and Threlfall 1975, Table 29). Burger and Lesser (1980) reported that Herring Gulls nesting alone in New Jersey had significantly larger mean clutch sizes (mean = 2.9) than did those nesting in colonies (mean = 2.5). Pierotti (1982) showed that Herring Gulls nesting in grassy meadows in Newfoundland had smaller clutch sizes than those nesting on exposed, rocky, marine terraces or on turf-covered maritime slopes.

Clutch size of Herring Gulls nesting closer to the predatory Great Black-backed Gull was lower than those nesting farther away (Erwin 1971, Table 28). This may not represent a true difference in clutch size, but may be the result of predation or disturbance by Great Black-backed Gulls.

Incubation Period At Gull Island, Newfoundland, the mean incubation period ($\pm$ 1.5 days) for 44 first eggs was 29.4 days; for 48 second eggs, 28.2 days; and for 28 third eggs, 27.1 days (Haycock and Threlfall 1975). At Great Island, Newfoundland, Pierotti (1982) reported that in 1977, first eggs averaged 28-29 days and second and third eggs averaged 26 days. The following year, incubation periods for first, second, and third eggs averaged 29, 27, and 26 days, respectively. Incubation periods at 33 nests at Kawinaw Lake, Manitoba, ranged from 24 to 27 days, averaging 25.8 (Vermeer 1971a). Mean

Table 27. Laying periods reported at some North American Herring Gull colonies (a).

Colony	Locality Laying period and year	Peak	Source
	MANITOBA		
Kawinaw Lake	early May-early June, 1971	15-21 May	Vermeer 1973c
	ONTARIO		
Brothers Island	mid-Apr.-late May, 1973	22 Apr.-3 May	Teeple 1977
Scotch Bonnet Island	late Apr.-late May, 1973	---- (b)	Gilbertson and Hale 1974a
Granite Island	Apr.-late May, 1975	11-15 May	Ryder and Carroll 1978
Granite Island	early May-late May, 1976	6-10 May	Ryder and Carroll 1978
	NEWFOUNDLAND		
Gull Island	late Apr.-late May, 1971	10-14 May	Haycock and Threlfall 1975
Great Island	---------, 1977-78	20-24 May	Pierotti 1982

(a) The terms early, mid-, and late refer to the first, mid-, and terminal thirds of the month, respectively. Unless otherwise stated, figures are for the main laying period and do not include birds that renested. Figures from Pierotti (1982) are the range of median dates of laying of the first egg for three nesting areas in each year.

(b) Peak laying for first clutches at Scotch Bonnet Island in 1975 was 21-30 April; peak laying in 1975 at two other Ontario colonies (Chantry Island and Port Colborne) was 23-25 April and 25 April-5 May, respectively (Gilman et al. 1977)

incubation periods reported from the Old World (Lockley 1932, Paludan 1951, Drent 1970, MacRoberts and MacRoberts 1972a, Parsons 1972) are similar, ranging from 26.4 days (Lockley 1932) to 30.1 days (Drent 1970).

Hatching Success Data from a number of studies (Table 30) indicate that under normal circumstances, about 75% of the eggs laid in a colony hatch. This amounts to about 2.3 eggs per nest, on the average. Hatching success is typically higher for nests initiated early in the season (Morris and Haymes 1977, Burger and Shisler 1980b, Table 31). Three-egg clutches typically hatch a higher proportion of eggs than do two-egg clutches, and one-egg clutches are usually least successful (Table 32). Occasionally, two-egg clutches are more successful than three-egg clutches (Kadlec and Drury 1968a, Morris and Haymes 1977), and some studies (e.g., Paynter 1949, Vermeer 1971a, Ryder and Carroll

Table 28. Mean clutch sizes reported for the Herring Gull in North America (a).

Mean clutch size		Number of clutches	Locality and year of observation	Source
			MANITOBA	
2.93		161	Kawinaw Lake, 1971 (3)	Vermeer 1971a
			ONTARIO	
2.67		70	Port Colborne, 1973 (3-75%)	Morris and Haymes 1977
2.63		108	Port Colborne, 1974 (3-64%)	Morris and Haymes 1977
2.86		312	Port Colborne, 1975 (3-75%)	Morris and Haymes 1977
2.82		60	Port Colborne, 1976 (3-77%)	Morris and Haymes 1977
2.53		97	Scotch Bonnet Island, 1973 (3-59%)	Gilbertson and Hale 1974a
2.43		53	Scotch Bonnet Island, 1975 (3-62%)	Gilman et al. 1977
2.64		44	Brothers Island, 1973 (3)	Teeple 1977
2.84		143	Chantry Island, 1975 (3-86%)	Gilman et al. 1977
2.99		100	Granite Island, 1975 (3-96+%)	Ryder and Carroll 1978
2.98		100	Granite Island, 1976 (3-96+%)	Ryder and Carroll 1978
2.58		50	Toronto Outer Harbor, 1977	Haymes and Blokpoel 1978a
			MICHIGAN	
2.88		287	Bellows Island, 1965 (3-77%)	Ludwig and Tomoff 1966
2.91		344	Pismire Island, 1965 (3-87%)	Ludwig and Tomoff 1966
2.84		215	Goose Island, 1972 (3-86%)	Chamberlin 1975
2.85		120	Goose Island, 1973 (3-86%)	Chamberlin 1975
2.97		450	South Manitou Island, 1972	Shugart 1977b
2.75		650	South Manitou Island, 1973	Shugart 1977b
2.91		370	South Manitou Island, 1974	Shugart 1977b
2.45	(b)	474	South Manitou Island, 1975	Southern et al. 1980
1.82	(b)	281	South Manitou Island, 1976	Southern et al. 1980
2.96	(b)	466	South Manitou Island, 1977	Southern et al. 1980
2.24	(b)	421	South Manitou Island, 1978	Southern et al. 1980
2.39	(b)	364	South Manitou Island, 1979	Southern et al. 1980
2.86		823	Rogers City, 1975	Patton 1979
2.68		786	Rogers City, 1976	Patton 1979
2.88		868	Rogers City, 1977	Patton 1979
2.76		855	Rogers City, 1978	Patton 1979
			WISCONSIN	
2.49	(c)	100	Little Sister Island, 1964 (3-61%)	Keith 1966a

Table 28. Continued.

Mean clutch size		Number of clutches	Locality and year of observation	Source
			NEWFOUNDLAND	
2.70	(d)	---	Gull Island, 1970	Haycock and Threlfall 1975
2.73		109	Gull Island, 1971	Haycock and Threlfall 1975
2.44-2.65	(e,f)	303	Great Island, 1976-1978	Pierotti 1982
2.27-2.67	(e,g)	343	Great Island, 1976-1978	Pierotti 1982
2.16-2.51	(e,h)	280	Great Island, 1976-1978	Pierotti 1982
			NEW BRUNSWICK	
2.47		100	Kent Island, 1947 (3-54%)	Paynter 1949
			MAINE	
2.62	(b)	---	47 colonies, 1944 (3-65%)	Gross in Kadlec and Drury 1968a
2.59	(b)	---	9 colonies, 1965 (3-60%)	Kadlec and Drury 1968a
2.68		99	3 colonies, 1968	Hunt 1972a
2.49		294	4 colonies, 1969	Hunt 1972a
2.51		430	4 colonies, 1970	Hunt 1972a
			MASSACHUSETTS	
2.55	(b)	---	7 colonies, 1964 (3-65%)	Kadlec and Drury 1968a
2.60	(b)	---	6 colonies, 1965 (3-70%)	Kadlec and Drury 1968a
2.45		567	Egg Rock, 1962 (3-58%)	Keith 1966a
2.83		249	Coatue, 1963 (3-83%)	Kadlec and Drury 1968a
			RHODE ISLAND	
2.41		275	Block Island, 1963 (3-55%)	Kadlec and Drury 1968a
2.84		258	Block Island, 1965 (3-84%)	Kadlec and Drury 1968a
2.89		266	Block Island, 1966 (3-88%)	Kadlec and Drury 1968a
2.85		370	Sandy Point, 1963 (3-85%)	Kadlec and Drury 1968a
2.88	(i)	48	Sandy Point, 1969	Erwin 1971
2.69	(j)	48	Sandy Point, 1969	Erwin 1971

Table 28. Concluded.

Mean clutch size	Number of clutches	Locality and year of observation	Source
		NEW JERSEY	
2.65	124	Islajo Island, 1975	Burger 1977a
2.76 (k)	808	5 colonies, 1977	Burger and Shisler 1980b

(a) Some of these figures are derived from counts of contents of nests during short term visits. Such reports are often misleading and do not give an entirely adequate assessment of clutch size because (1) clutches may be incomplete at the time of the visit; (2) loss of eggs is widespread and sometimes occurs during laying (Kadlec and Drury 1968a); and (3) Herring Gulls often build nests that never hold clutches (Paynter 1949, Kadlec and Drury 1968a). Generally speaking, the more detailed the study, the closer the mean clutch size approaches 3 (Kadlec and Drury 1968a and authors cited therein). In some instances we have calculated clutch size from data given in the original papers. When possible, we listed in parentheses the most frequently observed clutch size and the percentage of nests that contained this number of eggs.
(b) Empty nests excluded.
(c) Mean clutch size is from the earliest nest count; Keith believed that mean clutch size in this colony at the median date of clutch initiation would have been between 2.90 and 3.00.
(d) Figure is highest average clutch size obtained on any one visit.
(e) N is the combined sample for three years.
(f) Figures are range of values in rocky habitat.
(g) Figures are range of values on turf-covered slopes.
(h) Figures are range of values in grassy meadows.
(i) Mean clutch size for birds nesting far from Great Black-backed Gulls.
(j) Mean clutch size for birds nesting near Great Black-backed Gulls.
(k) The number of clutches does not include nests in which no eggs were laid.

1978) have found no relationship between time of laying and hatching success. Disturbance by man or other animals also influences hatching success. Herring Gulls laying early at a colony in Rhode Island did not have a significantly higher hatching success (87%) than those laying late in the season (78%) when they nested far from Great Black-backed Gulls, but hatching success of early nesters (77%) was significantly higher than that of late nesters (65%) when the two species nested together (Erwin 1971). Hunt (1972a) reported that colonies disturbed by picnickers in Maine had a significantly lower hatching success rate than those that remained undisturbed.

Table 29. Comparison of mean clutch sizes for early and late clutches in North American Herring Gulls.

Locality	Year	Early clutches	Number of clutches	Late clutches	Number of clutches	Source
Kawinaw Lake	1971 (a)	3.00	102	2.74	82	Vermeer 1971a
Goose Island	1973 (b)	2.89	55	2.84	51	Chamberlin 1975
Scotch Bonnet Island	1973 (c)	2.57	79	2.33	18	Gilbertson and Hale 1974a
Scotch Bonnet Island	1975 (d)	2.57	42	1.91	11	Gilman et al. 1977
Chantry Island	1975 (d)	2.91	126	2.24	17	Gilman et al. 1977
Toronto Outer Harbor	1977 (e)	2.77	22	2.43	28	Haymes and Blokpoel 1978a

(a) Early clutches are those begun prior to 17 May, the mean date of clutch initiation; late clutches are those begun thereafter.
(b) Nests with eggs hatching before 1 June were considered early nests.
(c) Late clutches were those begun after 22 May and were considered by the authors to be renesting attempts.
(d) Late clutches were those that were considered second nesting attempts.
(e) Late clutches were those initiated after 7 May.

Age at Fledging Age at first strong flight for 12 young Herring Gulls at Gull Island, Newfoundland, ranged from 42 to 48 days (mean = 45.2 days) (Haycock and Threlfall 1975). Paynter (1949) estimated a fledging time of about 43 days. The average age of fledging for 6 chicks at Gray's Rock, Massachusetts, was about 51 days, with the earliest fledging at an age of 35-44 days and the oldest at 56-61 days (Kadlec et al. 1969). Goethe (1956a in Kadlec et al.1969) reported a range of fledging ages for European birds of 43-62 days.

Fledging Success In successful Great Lakes colonies, each pair of Herring Gulls produced about 1.4-1.5 fledglings, amounting to about 46 fledglings per 100 eggs laid, or 58-73 fledglings per 100 eggs hatched (Gilman et al. 1977). It is difficult to compare studies because of the differences in terminology and methods of calculation, but Table 33 lists productivity figures for a number of studies of North American Herring Gull colonies.

Productivity of young in North American Herring Gull colonies varies widely. Particularly low productivity is often assocatiated with pesticide pollution. Kadlec and Drury (1968a) concluded that normal productivity in Herring Gull colonies is approximately 0.8-1.4 young per pair. Early nests tend to fledge more young (Pierotti 1982).

Table 30. Rates of hatching success reported for the Herring Gull in North America.

Percent of eggs laid that hatched	Number of eggs	Locality and year of observation	Source
		MANITOBA	
69.9	330	Kawinaw Lake, 1971	Vermeer 1971a
		ONTARIO	
45.5,54.5	55,132	Port Colborne, 1973 (two sites)	Morris and Haymes 1977
41.0,53.1	83,147	Port Colborne, 1974 (two sites)	Morris and Haymes 1977
46.7,61.8	105,178	Port Colborne, 1975 (two sites)	Morris and Haymes 1977
54.2	166	Port Colborne, 1976	Morris and Haymes 1977
16.3	245	Scotch Bonnet Island, 1973 (a)	Gilbertson and Hale 1974a
19	96	Scotch Bonnet Island, 1975	Gilman et al. 1977
24.1	116	Brother's Island, 1973 (b)	Teeple 1977
72	406	Chantry Island, 1975	Gilman et al. 1977
79.6	299	Granite Island, 1975	Ryder and Carroll 1978
84.2	298	Granite Island, 1976	Ryder and Carroll 1978
65.1	129	Toronto Outer Harbor, 1977	Haymes and Blokpoel 1978a
		MICHIGAN	
28.3	828	Bellows Island, 1965	Ludwig and Tomoff 1966
80.0+	1,000	Pismire Island, 1965	Ludwig and Tomoff 1966
80.4	215	Goose Island, 1972	Chamberlin 1975
68.7	611	Goose Island, 1973	Chamberlin 1975
47.9	119	South Manitou Island, 1972	Shugart 1977b
68.7	179	South Manitou Island, 1973	Shugart 1977b
56.1	148	South Manitou Island, 1974	Shugart 1977b
32.3	1,160	South Manitou Island, 1975	Southern et al. 1980
10.0	511	South Manitou Island, 1976	Southern et al. 1980
61.8	1,390	South Manitou Island, 1977	Southern et al. 1980
14.4	945	South Manitou Island, 1976	Southern et al. 1980
33.3	870	South Manitou Island, 1979	Southern et al. 1980
		WISCONSIN	
41	---	Little Sister Island, 1964	Keith 1966a

Table 30. Continued.

Percent of eggs laid that hatched	Number of eggs	Locality and year of observation	Source
		NEWFOUNDLAND	
72.9	---	Gull Island, 1971	Haycock and Threlfall 1975
74.8-78,8	778	Great Island, 1976-78 (c)	Pierotti 1982
65.1-80.4	893	Great Island, 1976-78 (d)	Pierotti 1982
67.8-78.6	672	Great Island, 1976-78 (e)	Pierotti 1982
		NEW BRUNSWICK	
71.3	247	Kent Island, 1947	Paynter 1949
80	256	Kent Island, 1976	Gilman et al. 1978
		MAINE	
47.2	99	3 colonies, 1968	Hunt 1972a
31.0	294	4 colonies, 1969	Hunt 1972a
37.0	430	4 colonies, 1970	Hunt 1972a
		MASSACHUSETTS	
68.8	44	Coatue, 1963	Kadlec and Drury 1968a
		RHODE ISLAND	
74.7	258	Block Island, 1965	Kadlec and Drury 1968a
79.3	266	Block Island, 1966	Kadlec and Drury 1968a
75.4	121	Sandy Point, 1963	Kadlec and Drury 1968a
67	48	Sandy Point, 1969 (f)	Erwin 1971
82	48	Sandy Point, 1969 (g)	Erwin 1971
		NEW JERSEY	
51.8	328	Islajo Island, 1975	Burger 1977a

(a) Figures calculated from Table 1 of the cited source and include both first and second nesting attempts.
(b) Data are calculated from Table 3 of the cited source and include both first and second clutches, but only clutches containing two and three eggs.
(c) Figures are for birds nesting in rocky habitat.
(d) Figures are for birds nesting on turf-covered slopes.

Table 30 Concluded.

(e) Figures are for birds nesting in grassy meadows.
(f) Data are for Herring Gulls nesting near Great Black-backed Gulls.
(g) Data are for Herring Gulls nesting far from Great Black-backed Gulls.

Table 31. Comparison of hatching success for early and late nests of North American Herring Gulls.

Locality	Year	Percent of eggs hatched, early nests	N (eggs)	Percent of eggs hatched, late nests	N (eggs)	Source
Bellows Island	1965 (a)	28.4	828	55	34?	Ludwig and Tomoff 1966
Kawinaw Lake	1971	70.4	321	62.2	151	Vermeer 1971a
Goose Island	1973 (b)	78.6	159	75.9	145	Chamberlin 1975
Brothers Island	1973 (c)	25.0	84	21.9	32	Teeple 1977
Scotch Bonnet Island	1973	17.2	203	11.9	42	Gilbertson and Hale 1974a
Scotch Bonnet Island	1975 (d)	22	108	0	21	Gilman et al. 1977
Chantry Island	1975 (d)	76	367	25	39	Gilman et al. 1977
Toronto Outer Harbor	1977 (e)	80.3	61	51.5	68	Haymes and Blokpoel 1978a
Port Colborne (CF)	1973 (f)	42.3	26	48.3	30	Morris and Haymes 1977
Port Colborne (CF)	1974 (f)	45.9	61	27.3	22	Morris and Haymes 1977
Port Colborne (CF)	1975 (f)	43.8	64	41.2	51	Morris and Haymes 1977
Port Colborne (L)	1973 (f)	65.7	70	41.9	62	Morris and Haymes 1977
Port Colborne (L)	1974 (f)	64.9	114	12.1	33	Morris and Haymes 1977
Port Colborne (L)	1975 (f)	68.0	100	54.5	23	Morris and Haymes 1977
Port Colborne (L)	1976 (f)	56.8	111	49.1	55	Morris and Haymes 1977

(a) Figures are estimates based on intermittent visits and represent what Ludwig and Tomoff believed to be initial and second nesting attempts.
(b) Early nests were those that had hatched eggs by 1 June.
(c) Early and late nests are those believed to be first and second clutches.
(d) The authors considered late nests second nesting attempts.
(e) Late nests were those in which eggs were first laid after 7 May.
(f) CF = Canada Furnace colony, L = Lighthouse colony.

Table 32. Comparison of hatching success in three- and two-egg clutches in some studies of North American Herring Gulls.

		Hatching Success				
Locality	Year	Three-egg clutches	N (eggs)	Two-egg clutches	N (eggs)	Source
Kent Island	1947	80.2%	162	56.4%	78	Paynter 1949
Sandy Point	1963	76.8	324	57.6	26	Kadlec and Drury 1968a
Coatue	1963	67.6	102	75.0	20	Kadlec and Drury 1968a
Block Island	1965	75.3	648	70.2	84	Kadlec and Drury 1968a
Block Island	1966	79.3	699	80.3	66	Kadlec and Drury 1968a
Gull Island	1971 (a)	76.4	171	34.5	--	Haycock and Threlfall 1975
Goose Island	1972	81.7	552	76.0	50	Chamberlin 1975
Brothers Island	1973 (b)	27.2	66	16.7	18	Teeple 1977
Brothers Island	1973 (b)	22.2	18	21.4	14	Teeple 1977
Toronto Outer Harbor	1977	80.5	87	38.2	34	Haymes and Blokpoel 1978a
Port Colborne (CF)	1973 (c)	47.6	42	66.7	6	Morris and Haymes 1977
Port Colborne (CF)	1974 (c)	45.0	75	23.5	18	Morris and Haymes 1977
Port Colborne (CF)	1975 (c)	58.7	84	31.3	16	Morris and Haymes 1977
Port Colborne (L)	1973 (c)	49.5	63	70.0	30	Morris and Haymes 1977
Port Colborne (L)	1974 (c)	52.5	114	57.5	20	Morris and Haymes 1977
Port Colborne (L)	1975 (c)	65.7	144	57.1	14	Morris and Haymes 1977
Port Colborne (L)	1976 (c)	57.0	138	65.7	18	Morris and Haymes 1977

(a) Figure for two-egg clutches subsumes hatching success for one-egg clutches as well.
(b) The first set of figures is for first nesting attempts; the second set is for second nesting attempts.
(c) CF = Canada Furnace colony, L = Lighthouse colony

Table 33. Productivity in North American Herring Gull colonies (a).

Number of young produced per pair or per nest		Locality and year of observation	Source
		ONTARIO	
0.21	(b)	Snake Island, ELO, 1972	Gilbertson 1974a
0.06	(b)	Presqu'ile Park, NLO, 1972	Gilbertson 1974a
0.08	(b)	Black Ant Island, SLR, 1972	Gilbertson 1974a
0.35-0.52	(b)	Big Chick Island, WLE, 1973	Gilbertson 1974a
0.12	(b)	Scotch Bonnet Island, NLO, 1972	Gilbertson 1974a
0.05-0.06	(d)	Scotch Bonnet Island, NLO, 1973	Gilbertson and Hale 1974a
0.15	(b)	Scotch Bonnet Island, NLO, 1975	Gilman et al. 1977
0.10	(b)	Brothers Island, ELO, 1972	Gilbertson 1974a
0.06-0.18	(d)	Brothers Island, ELO, 1973	Teeple 1977
0.48	(c)	Port Colborne, ELE, 1973	Morris and Haymes 1977
0.32-0.48	(c,e)	Port Colborne, ELE, 1974	Morris and Haymes 1977
0.65	(c,f)	Port Colborne, ELE, 1975	Morris and Haymes 1977
1.41	(b)	Port Colborne, ELE, 1975	Gilman et al. 1977
0.79	(c)	Port Colborne, ELE, 1976	Morris and Haymes 1977
1.32	(b)	Granite Island, NLS, 1975	Ryder and Carroll 1978
1.38	(b)	Granite Island, NLS, 1975	Gilman et al. 1977
1.55	(b)	Granite Island, NLS, 1976	Ryder and Carroll 1978
1.48	(b)	Chantry Island, ELH, 1975	Gilman et al. 1977
		MICHIGAN	
0.31-0.42	(b,d)	Bellows Island, GTB, 1965	Ludwig and Tomoff 1966
1.22-1.30	(b,d)	Pismire Island, NLM, 1965	Ludwig and Tomoff 1966
1.96	(c)	Goose Island, NLH, 1973	Chamberlin 1975
0.65	(b)	South Manitou Island, NLM, 1972	Schugart 1977b
0.51	(b,f)	South Manitou Island, NLM, 1973	Schugart 1977b
0.39	(b,f)	South Manitou Island, NLM, 1974	Schugart 1977b
0.01	(b,f)	South Manitou Island, NLM, 1975	Southern et al. 1980
0.00	(b,f)	South Manitou Island, NLM, 1976	Southern et al. 1980
1.38	(b,f)	South Manitou Island, NLM, 1977	Southern et al. 1980
0.00	(b,f)	South Manitou Island, NLM, 1978	Southern et al. 1980
0.00	(b,f)	South Manitou Island, NLM, 1979	Southern et al. 1980
		WISCONSIN	
0.3-0.4	(b)	Little Sister Island, GB, 1964	Keith 1966a

Table 33. Continued.

Number of young produced per pair or per nest		Locality and year of observation	Source
		NEWFOUNDLAND	
0.9	(c)	Gull Island , 1971	Haycock and Threlfall 1975
1.32-1.84	(c,g)	Great Island, 1976-78	Pierotti 1982
1.58-1.87	(c,h)	Great Island, 1976-78	Pierotti 1982
1.03-1.28	(c,i)	Great Island, 1976-78	Pierotti 1982
		NEW BRUNSWICK	
1.06	(c)	Kent Island, 1947	Paynter 1949
		MAINE	
0.80	(c,j)	3 colonies, 1968	Hunt 1972a
0.34	(c,j)	4 colonies, 1969	Hunt 1972a
0.28	(c,j)	4 colonies, 1970	Hunt 1972a
		MASSACHUSETTS	
1.09	(c)	Coatue, 1963	Kadlec and Drury 1968a
		RHODE ISLAND	
1.02	(c)	Block Island, 1963	Kadlec and Drury 1968a
0.93	(c)	Block Island, 1965	Kadlec and Drury 1968a
1.42	(c)	Block Island, 1966	Kadlec and Drury 1968a
1.35	(c)	Sandy Point, 1963	Kadlec and Drury 1968a
1.79	(k)	Sandy Point, 1969	Erwin 1971
2.44	(1)	Sandy Point, 1969	Erwin 1971
		NEW JERSEY	
1.43		3 colonies, 1977	Burger and Shisler 1980b

a) Abbreviations after localities used in this table are as follows: ELE, eastern Lake Erie; ELH, eastern Lake Huron; ELO, eastern Lake Ontario; GB, Green Bay, northern Lake Michigan; GTB, Grand Traverse Bay, northern Lake Michigan; NLO, northern Lake Ontario; NLH, northern Lake Huron; NLM, northern Lake Michigan; NLS, northern Lake Superior; WLE, western Lake Erie; SLR, St. Lawrence River.

Table 33. Concluded.

b) Figures represent the number of young produced per pair.
c) Figures represent the number of young produced per nest.
d) Figures represent estimates of minimum and maximum production, respectively.
e) Figures are the range of values for two colonies.
f) Figures are for years when production was affected by a resident population of red foxes (Vulpes vulpes).
g) Figures are range of values in rocky habitat.
h) Figures are range of values on turf-covered slopes.
i) Figures are range of values in grassy meadows.
j) Hunt considered any chick that reached a weight of 500 g as having fledged.
k) Figures are for birds nesting near Great Black-backed Gulls, are recalculated from Table 1 of the cited source, and represent the number of young produced per nest. Erwin (1971) listed 1.76 young produced per pair.
l) Data are for birds nesting far from Great Black-backed Gulls, are recalculated from Table 1 of the cited source, and represent the number of young produced per nest. Erwin (1971) listed 2.39 young produced per pair.

Disturbance by humans is often a major factor in the failure of Herring Gull colonies (Burger 1981a). However, Hunt (1972a) found no significant difference in productivity between disturbed and undisturbed colonies in Maine. Hunt pointed out that colonies near food sources produced significantly more young than more distant colonies. Nesting habitat may also relate to fledging success. Pierotti (1982) reported that Herring Gulls nesting on exposed rocky terraces and on turf-covered slopes at Great Island, Newfoundland, consistently fledged more young than did those nesting in grassy meadows. He thought that the lower success in grassy meadows may have been due to predation by the Great Black-backed Gulls that preferred this area as nesting habitat.

Mortality of Eggs and Young Probably the two major causes of nesting failure in Herring Gulls are environmental contamination by pollutants and failures related to disturbance, either by humans or by introduced predators. Nesting success has been greatly reduced at a number of colonies on the Great Lakes in recent years, largely because hatching failures attributed to pesticides (Gilman et al. 1977, Teeple 1977). With recent decreases in organochlorine contamination, reproductive success in many areas has returned to normal (Weseloh et al. 1979). Foxes (Vulpes vulpes) and other mammalian predators also take young gulls, and sometimes are the reason few young fledge (Shugart 1977b, Patton 1979, Southern et al. 1980). Human disturbance of colonies and the associated disruption may be caused either by research investigators (Burger 1981a, Pierotti 1982), by vandals, casual visitors such as campers, boaters and picnickers (Shugart in Scharf 1979), or even by supersonic aircraft (Burger 1981d).

Eggs may be eaten by Herring Gulls (Burger 1977a) and young birds may be killed and eaten by neighboring gulls (Chamberlin 1975). Young often are killed (Kadlec et al. 1969, Pierotti 1982) when they wander from their parents' territory into territories of other Herring Gulls (Haycock and Threlfall 1975, Ryder and Carroll 1978). Others are taken by Great Black-backed Gulls in some colonies (Paynter 1949, Pierotti 1982) and some may be taken by other avian predators. Reported or suspected avian predators include Common Crows (Corvus brachyrhynchos) (Chamberlin 1975), and Great Horned Owls (Bubo virginianus) (Shugart in Scharf 1979).

Exposure to inclement weather may cause the death of young birds (Kadlec et al. 1969) and storms may result in the loss of nests from flooding (Burger 1977a, Shugart in Scharf 1979). Disease occasionally accounts for some deaths, (Pierotti 1982, Shugart in Scharf 1979), but apparently is seldom a major factor in nesting failures. Most mortality of Herring Gull chicks takes place in the first 10 days following hatching (Kadlec et al. 1969, Haycock and Threlfall 1975, Ryder and Carroll 1978).

Renesting Some Herring Gulls relay if they lose their first clutches, but the proportion that do, in relation to various circumstances, is poorly known. Teeple (1977) believed that 13 of 34 pairs relaid on Brothers Island near Kingston, Ontario in 1973. Haycock and Threlfall (1975) reported that 7 replacement clutches at Gull Island, Newfoundland, were initiated 12-32 days (mean = 12.6 days, n = 5) after the loss of the first clutch.

Parsons (1976a) gave the interval between loss of the first clutch and renesting as 12-15 days. The interval is slightly longer for birds initially nesting late, and for birds whose clutches are taken after 15 days of incubation, and shortest for early nesters losing their clutch immediately after laying. Renesting is frequent in the Lake Ontario colonies, where pesticide levels are high and hatching success is very poor (Gilbertson and Hale 1974a, Teeple 1977).

Age at First Breeding Chabrzyk and Coulson (1976) found that many of 1,151 banded Herring Gulls first bred at 5 years of age. Some bred at 4 years, and none bred earlier. Birds breeding in subadult plumage were more common in growing colonies than in stable or space-limited colonies.

Maximum Natural Longevity A Herring Gull banded in New Brunswick was obtained in Maryland after reaching a minimum age of 27 years and 3 months (Clapp et al. 1982a). A previously published longevity record of 36 years (Pettingill 1967) was an error (Jonkel and Pettingill 1974).

Weight Data on weights of North American Herring Gulls are given in Table 34.

SUSCEPTIBILITY TO OIL POLLUTION

Herring Gulls seldom die from oiling, but occasional mortality from oiling has been recorded (Table 35). Certainly their populations have not been affected by oiling to the extent of some alcid populations (Bourne and Devlin 1969). Gulls wintering offshore may be contaminated by floating oil while they roost on the water at night. Herring Gulls winter offshore in great numbers in many areas, including the southeastern United States (Robertson

Table 34. Weight (in grams) of North American Herring Gulls (a).

Mean Weight	Range	Number weighed	Sample and season	Area	Source
1232	1014-1618	180	ad. males, summer	Newfoundland	Threlfall and Jewer 1978
1334	1222-1568	5	ad. males, summer	Alaska	USNM spec.
1391	1248-1614	18	ad. males, summer	Alaska	USNM, Williamson coll.
----	1093-1336	32	ad. males	Newfoundland	Haycock and Threlfall 1975
999	832-1274	78	ad. females, summer	Newfoundland	Threlfall and Jewer 1978
----	937-1118	9	ad. females	Newfoundland	Haycock and Threlfall 1975
1133	1050-1282	12	ad. females, summer	Alaska	USNM, Williamson coll.
57-70	---	1215	newly hatched young	Newfoundland	Pierotti 1982
347-484	---	562	15 day old young	Newfoundland	Pierotti 1982
393	203-583	12	15 day old young	Massachusetts	Kadlec et al. 1969
443	293-593	6	15 day old young	Massachusetts	Kadlec et al. 1969
776-986	---	342	30 day old young	Newfoundland	Pierotti 1982
787	553-1021	9	30 day old young	Massachusetts	Kadlec et al. 1969
853	635-1071	6	30 day old young	Massachusetts	Kadlec et al. 1969
982	640-1324	4	50 day old young	Massachusetts	Kadlec et al. 1969
982	688-1276	4	50 day old young	Massachusetts	Kadlec et al. 1969
95	65-105	24	fresh eggs	Newfoundland	Haycock and Threlfall 1975
88-92	58-120	404	fresh eggs	Newfoundland	Pierotti 1982

Table 34. Concluded.

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a) Published weights over 100 grams are rounded to the nearest gram. Figures for eggs and young from Pierotti (1982) are the range of values for means taken in three habitats in two years. The number of weights given is the total number of birds upon which these means are based. Figures for range for fresh eggs are ranges ± 2 S.D. for the largest and smallest means, respectively. Figures for range from Kadlec et al. (1969) are the mean ± 1 S.D. The first set of figures is for all chicks weighed. The second is for all believed to have fledged.

and Mason 1965). Oiled Herring (and other) Gulls are commonly seen in Florida around sanitary landfills (W. Hoffman, pers. comm.), but these birds probably become smeared with waste motor oil while digging in the landfills.

Files in the Bird Banding Laboratory, Patuxent, Maryland, attributed the death of 57 of these gulls to oiling, far more than for any other species of *Larus* listed. Most of the birds were found in the northern portions of the range; only five were reported from the southeastern United States (four from Texas and one from Florida). Herring Gull populations are stable or increasing in most areas of North America and in the Old World. Numbers wintering in the southeastern United States are considerable and are likely to increase in the future. Oil development in the southeastern United States would probably not have a signficant impact on overall populations of this species.

BIBLIOGRAPHY

1983

Baerends, G. P. and R. H. Drent (eds.). The Herring Gull and its egg. Part II. The responsiveness to egg-features. Behaviour 82: xiii and 416 pp.

Bergman, G. 1983. Population dynamics, colony formation and competition in *Larus argentatus*, *fuscus* and *marinus* in the archipelago of Finland. *Ann. Zool. Fenn.* 19: 143-164.

Peakall, D. B., D. S. Miller, and W. B. Kinter. 1983. Toxicity of crude oils and their fractions to nestling Herring Gulls--1. physiological and biochemical effects. Mar. Environ. Res. 8: 63-71.

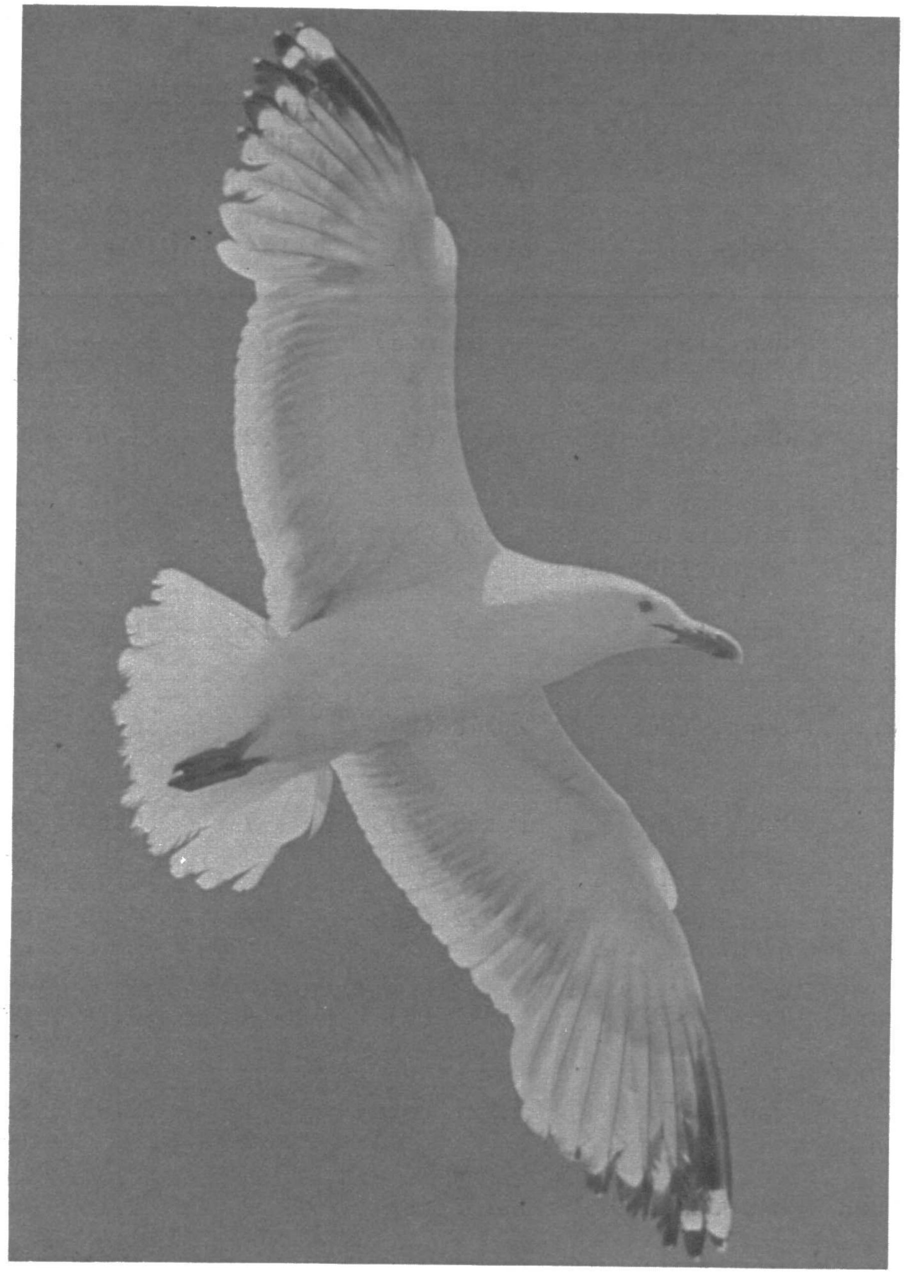
Sibly, R. M. and R. H. McCleery. 1983a. Increase of weight of Herring Gulls while feeding. J. Anim. Ecol. 52: 35-50.

______. 1983b. The distribution between feeding sites of Herring Gulls breeding at Walney Island, U.K. J. Anim. Ecol. 52: 51-68.

Table 35. Number of dead birds and number and percentage of dead Herring Gulls found after major oiling incidents.

Area	Dates	Number of oiled dead birds	Number of dead Herring Gulls	Percent- of Herring Gulls	Source
Island Beach, New Jersey	Jan. 1945	92 (a)	27	29.35	Kramer and Kramer 1945
Poole Harbour, Dorset, England	Jan. 1961	433 (b,c)	12	2.77	Bourne 1968a
Southeast Kent, England	winters of 1963-64 to 1965-66	598 (b)	40	7.86	Gibson 1966
Northeast England	Jan. 1966	805	15	1.86	Parrack 1967
Medway Estuary, Kent, England	Sept. 1966	2,748 (b)	165	6.00	Bourne 1968a
Tay Estuary, Scotland	Mar.-Apr. 1968	1,168 (c)	7	0.60	Greenwood and Keddie 1968
Northeast Britain	Jan.-Feb. 1970	10,992 (a,b)	32	0.29	Greenwood et al. 1971
Martha's Vineyard, Massachusetts	Feb. 1970	541 (b)	4	0.74	CSLP 1971
San Francisco Bay, California	Jan. 1971	3,221 (b,d)	1	0.03	Smail et al. 1972
Northern Scotland	May-Jun. 1971	1,101 (b)	2	0.18	Bourne 1971a
Waddensea, Denmark	Dec. 1972	9,151 (b)	3	0.03	Joensen and Hansen 1977
Firth of Clyde, Ayrshire, Scotland	Jan. 1974	279 (b)	3	1.88	Lloyd et al. 1974

(a) Total includes some birds that were not oiled.
(b) Total includes only those birds identified to species.
(c) This count is of both dead and alive oiled birds.
(d) This figure represents birds brought to cleaning/receiving stations.



Adult Herring Gull in breeding plumage. Photograph by Pat Lynch.

1982

Becker, P. H. and M. Erdelen. 1982. Windrichtung und Vegetationsdeckung am nest der Silbermowe (Larus argentatus). [Vegetation surrounding Herring Gulls' (Larus argentatus) nests in relation to wind direction.] J. Ornithol. 123: 117-130. [In German with English summary.]

Bergman, G. 1982. Population dynamics, colony formation and competition in Larus argentatus, fuscus and marinus in the archipelago of Finland. Ann. Zool. Fenn. 19: 143-164.

Blokpoel, H. and D. V. Weseloh. 1982. Status of colonial waterbirds nesting on Little Galloo Island, Lake Ontario. Kingbird 32: 149-157.

Coulson, J. C., N. Duncan and C. Thomas. 1982. Changes in the breeding biology of the Herring Gull (Larus argentatus) induced by reduction in the size and density of the colony. J. Anim. Ecol. 51: 739-756.

Coulson, J. C., P. Monaghan, J. Butterfield, N. Duncan, C. S. Thomas and H. Wright. 1982. Variation in the wing-tip pattern of the Herring Gull in Britain. Bird Study 29: 111-120.

Gochfeld, M. and J. Burger. 1982b. Biological concentration of cadmium in estuarine birds of the New York Bight. Colonial Waterbirds 5: 116-123.

Gotmark, F. 1982. Coloniality in five Larus gulls: a comparative study. Ornis Scand. 13: 211-224.

Hanssen, O. J. 1982. Evaluation of some methods of censusing larid populations. Ornis Scand. 13: 183-188.

Holley, A. J. F. 1982. Post-fledging interactions on the territory between parents and young Herring Gulls Larus argentatus. Ibis 124: 198-203.

Lemmetyinen, R., P. Rantamaki and A. Karlin. 1982. Levels of DDT and PCB's in different stages of life cycle of the Arctic Tern Sterna paradisaea and the Herring Gull Larus argentatus. Chemosphere 11: 1050-1068.

Mineau, P., G. E. J. Smith, R. Markel and C.-S. Lam. 1982. Aging Herring Gulls from hatching to fledging. J. Field Ornithol. 53: 394-402.

Morris, R. D. and M. J. Bidochka. 1982. Mate guarding in Herring Gulls. Colonial Waterbirds 5: 124-130.

Mudge, G. P. and P. N. Ferns. 1982. The feeding ecology of five species of gulls (Aves: Larini) in the inner Bristol Channel. J. Zool. (Lond.) 197: 497-510.

Parsons, K. C. 1982. Nest-site habitat and hatching success of gulls. Colonial Waterbirds 5: 131-138.

Peakall, D. B., D. J. Hallett, J. R. Bond, G. L. Foureman and D. S. Miller. 1982. Toxicity of Prudhoe Bay crude oil and its aromatic fractions to nestling Herring Gulls. Environ. Res. 27: 206-215.

Perry, P. 1982. The use of gull nests by Eiders. Brit. Birds 75: 360-365.

Pierotti, R. 1982. Habitat selection and its effect on reproductive output in the Herring Gull in Newfoundland. Ecology 63: 854-868.

Southern, L. K., S. R. Patton, and W. E. Southern. 1982. Nocturnal predation on _Larus_ gulls. Colonial Waterbirds 5: 169-172.

Walker, D. G. 1982. Herring Gull killing a Black-headed Gull. Brit. Birds 75: 580-581.

Wesehloh, D. V. and P. Mineau. 1982. Demography, productivity, and contaminant levels in Herring Gulls in Lake Erie. (Abstract only.) Colonial Waterbirds 5: 179.

1981

Amlaner, C. J. and D. J. McFarland. Sleep in the Herring Gull (_Larus argentatus_). Anim. Behav. 29: 551-556.

Andrews, R. 1981. The gull population on Monomoy Island, Massachusetts, USA. (Abstract only.) Colonial Waterbirds 4: 194.

Burger, J. 1981a. Effect of human disturbance on colonial species, particularly gulls. Colonial Waterbirds 4: 28-36.

_____. 1981b. Feeding competition between Laughing Gulls and Herring Gulls at a sanitary landfill. Condor 83: 328-335.

_____. 1981c. Movements of juvenile Herring Gulls hatched at Jamaica Bay Refuge, New York. J. Field Ornithol. 52: 285-290.

_____. 1981d. Behavioural responses of Herring Gulls _Larus argentatus_ to aircraft noise. Environ. Poll. 24: 177-184.

_____. 1981e. On becoming independent in Herring Gulls: parent-young conflict. Amer. Nat. 117: 444-456.

Burger, J. and M. Gochfeld. 1981a. Age-related differences in piracy behaviour of four species of gulls, _Larus_. Behaviour 77: 242-267.

_____. 1981b. Unequal sex ratios and their consequences in Herring Gulls (_Larus argentatus_). Behav. Ecol. Sociobiol. 8: 125-128.

_____. 1981c. Discrimination of the threat of direct vs. tangential approach to the nest by incubating Herring _Larus argentatus_ and Great Black-backed Gulls _Larus marinus_. J. Comp. Physiol. Psychol. 95: 676-684.

Coulson, J. C., N. Duncan, C. S. Thomas and P. Monaghan. 1981. An age-related difference in the bill depth of Herring Gulls *Larus argentatus*. Ibis 123: 499-502.

DeWire, R. C. 1981. Banding gulls at Chimon Island [Connecticut]. Conn. Warbler 1: 17-18.

Dijkeen, L. J. 1981. Het verschil in koptekining bij nest jongen van Zilvermeeuw (*Larus argentatus*) en Kleine Mantelmeeuw (*Larus fuscus*). [The differences in head markings of juvenal Herring Gull *Larus argentatus* and Lesser Black-backed Gull *Larus fuscus*.] Watervogels 6: 19-23. [In Dutch with English summary.]

Duncan, N. 1981. The Abbeystead and Mallowdale gull colony before control. Bird Study 28: 133-138.

Elliott, R. E. 1981. Orbital ring colours of Herring Gulls in Britain. Bird Study 28: 66-68.

Erwin, R. M., J. Galli and J. Burger. 1981. Colony site dynamics and habitat use in Atlantic coast seabirds. Auk 98: 550-561.

Ferns, P. N. and G. P. Mudge. 1981. Accuracy of nest counts at a mixed colony of Herring and Lesser Black-backed Gulls. Bird Study 28: 244-246.

Fox, G. A., C. R. Cooper and J. P. Ryder. 1981. Predicting the sex of Herring Gulls by using external measurements. J. Field Ornithol. 52: 1-9.

Grant, P. J. and R. A. Hume. 1981. Herring Gull with characteristics of Mediterranean race in Kent. Brit. Birds 74: 350-351.

Holley, A. J. F. 1981. Naturally arising adoption in the Herring Gull. Anim. Behav. 29: 302-303.

Kent, B. W. 1981. Prey dropped by Herring Gulls (*Larus argentatus*) on soft sediments. Auk 98: 350-354.

King, B. 1981. Inland ground-nesting by Herring Gulls. Brit. Birds 74: 264-265.

Mallalieu, M. and T. N. Holdge. 1981. Yellow-legged Herring Gulls in North Kent. Brit. Birds 74: 351-352.

McGill-Harelstad, P. 1981. The effects of interspecific competition on reproductive success of Great Black-backed and Herring Gulls. (Abstract only.) Colonial Waterbirds 4: 197.

McGill-Harelstad, P. and T. L. Taigen. 1981. Thermogenic capacity of gull chicks. (Abstract only.) Am. Zool. 21: 914.

Mineau, P. and D. V. C. Wesehloh. 1981. Low-disturbance monitoring of Herring Gull reproductive success on the Great Lakes. Colonial Waterbirds 4: 138-142.

Morris, R. D., M. C. Benkel, A. Biernacki and J. M. Ross. 1981. A new transmitter assembly for Herring Gulls. J. Field Ornithol. 52: 242-244.

Nicholson, J. K. 1981. The comparative distribution of zinc, cadmium, and mercury in selected tissue of the Herring Gull (*Larus argentatus*). Comp. Biochem. Physiol. 68C: 91-94.

Niebuhr, V. 1981. An investigation of courtship feeding in Herring Gulls *Larus argentatus*. Ibis 123: 218-223.

Nilsen, J-E. 1981. Gratrutar jagar sanglarka. [Herring Gulls chasing Skylark.] Var Fagelvarld 40: 66.

Norstrom, R. J., A. P. Gilman and D. J. Hallett. 1981. Total organically-bound chlorine and bromine in Lake Ontario Herring Gull eggs, 1977, by instrumental neutron activity and chromatographic methods. Sci. Total Environ. 20: 217-230.

Oliver, P. J. 1981. Herring Gull with yellow legs nesting in London. Brit. Birds 74: 353.

Portnoy, J. W. and M. A. Soukup. 1981. Gull use of a freshwater kettle hole pond: quantification and seasonal variation. (Abstract only.) Colonial Waterbirds 4: 200.

Quinney, T. E., B. N. Miller and K. R. S. Quinney. 1981. Gulls robbing prey from Great Blue Herons (*Ardea herodias*). Can. Field-Nat. 95: 205-206.

Redman, P. S. 1981. Yellow-legged Herring Gulls in France and Britain. Brit. Birds 74: 349-350.

Ryttman, H. and H. Tegelstrom. 1981. Low degree of isozyme variation within and between Herring Gull (*Larus argentatus*), Lesser Black-backed Gull (*Larus fuscus*) and their British and Swedish subspecies. Hereditas 94: 143-148.

Ryttman, H., H. Tegelstrom and H. Jansson. 1981. Genetiska undersokningar av artsambandet mellan gratrut *Larus argentatus* och silltrut *Larus fuscus*. [Genetic studies of the relationship between Herring Gull *Larus argentatus* and Lesser Black-backed Gull *Larus fuscus*.] Var Fagelvarld 40: 239-248. [In Swedish with English summary.]

Snell, R. R. 1981. Herring Gull attacks and eats adult male Oldsquaw. Wilson Bull. 93: 110-111.

Stanley, P. I., T. Brough, M. R. Fletcher, N. Horton and J. B. A. Rochard. 1981. The origins of Herring Gulls wintering inland in south-east England. Bird Study 28: 123-132.

Treleaven, R. B. 1981. Peregrine feeding Herring Gull chick to young. Brit. Birds 74: 97.

Triplet, P. 1981. Notes a propos de l'action predatrice du Goeland argente sur l'Anguille. Nos Oiseaux 36: 169. [In French.]

Vinicombe, K. 1981. Yellow-legged Herring Gulls in Britain. Brit. Birds 74: 352-353.

Weber, J. W. 1981. The *Larus* gulls of the Pacific Northwest's interior, with taxonomic comments on several forms. (Part II--conclusion.). Continental Birdlife 2: 74-91.

Witt, H.-H, J. Crespo, E. de Juana, and J. Varela. 1981. Comparative feeding ecology of Audouin's Gull (*Larus audouinii*) and the Herring Gull (*L. argentatus*) in the Mediterranean. Ibis 123: 519-526.

1980

Andrle, R. F. 1980. Three more probable hybrids of *Larus hyperboreus* and *L. argentatus*. Wilson Bull. 92: 389-393.

Braun, B. M., P. A. Heinz and G. H. Heinz. 1980. Herring Gull predation on Red-breasted Merganser ducklings. Wilson Bull. 92: 403.

Burger, J. 1980a. Nesting adaptation of Herring Gull (*Larus argentatus*) to saltmarshes and storm tides. Biol. Behav. 5: 147-162.

_____. 1980b. Territory size differences in relation to reproductive stage and type of intruder in Herring Gulls (*Larus argentatus*). Auk 97: 733-741.

Burger, J. and F. Lesser. 1980. Nest site selection in an expanding population of Herring Gulls. J. Field Ornithol. 51: 270-280.

Burger, J. and J. Shisler. 1980b. The process of colony formation among Herring Gulls *Larus argentatus* nesting in New Jersey. Ibis 122: 15-26.

Burger, J., M. Fitch, G. Shugart and W. Werther. 1980. Piracy in *Larus* gulls at a dump in New Jersey. Proc. 1979 Conf. Colonial Waterbird Group 3: 87-98.

Camberlein, G. 1980. Methodes d'effrayment du Goeland argente appliquees a la protection de la mytiliculture dans les Cotes du Nord. [Bird-scaring away methods against Herring Gulls and their protective effects on the culture of mussels in the Cotes du Nord region.] Bull. Mens. Off. Natl. Chasse No. Spec. Sci. Tech. (Paris) pp. 261-267. [In French with English summary.]

Camberlein, G. and D. Flote. 1980. Dynamique et gestion de la population de Goeland argente (Larus argentatus) en Bretagne. (Abstract only.) Oiseau Rev. Fr. Ornithol. 50: 273-275.

Cambi, D. 1980. Accertamento e conferma della nidificazione del Gabbiano reale (Larus argentatus) sul Lago di Garda. Nota preliminare. [Confirmation of Herring Gulls (Larus argentatus) nesting on Lake Garda. Preliminary note.] Riv. Ital. Ornitol. 50: 19-25. [In Italian with English and French summaries.]

Coulson, J. C., N. Duncan and P. Monoghan. 1980. Variation in Herring Gulls. Brit. Birds 73: 230-231.

Dunn, E. H. and I. L. Brisbin, Jr. 1980. Age-specific changes in the major body components and caloric values of Herring Gull chicks. Condor 82: 398-401.

Erwin, R. M. 1980b. Breeding habitat use by colonially nesting waterbirds in two mid-Atlantic U.S. regions under different regimes of human disturbance. Biol. Conserv. 18: 39-51.

Fitch, M. 1980. Monogamy, polygamy, and female-female pairs in Herring Gulls. Proc. 1979. Conf. Colonial Waterbird Group 3: 44-48.

Goethe, F. 1980. Lebens- und Fortpflanzungsalter bei Heringsmowen Larus f. fuscus in der Gefangenhaltung und bei Silbermowen L. a. argentatus im Freiland. [Age and reproductive age of Lesser Black-backed Gulls Larus f. fuscus in captivity and of Herring Gulls L. a. argentatus in the wild.] Ornis Fenn. 57: 40-41. [In German with Finnish and English summaries.]

Goodermote, D. 1980. Herring Gull nest counts on the north shore of Lake Superior. Loon 52: 15-17.

Grant, P. J. 1980. Field identification of west Palearctic gulls. Part 3. Audouin's, Herring, Lesser Black-backed, Great Black-backed and Great Black-headed Gulls. Brit. Birds 73: 113-158.

Graves, J. A. and A. Whiten. 1980. Adoption of strange chicks by Herring Gull, Larus argentatus L. Z. Tierpsychol. 54: 267-278. [In English with German summary.]

Hamas, M. J. 1980. Herring Gulls nesting on Beaver Island. Jack-Pine Warbler 58: 93.

Hosey, G. R. and F. Goodridge. 1980. Establishment of territories in two species of gull on Walney Island, Cumbria. Bird Study 27: 73-80.

Ingold, J. L. 1980. Play in Herring Gulls. Inl. Bird Banding 52: 38.

Kilpi, M., H. Puntii, and T. Toivonen. 1980. Numbers of gulls nesting on the northern coast of the Gulf of Finland. Ornis Fenn. 57: 153-160. [In English with Finnish summary.]

King, B. 1980. Foot-paddling by pairs of Herring Gulls. Brit. Birds 73: 312.

Kuschert, H. 1980. Morphologisch-biometrische Untersuchungen an Silbermowen (*Larus argentatus*) einer Binnenlandkolonies Schlewig-Holstein. [Morphological and biometrical research on Herring Gulls (*Larus argentatus*) from an inland colony in Schleswig-Holstein.] Angew. Ornithol. 4: 190-194. [In German with English summary.]

Kuschert, H. and G. Vauk. 1980. Danische Ostsee-Silbermoew (*Larus argentatus*) als Brutvogel im Binnenland Schleswig-Holsteins (Ploner See). [Danish Herring Gull *Larus argentatus* as a breeding bird in inland Schleswig-Holstein (Ploner-See).] Vogelwarte 30: 147.

Leach, M. C. M., S. V. Kearsey and C. Wells. 1980. The 1978-79 survey of Herring Gull (*Larus argentatus*) colonies on the Yorkshire and Cleveland Coast. Naturalist (Leeds) 105: 107-114.

Lustick, S., M. Adam and A. Hinko. 1980. Interaction between posture, color, and the radiative heat load in birds. Science 208: 1052-1053.

Monaghan, P. 1980. Dominance and dispersal between feeding sites in the Herring Gull (*Larus argentatus*). Anim. Behav. 28: 521-527.

Morris, R. D. and J. E. Black. 1980. Radiotelemetry and Herring Gull foraging patterns. J. Field Ornithol. 51: 110-118.

Myrberget, S. and O. Olsvik. 1980. Gramakeunge spiste larver av Frostmaler. [Herring Gull eats winter moth larvae.] Fauna (Oslo) 33: 41. [In Norwegian with English summary.]

Norstrom, R. J., D. J. Hallett, F. I. Onuska and M. E. Comba. 1980. Mirex, and its degradation products in Great Lakes Herring Gulls. Environ. Sci. Technol. 14: 860-866.

Patten, S. M., Jr. 1980. Interbreeding and evolution in the *Larus glaucescens-Larus argentatus* complex on the south coast of Alaska. Ph.D. thesis, Johns Hopkins Univ./Baltimore, MD. 250 pp.

Plath, L. 1980. Bruten der Silbermowe (*Larus argentatus*) auf einem Hallendach in Rostock. [Breeding of *Larus argentatus* in Rostock.] Beitr. Vogelkd. 26: 358. [In German.]

Plotz, J. 1980. Parasitosen durch Nematodenbefall bei Silbermowen (Larus argentatus) und Mantelmowen (Larus marinus) von der Insel Helgoland. [Parasitosis through nematode infection in Herring Gulls (Larus argentatus) and Greater Black-backed Gulls (Larus marinus) from Helgoland.] Angew. Ornithol. 4: 195-200. [In German with English summary.]

Pulliainen, E. and A. Marjakangas. 1980. Eggshell thickness in eleven sea and shore bird species of the Bothnian Bay. Ornis. Fenn. 57: 65-70.

Richards, C. E. 1980. Herring Gulls catching Greater Pipe-fishes. Brit. Birds 73: 476.

Robertson, I. S. 1980. Immature Herring Gulls picking up ice slivers. Brit. Birds 73: 35.

Ryttman, H., H. Tegelstrom, and H. Jansson. 1980. Immunoelectrophoretical comparison of sera from Herring Gull (Larus argentatus) and Lesser Black-backed Gull (Larus fuscus) (Aves). Hereditas 92: 113-116.

Shugart, G. W. 1980. Frequency and distribution of polygyny in Great Lakes Herring Gulls in 1978. Condor 82: 426-429.

Sommani, E. 1980. Ripetute nidificazioni de Gabbiano Reale (Larus argentatus) nella citta di Roma. Riv. Ital. Ornitol. 50: 226-227. [In Italian.]

Southern, W. E. 1980a. Comparative distribution and orientation of North American gulls. Pp. 449-498 in J. Burger, B. C. Olla and H. E. Winn (eds.). Behavior of Marine Animals. Vol. 4: Marine Birds. Plenum Press NY. xvii and 515 pp.

_____. 1980b. The impact of fox predation on gull breeding success, Sleeping Bear Dunes National Lakeshore. Pp. 111-129 in Proc. 2nd Conf. Sci. Research Nat. Parks, Vol. 12: Terrestrial Biology: Zoology. Natl. Park Serv., Washington, D.C.

Southern, W. E., S. R. Patton and L. A. Hanners. 1980. Differential response of Ring-billed Gulls and Herring Gulls to fox predation. Proc. 1979 Conf. Colonial Waterbird Group 3: 119-127.

Sutherland, A. 1980. Erythristic Herring Gull eggs in Caithness. Scott. Birds 11: 84.

Vauk, G., E. Vauk-Hentzelt and M. Stede. 1980. Nachweise von Geflugltuberkulose (Tuberkulosis avium) bei freilebenden Silbermowen (Larus argentatus). [Two records of fowl-tuberculosis (Tuberkulosis avium) in free living Herring Gulls (Larus argentatus).] Angew. Ornithol. 4: 185-189. [In German with English summary.]

Ward, L. D. and J. Burger. 1980. Survival of Herring Gull and domestic chicken embryos after simulated flooding. Condor 82: 142-148.

Westin, P. 1980. Gratrut fangar koltrast i flykten. [Herring Gull catching migrating Blackbird in the air.] Var Fagelvarld 39: 44. [In Swedish with English summary.]

Whilde, A. 1980. The number of gulls breeding in the west of Ireland. Irish Nat. J. 19: 328.

1979

Bourne, W. R. P. 1979. Prolonged parental care in Herring Gulls nesting in town in eastern Scotland. Bird Study 26: 196-197.

Burger, J. 1979a. Competition and predation: Herring Gulls versus Laughing Gulls. Condor 81: 269-277.

_____. 1979b. Colony size: a test for breeding synchrony in Herring Gull (Larus argentatus) colonies. Auk 96: 694-703.

Burger, J. and J. K. Shisler. 1979. The immediate effects of ditching a saltmarsh on nesting Herring Gulls Larus argentatus. Biol. Conserv. 15: 85-103.

Butler, R. G. and P. Lukasiewicz. 1979. A field study of the effect of crude oil on Herring Gull chick growth. Auk 96: 809-812.

Carlsson, L. 1979. Trutar som naringsparasit pa hagar. [Gulls kleptoparasitizing heron, Ardea cinerea.] Var Fagelvarld 38: 50. [In Swedish with English summary.]

Duhautois, L. 1979. Mise au point sur les incursions des Goelands argentes Larus argentatus sp. PL. en Ile-de-France. Passer 16: 29-41.

Elowe, K. D. and S. Payne. 1979. Aging young Herring Gulls from measurements of body parts. Bird-Banding 50: 49-55.

Evans, R. M. 1979. Responsiveness of young Herring Gulls to stimuli from their own and other species: effects of training with food. Can. J. Zool. 57: 1452-1457.

Foxall, R. A. 1979. Presumed hybrids of the Herring Gull and the Great Black-backed Gull. Am. Birds 33: 838.

Gilman, A. P., D. B. Peakall, D. J. Hallett, G. A. Fox and R. J. Norstrom. 1979. Herring Gulls (Larus argentatus) as monitors of contamination in the Great Lakes. Pp. 280-290 in Animals as Monitors of Environmental Pollutants. Proc. Symp. Environ. Pollut., Natl. Acad. Sci.

Henley, C. A. 1979. Factors influencing egg loss and chick mortality in Larus argentatus and L. fuscus. Ph.D. thesis, Univ. Oxford/England.

Kallander, H. 1979. Labben pa truten och truten pa labben eller hunden pa katten och katten pa hunden del 2. [Secondary kleptoparasitism by gulls on Arctic Skuas.] Anser 18: 299. [In Swedish with English summary.]

Karmborg, T. 1979. Trutar dodar koltrast. [Herring Gull, Larus argentatus, and Great Black-backed Gull, L. marinus, killing Blackbird.] Var Fagelvarld 38: 50. [In Swedish with English summary.]

Kempf, C., J. Lavergne, B. Sittler and F. Steimer. 1979. Tentative de nidification du Goeland argente Larus argentatus sur le Rhin francais. Alauda 47: 37-38.

Lebeurier, E. 1979. Le Goeland argente est-il fidele a son lieu de nidification? Oiseau Rev. Fr. Ornithol. 49: 233-234.

Lustick, S., B. Battersby and M. Kelty. 1979. Effects of isolation on juvenile Herring Gull energetics and behavior. Ecology 60: 673-678.

Mille, J.L. 1979. A propos du comportement predateur du Goeland argente. [Regarding the predatory behavior of the Herring Gull.] Alauda 47:40.

Miller, D. S., D. B. Peakall and W. B. Kinter. 1979. Grude oil ingestion impairs osmo-regulatory and nutrient transport in Herring Gulls. Fed. Am. Soc. Exp. Biol. 61st Annu. Meet., Chicago, 1977. Fed. Proc. 36: 1008.

Monaghan, P. 1979. Aspects of the breeding biology of Herring Gulls Larus argentatus in urban colonies. Ibis 121: 475-481.

Monaghan, P. and N. Duncan. 1979. How old is a Herring Gull? Not necessarily as old as it looks. Brit. Birds 72: 100-103.

Nunnally, S., D. Nunnally, R. Needham and R. Lennon. 1979. Nocturnal feeding of gulls at a lighted pier. Chat 43: 63.

Patton, S. R. 1979. Short and long term effects of Red Fox nocturnal predation on the nesting success of colonial breeding Herring and Ring-billed Gulls. M.S. thesis, N. Ill. Univ./Dekalb, IL. vi and 107 pp.

Pierotti, R. 1979. The behavior of Herring and Great Black-backed Gulls in a mixed colony. (Abstract only.) Pac. Seabird Group Bull. 6: 46.

Radford, D. J. 1979. Gull deaths on the North Ulster coast, February 1978. Irish Nat. J. 19: 391-395.

Sobey, D. G. and J. B. Kenworthy. 1979. The relation between Herring Gulls and the vegetation of their breeding colonies. J. Ecol. 67: 469-496.

Southern, L. K. and W. E. Southern. 1979. Absence of nocturnal predator defense mechanisms in breeding gulls. Proc. 1978 Conf. Colonial Waterbird Group 2: 157-162.

Stelfox, H. A. and G. J. Brewster. 1979. Colonial-nesting Herring Gulls and Common Terns in northeastern Saskatchewan. Can. Field-Nat. 93: 132-138.

Szaro, R. C., N. C. Coon and E. Kolbe. 1979. Pesticide and PCB of Common Eider, Herring Gull and Great Black-backed Gull eggs. Bull. Environ. Contam. Toxicol. 22: 394-399.

Szokalski, M. 1979. Legi mew srebrzystych (Larus argentatus) na Wolinie. [Breeding of Herring Gull (Larus argentatus) on Wolin Island.] Notatki Ornitol. 20: 51-52. [In Polish with English summary.]

Taylor, G. K. 1979. Playful interactions between resident Herring Gull Larus argentatus and migrating birds over the Isle of May. Ibis 121: 516-517.

Vauk-Hentzelt, E. 1979. Zur Bestimmung der Cestoden von Silbermowen (Larus argentatus) und Dreizenmowen (Rissa tridactyla) aus dem Berich der Insel Helgoland. Abh. Geb. Vogelkd. 6: 153-161.

Weseloh, D. V., P. Mineau and D. J. Hallett. 1979. Organochlorine contaminants and trends in reproduction in Great Lakes Herring Gulls, 1974-1978. Trans. N. Am. Wildl. Nat. Resour. Conf. 44: 543-557.

1978

Blokpoel, H. and P. M. Fetterolf. 1978. Colonization by gulls and terns of the Eastern Headland, Toronto Outer Harbour. Bird-Banding 49: 59-65.

Blokpoel, H. and G. B. McKeating. 1978. Fish-eating birds nesting in Canadian Lake Erie and adjacent waters. Can. Wildl. Serv. Prog. Notes 87. 12 pp.

Burger, J. and J. Shisler. 1978a. Nest site selection and competitive interactions of Herring and Laughing Gulls in New Jersey. Auk 95: 252-266.

_____. 1978b. The effects of ditching a salt marsh on colony and nest site selection by Herring Gulls (Larus argentatus). Am. Midl. Nat. 100: 54-63.

Coulson, J. and P. Monaghan. 1978. Herring Gulls move into town. New Sci. 79: 456-458.

de Wijs, W. R. J. 1978. Sexual dimorphism and some other aspects of the breeding biology of Herring and Lesser Black-backed Gulls on Skomer Island. Thesis, Inst. Taxonomische. Zool., Univ. Amsterdam. 29 pp.

Dexter, R. W. 1978. Recoveries of Herring Gulls banded at Cape Ann, Massachusetts. N. Am. Bird Bander 3: 52-54.

Duncan, N. 1978. The effects of culling Herring Gulls (Larus argentatus) on recruitment and population dynamics. J. Appl. Ecol. 15: 697-713.

Edholm, M. 1978. Notskrika anfallen och dodad av Gratrutar. [Herring Gulls attacking and killing migrating Jay.] Var Fagelvarld 37: 258-259. [In Swedish with English summary.]

Erwin, R. M. 1978a. Population and colony site dynamics in selected Massachusetts waterbirds. Proc. 1977 Conf. Colonial Waterbird Group 1: 19-25.

Fisher, D. J. 1978. First record of Black-headed Gull Larus ridibundus and third record of Herring Gull Larus argentatus for South America. Bull. Br. Ornithol. Club 98: 113.

Fisk, E. J. 1978c. The growing use of roofs by nesting birds. Bird-Banding 49: 134-141.

Fox, G. A., A. P. Gilman, D. B. Peakall and F. W. Anderka. 1978. Behavioral abnormalities of nesting Lake Ontario Herring Gulls. J. Wildl. Manage. 42: 477-483.

Fritze, E. 1978. Ringmaerkning af Solvmage (Larus argentatus) og Svartbag (Larus marinus) pa kobenhavns Kommunale Losseplads, Amager i 1970-71. Feltornithologen 20: 7-9.

Galusha, J. G., Jr. and C. J. Amlaner, Jr. 1978. The effects of diurnal and tidal periodicities in the numbers and activities of Herring Gulls Larus argentatus in a colony. Ibis 120: 322-328.

Geroudet, P. 1978. Attaque d'un Grebé castagneux par un Goeland argente. Nos Oiseaux 34: 358.

Gigon, M. 1978. Tentative de nidification du Goeland argente sur le Lac de Bienne. Nos Oiseaux 34: 352-353.

Gilman, A. P., D. J. Hallett, G. A. Fox, L. J. Allan, W. J. Learning and D. B. Peakall. 1978. Effects of injected organochlorines on naturally incubated Herring Gull eggs. J. Wildl. Manage. 42: 484-493.

Goethe, G. 1978. Danische Ostsee-Silbermowe, Larus argentatus, Brutvogel auf der Insel Trischen (Nordsee). Vogelwarte 29: 277-279. [In German.]

Goldspink, G., C. Mills and K. Schmidt-Nielsen. 1978. Electrical activity of the pectoral muscles during flapping flight in the Herring Gull (Larus argentatus). Experientia 34: 862-865.

Harris, M. P., C. Morley and G. H. Green. 1978. Hybridization of Herring and Lesser Black-backed Gulls in Britain. Bird Study 25: 161-166.

Haymes, G. T. and H. Blokpoel. 1978a. Reproductive success of larids nesting on the eastern headland of the Toronto Outer Harbour in 1977. Ont. Field Biol. 32: 1-17.

Hume, R. A. 1978. Variations in Herring Gulls at a Midland roost. Brit. Birds 71: 338-345.

Ingolfsson, A. and B. T. Estrella. 1978. The development of shell-cracking behavior in Herring Gulls. Auk 95: 577-579.

Johansen, O. 1978. [DDE, PCB and Hg in eggs of Larus marinus and Larus argentatus from colonies in More and Romsdal.] Stavenger Mus. Arbok 1978: 67-71. [In Norwegian with English summary.]

Joiris, C. 1978. Le Goeland argente portugais (Larus argentatus lusitanius), nouvelle forme de Goeland argente a pattes jeunes. Aves 15: 17-18.

Kanwisher, J. W., T. C. Williams, J. M. Teal and K. O. Lawson, Jr. 1978. Radiotelemetry of heart rates from free-ranging gulls. Auk 95: 288-293.

Kempf, C., J. Lavergne, B. Sittler and F. Steimer. 1978. Tentative de nidification du Goeland argente en Alsace. Ornithol. Beob. 75: 274-275.

King, B. 1978. Herring Gulls obtaining mussels by flight-plunging and submerging. Brit. Birds 71: 129-130.

Kosonen, L. and R. Makinen. 1978. Harmaalokin pesinta rakennukissa. [Herring Gulls nesting on a building.] Ornis Fenn. 55: 87. [In Finnish with English summary.]

Kumari, E. 1978. On the distribution dynamics of the Herring Gull in the east Baltic area within the past 125 years. Ornitol. Kogumik 9: 11-43. [In English with Estonian and Russian summaries.]

Lustick, S., B. Batersby and M. Kelty. 1978. Behavioral thermoregulation: orientation toward the sun in Herring Gulls. Science 200: 81-83.

Madge, S. C. 1978. Apparent immature Glaucous X Herring Gull hybrids. Brit. Birds 71: 272-274.

Miller, D. S., D. B. Peakall and W. B. Kinter. 1978. Ingestion of crude oil: sublethal effects in Herring Gull chicks. Science 199: 315-317.

Moller, A. P. 1978. Magernes Larinae yngleudbredelse, bestandsstorelse og -aendringer i Danmark, med supplerende om forholdene i det ovrige Europa. [Distribution, population size and changes in gulls Larinae breeding in Denmark, with a review of the situation in other parts of Europe.] Dan. Ornithol. Foren. Tidsskr. 72: 15-39.

Monaghan, P. 1978. The role of refuse tips as a winter food supply for Herring Gulls. (Abstract only.) Ibis 120: 115.

Montevecchi, W. 1978. Tonic immobility responses of Herring Gull chicks. Condor 80: 248-249.

Morrison, R. I. G. 1978. Herring Gulls stealing prey from Parasitic Jaegers. Wilson Bull. 90: 649-650.

Mudge, G. P. 1978a. Ecological studies of Herring Gulls (Larus argentatus Pont.) and other Larini in an urban environment. Ph.D. thesis, Univ. Coll./Cardiff, Wales.

_____. 1978b. The gull increase, as illustrated by studies in the Bristol Channel. Ibis 120: 115-116.

Mudge, G. P. and P. N. Ferns. 1978. Durability of patagial tags on Herring Gulls. Ringing Migr. 2: 42-45.

Norstrom, R. J., D. J. Hallett and R. A. Sonstegard. 1978. Coho salmon (Oncorhynchus kisutch) and Herring Gulls (Larus argentatus) as indicators of organochlorine contamination in Lake Ontario. J. Fish. Res. Board Can. 35: 1401-1409.

Parsons, J. and N. Duncan. 1978. Recoveries and dispersal of Herring Gulls from the Isle of May. J. Anim. Ecol. 47: 993-1005.

Patten, S. M., Jr. and L. R. Patten. 1978. Effects of petroleum exposure on the breeding ecology of the Gulf of Alaska Herring Gull group (Larus argentatus x Larus glaucescens) and reproductive ecology of large gulls in the northeast Gulf of Alaska. Pp. 151-309 in Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators, Vol. 7. NOAA, Environ. Res. Lab., Boulder, CO.

Patton, S. R. and W. E. Southern. 1978. The effect of nocturnal red fox predation on the nesting success of colonial gulls. Proc. 1977 Conf. Colonial Waterbird Group 1: 91-101.

Peakall, D. B., D. S. Miller, G. Lambert, J. Kahn, and W. B. Kinter. 1978. Effects of crude oil fractions on Herring Gull chicks (Larus argentatus). Bull. Mt. Desert Isl. Biol. Lab. 18: 74-75.

Plath, L. 1978. Eine weitere Binnenlandbrut der Silbermowe. Falke 25: 136-138.

Ryder, J. P. and T. R. Carroll. 1978. Reproductive success of Herring Gulls on Granite Island, northern Lake Superior, 1975 and 1976. Can. Field-Nat. 92: 51-54.

Ryder, R. A. 1978. Gulls in Colorado, their distribution, status, and movements. Proc. 1977 Conf. Colonial Waterbird Group 1: 3-9.

Ryttman, H., H. Tegelstrom and H. Jansson. 1978. Egg dimensions of Herring Gulls *Larus argentatus* and Lesser Black-backed Gulls *L. fuscus*. Ibis 120: 353-356.

Spitzer, G. 1978. Zur Reproduktionsrate der Mittelmeer-Silbermowe (*Larus argentatus michahellis*). [On the reproduction rate of the Yellow-legged Herring Gull (*Larus argentatus michahellis*).] Vogelwarte 29: 272-275. [In German with English summary.]

Tatarincova, I. P. and F. N. Shklyarevich. 1978. [The head length as a diagnostic feature for sex determination in the Laridae.] Zool. Zh. 57: 1446-1447. [In Russian with English summary.]

Threlfall, W. 1978. Dispersal of Herring Gulls from the Witless Bay Sea Bird Sanctuary, Newfoundland. Bird-Banding 49: 116-124.

Threlfall, W. and D. D. Jewer. 1978. Notes on the standard body measurements of two populations of Herring Gulls (*Larus argentatus*). Auk 95: 749-753.

Tinbergen, N. 1978. [An uncomfortable co-existence.] Levende Nat. 81: 11-21. [In Dutch.]

van Zurk, H. 1978. Attaque d'un Pigeon domestique par un Goeland argente. Alauda 46: 182-183.

von Rautenfeld, D. V. 1978. Bemerkungen zur austauschbarkeit von keuken der Silbermowe *Larus argentatus* nach der ersten lebenswoche. [Comments on the exchangability of Herring Gull chicks *Larus argentatus* after the first week of life.] Z. Tierpsychol. 47: 180-181. [In German with English summary.]

Walters, J. 1978. The primary moult of four gull species near Amsterdam. Ardea 66: 32-47.

Werder, J-P. 1978. Nidification du Goeland argente, *Larus argentatus*, aux Grangettes (Noville). Nos Oiseaux 34: 353.

1977

Allen, L. J. 1977. The comparative feeding ecology relative to population dynamics of the Herring and Ring-billed Gulls (*Larus argentatus* and *L. delawarensis*) and some comparisons with the Caspian Tern. M.S. thesis. Queens Univ./Kingston, Ontario. 196 pp.

Arujo, J., J. Munoz-Cobo and F. J. Purroy. 1977. Las rapaces y aves marinas del archipelago de Cabrera. Madrid Inst. Nac. Conserv. Nat., Nat. Hispanica 12. 94 pp. [In Spanish.]

Armistead, H. T. 1977. American Oystercatcher and Herring Gull breed in Dorchester County. Md. Birdlife 33: 111-112.

Battersby, B. and S. Lustick. 1977. The effects of wind, insulation, and ambient temperature on the energetics of the Herring Gull (Larus argentatus). Am. Zool. 17: 929.

Blokpoel, H. 1977. Gulls and terns nesting in northern Lake Ontario and the upper St. Lawrence River. Can. Wildl. Serv. Prog. Notes 75. 12 pp.

Burger, J. 1977a. Nesting behavior of Herring Gulls: invasion into Spartina salt marsh areas of New Jersey. Condor 79: 162-169.

_____. 1977b. Role of visibility in nesting behavior of Larus gulls. J. Comp. Physiol. Psychol. 91: 1347-1358.

Chamberlin, M. L. 1977a. Herring Gull dump nests? Jack-Pine Warbler 55: 97-99.

_____. 1977b. Relationships between egg pigmentation and hatching sequence in the Herring Gull. Auk 94: 363-365.

Donahue, P. K. 1977. Reddish Egret and Herring Gull in Caribbean Colombia. Am. Birds 31: 286.

Duncan, W. N. M. and P. Monaghan. 1977. Infidelity to the natal colony by breeding Herring Gulls. Ringing Migr. 1: 166-172.

Eggers, H., R. Berling, F. Riemer and A. Grisk. 1977. Uber den gehalt von DDT, DDE-metaboliten und Polychlorierten Biphenylen in eiern der Silbermowe (Larus argentatus). [On the amounts of DDT, DDE-metabolites and polychlorinated biphenyls in the eggs of Larus argentatus.] Beitr. Vogelkd. 23: 1-8. [In German.]

Fernandez, O. 1977. Le mimetisme du nid du Goeland argente a pieds jaunes Larus argentatus michahellis. Alauda 45: 242-243. [In French.]

Fetterolf, P. M. and H. Blokpoel. 1977. Terns and gulls nesting on Toronto's eastern headland. Ont. Field Biol. 31: 51-52.

Gilbertson, M. and G. A. Fox. 1977. Pollutant-associated embroyonic mortality of Great Lakes Herring Gulls. Environ. Pollut. 12: 211-216.

Gilman, A. P., G. A. Fox, D. B. Peakall, S. M. Teeple, T. R. Carroll and G. T. Haymes. 1977. Reproductive parameters and egg contaminant levels of Great Lakes Herring Gulls. J. Wildl. Manage. 41: 458-468.

Hallett, D. J., R. J. Norstrom, F. I. Onuska, and M. E. Comba. 1977a. Mirex, chlordane, dieldrin, DDT and PCBs: metabolites and photoisomers in Lake Ontario Herring Gulls. Pp. 183-192 in G. W. Ivie and H. W. Dorough (eds.). Fate of pesticides in large animals. Academic Press, New York.

_____. 1977b. Analysis of polynuclear aromatic hydrocarbons and organochlorine pollutants in Great Lakes Herring Gulls by high resolution gas chromatography. Proc. Second Internatl. Symposium on Glass Capillary Chromatography. Hindelang, Germany.

Hansen, K. 1977. Solvmage angriber og draeber vokesen Stormmage. Feltornithologen 19: 42-43.

Haymes, G. T. and R. D. Morris. 1977. Brood size manipulations in Herring Gulls. Can. J. Zool. 55: 1762-1766.

Hildebrandt, T. D. and L. D. Fay. 1977. Chemical residues in Herring Gull eggs from the Great Lakes. Mich. Dep. Nat. Resour. Wildl. Div. Rep. 2766.

Hily, C. 1977. Observations sur la limite sud de reproduction du Goeland argente a pieds roses *Larus argentatus argenteus*. Alauda 45: 126-127. [In French.]

Houde, P. A. 1977a. Low productivity of terns on Hicks Island, 1975. Proc. Linn. Soc. N. Y. 73: 49-57.

_____. 1977b. Gull-tern interactions on Hicks Island, 1975. Proc. Linn. Soc. N. Y. 73: 58-64.

Lauro, A. J. 1977. Gull predation on an ant swarm. Kingbird 27: 87-88.

Ljunggren, L. 1977. Havstruten soker sig till Olandsbron. Fauna Flora 72: 175-181. [In Swedish.]

McGill, P. A. 1977. Breeding ecology and competition between Great Black-backed and Herring Gulls. M.S. thesis, Cornell Univ./Ithaca, NY.

Meeth, P. 1977. Notes on sea-birds 56. Herring Gulls *Larus argentatus* in Kenya. Ardea 65: 89.

Miller, D. S., J. Kahn, E. Shaeen, D. B. Peakall and W. B. Kinter. 1977. Effects of ingestion of a weathered crude oil on immature Black Guillemots, *Cepphus grylle*, and Herring Gulls, *Larus argentatus*. Bull. Mt. Desert Isl. Biol. Lab. 17: 40-42.

Monaghan, P. 1977. The utilization of urban resources by the Herring Gull (*Larus argentatus*). Ph.D. thesis, Univ. Durham/Durham, England. 228 pp.

Monaghan, P. and J. C. Coulson. 1977. Status of large gulls nesting on buildings. Bird Study 24: 89-104.

Morris, R. D. and G. T. Haymes. 1977. The breeding biology of two Lake Erie Herring Gull colonies. Can. J. Zool. 55: 796-805.

Munro, J. and J. Bedard. 1977. Gull predation and creching behaviour in the Common Eider. J. Anim. Ecol. 46: 799-810.

Nicolau-Guillaumet, P. 1977. Mise au point et reflexions sur la repartition des Goelands argentes Larus argentatus de France. Alauda 45: 53-73. [In French with English summary.]

Pasquier, R. F. 1977. Herring Gull eating bayberry. Wilson Bull. 89: 338.

Patten, S. M., Jr. and L. R. Patten. 1977. Evolution, pathobiology and breeding ecology of the Gulf of Alaska Herring Gull group (Larus argentatus X Larus glaucescens). Pp. 446-595 in Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators, Vol. 12. NOAA, Environ. Res. Lab., Boulder, CO.

Schreiber, E. A. and R. W. Schreiber. 1977. Gulls wintering in Florida: Christmas Bird Count analysis. Fla. Field Nat. 5: 35-40.

Shugart, G. W. 1977a. A method for externally sexing gulls. Bird-Banding 48: 118-121.

_____. 1977b. Resident Red Fox predation upon an island gull colony. Jack-Pine Warbler 55: 199-205.

Shugart, G. W. and W. C. Scharf. 1977. Predation and dispersion of Herring Gull nests. Wilson Bull. 89: 472-473.

Shugart, G. W. and W. E. Southern. 1977. Close nesting, a result of polygyny in Herring Gulls. Bird-Banding 48: 276-277.

Sobey, D. G. 1977. The defecating behaviour of Herring Gulls, Larus argentatus. Ibis 119: 515-520.

Teeple, S. M. 1977. Reproductive success of Herring Gulls nesting on Brothers Island, Lake Ontario, in 1973. Can. Field-Nat. 91: 148-157.

van Rhijn, J. G. 1977. The patterning of preening and other comfort behaviour in a Herring Gull. Behaviour 63: 71-109.

Verbeek, N. A. M. 1977a. Interactions between Herring and Lesser Black-backed Gulls feeding on refuse. Auk 94: 726-735.

_____. 1977b. Age differences in the digging frequency of Herring Gulls on a dump. Condor 79: 123-125.

_____. 1977c. Comparative feeding behavior of immature and adult Herring Gulls. Wilson Bull. 89: 415-421.

Verbeek, N. A. M. 1977d. Timing of primary moult in adult Herring Gulls and Lesser Black-backed Gulls. J. Ornithol. 118: 87-92.

_____. 1977e. Comparative feeding ecology of Herring Gulls Larus argentatus and Lesser Black-backed Gulls Larus fuscus. Ardea 65: 25-42.

Wietfeld, J. 1977. Untersuchungen an Speiballen der Silbermowe (Larus argentatus) im Naturschutzgebiet Grosser Knechtsand (Elbe-Weser-Mundung). [Studies on food selection in Herring Gulls (Larus argentatus) on the Grosser Knechtsand, Elbe-Weser-estuary, German bight.] Vogelwelt 98: 221-229. [In German with English summary.]

Williams, B. M., D. W. Richards, D. P. Stephens and T. Griffiths. 1977. The transmission of S. livingstoni to cattle by the Herring Gull (Larus argentatus). Vet. Rec. 100: 450-451.

1976

Anderson, D. W. and J. J. Hickey. 1976. Dynamics of storage of organochlorine pollutants in Herring Gulls. Environ. Pollut. 10: 183-200.

Andrle, R. F. 1976. Herring Gulls breeding on cliff at Niagara Falls, New York. Can. Field-Nat. 90: 480-481.

Anon. 1976. Gulls nesting on buildings. Brit. Trust Ornithol. News 79: 3-4.

Banaja, A. A., J. L. James and J. Riley. 1976. Some observations on egg production and autoreinfection of Reighardia sternae (Diesing, 1864), a pentastomid parasite of the Herring Gull. Parasitology 72: 81-91.

Bates, D. J., H. M. S. Blair and I. H. J. Lyster. 1976. First recorded erythristic eggs of Arctic Skua and Herring Gull in Britain. Scott. Birds 9: 143-147.

Baudinette, R. V., J. P. Loveridge, K. J. Wilson, C. D. Mills and K. Schmidt-Nielsen. 1976. Heat loss from feet of Herring Gulls at rest and during flight. Am. J. Physiol. 230: 920-924.

Buck, O. D., C. L. Cooper and J. L. Crites. 1976. Helminth parasites of the Herring Gull, Larus argentatus, from the Bass Island region of western Lake Erie. Proc. Helminthol. Soc. Wash. 43: 233-234.

Chabrzyk, G. and J. C. Coulson. 1976. Survival and recruitment in the Herring Gull Larus argentatus. J. Anim. Ecol. 45: 187-203.

Coulson, J. C. 1976. An evaluation of the reliability of rings used on Herring and Lesser Black-backed Gulls. Bird Study 23: 21-26.

Dunn, E. H. 1976. The development of endothermy and existence energy expenditure in Herring Gull chicks. Condor 78: 493-498.

Ferns, P. N. and G. P. Mudge. 1976. Breeding densities of Herring and Lesser Black-backed Gulls on Steep Holm. Proc. Bristol Nat. Hist. Soc. 35: 85-97.

Flegg, J. J. M. and R. A. Morgan. 1976. Mortality in British gulls. Ringing Migr. 1: 65-74.

Fritze, E. 1976. Ringing of Herring Gulls (*Larus argentatus*) and Greater Black-backed Gulls (*Larus marinus*) on Copenhagen dump. Ring 8: 22-24.

Giroux, J. F. 1976. Herring Gull trapped in the ice. Can. Field-Nat. 90: 466.

Greenhalgh, M. E. and M. S. Greenwood. 1976. Observations on the establishment of a Herring Gull and Lesser Black-backed Gull colony. Seabird Rep. 5: 21-27.

Greve, K. 1976. Zur Vorkommen der Silbermowe (*Larus argentatus*) bei Braunschwieg. Ornithol. Mitt. 28: 152-153.

Hallett, D. J., R. J. Norstrom, F. I. Onuska, M. E. Comba, and R. Sampson. 1976. Mass spectral confirmation and analysis by the Hall detector of mirex and photomirex in Herring Gulls from Lake Ontario. J. Agric. Food Chem. 24: 1189-1193.

Irwin, S. W. B. and H. J. Prentice. 1976. The parasitic fauna in the digestive tracts of three Herring Gulls, *Larus argentatus*, taken from Strangford Lough. Irish Nat. J. 18: 281-282.

Isenmann, P. 1976. Contribution a l'etude de la biologie de reproduction et de l'ecologie du Goeland argente a pieds jaunes (*Larus argentatus michahellis*) en Camargue. Terre Vie 30: 551-563. [In French with English summary.]

Kadlec, J. A. 1976. A re-evaluation of mortality rates in adult Herring Gulls. Bird-Banding 47: 8-12.

King, B. 1976. Further records of foot-paddling by gulls on grassland. Brit. Birds 69: 180-181.

Kruuk, H. 1976. The biological function of gulls' attraction towards predators. Anim. Behav. 24: 146-153.

Kumerloeve, H. 1976. Brandgansert (*Tadorna tadorna*) bei Flugabwehr und Verfolgung einer beutesuchenden Silbermowe (*Larus argentatus*). Ornithol. Mitt. 28: 216.

Lawson, K., J. Kanwisher and T. C. Williams. 1976. A UHF radiotelemetry system for wild animals. J. Wildl. Manage. 40: 360-362.

Ludwig, F. C. 1976. Toy balloon causes gull mortality. Jack-Pine Warbler 54: 179.

Martelli, C. 1976. Gabbiani reali Larus argentatus presenti neu' ex aeroporto di Centocelle (Roma). Riv. Ital. Ornitol. 46: 274-275.

Moore, F. R. 1976. The dynamics of seasonal distribution of Great Lakes Herring Gulls. Bird-Banding 47: 141-159.

Morris, R. D. and R. A. Hunter. 1976. Monitoring incubation attentiveness of ground-nesting colonial seabirds. J. Wildl. Manage. 40: 354-357.

Noseworthy, C. M. and J. Lien. 1976. Ontogeny of nesting habitat recognition and preference in neonatal Herring Gull chicks, Larus argentatus Pontoppidan. Anim. Behav. 24: 637-651.

Parsons, J. 1976a. Factors determining the number and size of eggs laid by the Herring Gull. Condor 78: 481-492.

______. 1976b. Nesting density and breeding success in the Herring Gull Larus argentatus. Ibis 118: 537-546.

Parsons, J., G. Chabrzyk and N. Duncan. 1976. Effects of hatching date on post-fledging survival in Herring Gulls. J. Anim. Ecol. 45: 667-675.

Patten, S. M., Jr. 1976. Sympatry and interbreeding of Herring and Glaucous-winged Gulls in southern Alaska. (Abstract only.) Pac. Seabird Group Bull. 3: 25-26.

Patten, S. M., Jr. and L. R. Patten. 1976. Breeding ecology of the Gulf of Alaska Herring Gull group. Pp. 271-368 in Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators, Vol. 2. NOAA, Environ. Res. Lab., Boulder, CO.

Schmidt-Nielsen, B. 1976. Intracellular concentrations of the salt gland of the Herring Gull Larus argentatus. Am. J. Physiol. 230: 514-521.

Sobey, D. 1976. The effect of Herring Gulls on the vegetation of the Isle of May. Bot. Soc. Edinb. Trans. 42: 469-485.

Spitzer, G. 1976. Zur Ernahrung gelbfussiger Silbermowen (Larus argentatus michahellis) in der Adria und im Binnenland. [On the nutrition of the yellow-legged Herring Gull (Larus argentatus michahellis) in the Adriatic area and in the inland.] Vogelwarte 28: 298-306. [In German with English summary.]

Tolonen, K. E. 1976. Behavioral ecology of Larus argentatus and Larus marinus: age specific differential in feeding efficiency, a probable factor in the evolution of delayed breeding. Ph.D. thesis, Yale Univ./New Haven, CT. 275 pp.

Williams, B. M., D. W. Richards and J. Lewis. 1976. Salmonella infection in the Herring Gull (Larus argentatus). Vet. Rec. 98: 51.

Winkel, W. 1976. Experimentelle Freiland-Untersuchungen zum Bruttrieb der Silbermowe, (Larus argentatus). Uber den Einfluss von Fleckung, Farbe, Grosse form, Gewicht, und Zahl der Eier. [Experimental study of the brooding drive of the Herring Gull (Larus argentatus) in the wild. On the influence of the marking, colour, size, shape, weight, and number of the eggs.] Vogelwarte 28: 212-229. [In German with English summary.]

1975

Anon. 1975a. Herring Gulls survive after inadvertent burial in an ice store. Sea Swallow 24: 63.

_____. 1975b. Herring Gull wing tagging. J. Gloucester. Nat. Soc. 26: 124.

Armistead, H. T. 1975. Breeding of Greater Black-backed Gull, Herring Gull, and Gadwall at Smith Island, Maryland. Md. Birdlife 31: 131-134.

Banaja, A. A., J. L. James and J. Riley. 1975. An experimental investigation of a direct life-cycle in Reighardia sternae (Diesing 1864), a pentastomid parasite of the Herring Gull (Larus argentatus). Parasitology 71: 493-503.

Barth, E. K. 1975a. Moult and taxonomy of the Herring Gull Larus argentatus and the Lesser Black-backed Gull L. fuscus in northwestern Europe. Ibis 117: 384-387.

_____. 1975b. Taxonomy of Larus argentatus and Larus fuscus in northwestern Europe. Ornis Scand. 6: 49-63.

Bock, F. 1975. Angaben zur Brutbiologie der Mittelmeersilbermowe (Larus argentatus michahellis). Egretta 18: 65-66.

Chamberlin, M. L. 1975. Breeding ecology of Herring Gulls on an island in northern Lake Huron. M.S. thesis, Central Mich. Univ./Mt. Pleasant, MI. iv and 75 pp.

Cuthbert, F. J. and W. E. Southern. 1975. A method for marking young gulls for individual recognition. Bird-Banding 46: 252-253.

Davis, J. W. F. 1975a. Specialization in feeding location by Herring Gulls. J. Anim. Ecol. 44: 795-804.

_____. 1975b. Age, egg-size and breeding success in the Herring Gull Larus argentatus. Ibis 117: 460-473.

Evans, R. M. 1975. Responsiveness of young Herring Gulls to adult "mew" calls. Auk 92: 140-143.

Fox, G. A., A. P. Gilman, D. J. Hallett, R. J. Norstrom, F. I. Onuska and D. B. Peakall. 1975. Herring Gull productivity and toxic chemicals in the Great Lakes in 1975. Toxic Chemicals Div., Can. Wildl. Serv. Manuscript Rep. 34. 35 pp.

Franchimont, J. 1975. Un important dortoir de mouettes rieuses (Larus ridibundus) et de goelands argentes (Larus argentatus) sur la Meuse, a la frontiere belgo-nederlandaise. Aves 12: 286-287.

Galusha, J. G. 1975. Social behaviour of Larus argentatus and Larus fuscus. Ph.D. thesis, Univ. Oxford/Oxford, England. 135 pp.

Groves, S. and G. Peabody. 1975. Dead Herring Gull is found inside dead Goosefish. Bird-Banding 46: 76.

Harrington, B. A. 1975. Pelagic gulls in winter off southern California. Condor 77: 346-350.

Harris, J. T. and S. W. Matteson. 1975. Gulls and terns as indicators of man's impact upon Lake Superior. Univ. Wisc. Sea Grant Program Tech. Rep. 227. 45 pp.

Hartwig, E. and M. Sohl. 1975. Zur Nahrung der Silbermowe (Larus argentatus) auf der Norseeinsel Sylt. I. Zusammensetzung der Nahrung. [On the feeding ecology of the Herring Gull (Larus argentatus) on the island of Sylt (North Sea). I. Composition of food.] Zool. Anz. 194: 350-360. [In German with English summary.]

Haycock, K. A. and W. Threlfall. 1975. The breeding biology of the Herring Gull in Newfoundland. Auk 92: 678-697.

Helle, E. 1975. Sammakot harmaalokin ravintona. [Frogs as food of Herring Gulls.] Ornis Fenn. 52: 32-33. [In Finnish with English summary.]

Hesselwood, J. 1975. A report on the fishing line enquiry. Naturalist (Leeds) 929: 70.

Hoogerwerf, A. 1975. Zilvermeeuwen en de gerine aanwas bij Eiders en Bergeenden op Vlieland. Piper 13: 117-124. [In Dutch with English summary.]

Kadlec, J. A. 1975. Recovery rates and loss of aluminum, titanium, and incoloy bands on Herring Gulls. Bird-Banding 46: 230-235.

Kallander, H. 1975. [Piracy by Herring Gulls Larus argentatus on Whooper Swans Cygnus cygnus.] Anser 14: 29-38. [In Swedish with English summary.]

King, B. 1975. Gull behaviour during sea-mist in the Bristol Channel. Bristol Ornithol. 8: 111-112.

Kury, C. R. and M. Gochfeld. 1975. Human interference and gull predation in cormorant colonies. Biol. Conserv. 8: 23-34.

Monaghan, P. 1975. The rooftop gull. Wildlife (Lond.) 17: 170-172.

Moore, F. R. 1975. Influence of solar and geomagnetic stimuli on the migratory orientation of Herring Gull chicks. Auk 92: 655-664.

O'Meara, M. 1975. Building-nesting Herring Gulls in County Waterford. Irish Nat. J. 18: 152-153.

Owen, B. A. 1975a. Inland breeding by gulls in Gloucester 1974. J. Gloucester Nat. Soc. 26: 35-36.

_____. 1975b. Inland breeding by gulls in Gloucester 1975. J. Gloucester Nat. Soc. 26: 107-108.

_____. 1975c. Inland breeding by gulls in Gloucester. J. Gloucester Nat. Soc. 26: 249-250.

Parnell, J. F. and R. F. Soots. 1975b. Herring and Great Black-backed Gulls nesting in North Carolina. Auk 92: 154-157.

Parsons, J. 1975a. Seasonal variation in the breeding success of the Herring Gull: an experimental approach to pre-fledging success. J. Anim. Ecol. 44: 553-573.

_____. 1975b. Asynchronous hatching and chick mortality in the Herring Gull *Larus argentatus*. Ibis 117: 517-520.

Scharf, W. C. and G. Shugart. 1975. Nestling banding: an index of reproductive success in a Herring Gull colony. Inl. Bird Banding News 47: 125-129.

Schwarz, D. and H. W. Nehls. 1975. Silbermowen (*Larus argentatus* L.) ohne Salzdrusen (Glandulae supraorbitales) im Freilandversuth. Beitr. Vogelkd. 21: 305-311.

Sobey, D. G. 1975. The relationship between Herring Gulls and the vegetation of their nesting and roosting sites. Ph.D. thesis, Univ. Aberdeen/Aberdeen, Scotland.

Spaans, M. J. and A. L. Spaans. 1975. Enkele gegevens over de broed biologie van de Zilvermeeuw *Larus argentatus* op Terschelling. [Some data on the breeding biology of the Herring Gull *Larus argentatus* on the Dutch Frisian Island of Terschelling.] Limosa 48: 1-39. [In Dutch with English summary.]

Tuaev, D. G., V. V. Vasil'ev and F. A. Abushev. 1975. [On elucidation of the causes of death of Larus argentatus in the Caspian Sea.] Pp. 237-239 in A. I. Cherepanov (ed.). [Transcontinental connections of migratory birds and their role in the distribution of arboviruses.] Akad. Nauk SSSR. Sibirskoe Otdelenie, biologicheskii Institut. Izdatel'stvo 'Nauka', Novosibirsk. [In Russian with English summary.]

Van den Steen, J. 1975. De problematiek antrent subspecifieke determinatie van geelpoot-zilvermeeuwen. Wielewaal 41: 359-364.

1974

Barth, E. K. 1974a. Svartbak druknet Gramake. [Great Black-backed Gull drowns a Herring Gull.] Fauna 27: 95-96. [In Norwegian with English summary.]

______. 1974b. Raser av Sildemake og Gramake i Norge. [Subspecies of the Lesser Black-backed Gull and the Herring Gull in Norway.] Fauna 27: 236-237. [In Norwegian with English summary.]

Baudinette, R. V. and K. Schmidt-Nielsen. 1974. Energy cost of gliding flight in Herring Gulls. Nature (Lond.) 248: 83-84.

Britton, P. L. 1974. Broad-billed Sandpipers and Herring Gulls wintering on the North Kenya coast. Bull. East Afr. Nat. Hist. Soc. 1974: 112-113.

Citron, J. D. 1974. Gulls steal fish from Common Mergansers. Delmarva Ornithol. 9: 71-72.

Drury, W. H. and J. A. Kadlec. 1974. The current status of the Herring Gull population in the northeastern United States. Bird-Banding 45: 297-306.

Eggers, J. 1974. Vorkommen und Herkunft der Lechmowe (Larus ridibundus) im Hamburger Raum im Vergleich zur Sturm-, Silber-, und Mantelmowe (Larus canus, L. argentatus, L. marinus). Hamburg. Avifauna Beitr. 12: 95-144. [In German with English summary.]

Filonov, K. P., V. I. Lysenko and V. D. Siokhin. 1974. [Peculiarities of Limicolae and Lari nesting on islands of Molochny Estuary (the Sea of Azov).] Vestn. Zool. 1974: 52-58. [In Russian with English summary.]

Fimreite, N., E. Brun, A. Frostlie, P. Frederichsen and N. Gundesen. 1974. Mercury in eggs of Norwegian sea birds. Astarte 7: 71-75.

Firth, R., Jr. 1974. Experimental cross-fostering of Herring Gull and Great Black-backed Gull chicks. Auk 91: 139-144.

Forsythe, D. M. 1974a. An ecological study of gull populations to reduce the bird-aircraft strike hazard at Charleston Air Force Base. Air Force Weapons Lab. Tech. Rep. 73. 142 pp.

Gauthreaux, S. A., Jr. [ed.] 1974. Proc. Conf. on the Biol. Aspects of the Bird/Aircraft Collision Problem, 5-7 February 1974. Dep. Zool., Clemson Univ./Clemson, SC. 535 pp.

Gilbertson, M. 1974a. Pollutants in breeding Herring Gulls in the lower Great Lakes. Can. Field-Nat. 88: 273-280.

Gilbertson, M. and R. Hale. 1974a. Characteristics of the breeding failure of a colony of Herring Gulls in Lake Ontario. Can. Field-Nat. 88: 356-358.

_____. 1974b. Early embryonic mortality in a Herring Gull colony in Lake Ontario. Can. Field-Nat. 88: 354-356.

Gochfeld, M. 1974b. Prevalence of subcutaneous emphysema in young terns, skimmers and gulls. J. Wildl. Dis. 10: 115-120.

_____. 1974c. Gull predation on migrant passerine birds. Englehardtia 6: 12-13.

Grant, D. R. 1974. Local gull movements as a hazard to aircraft. Bird Study 21: 169-179.

Grubb, T. C., Jr. 1974. Individual distance in the Herring Gull. Auk 91: 637-639.

Hibbert, F. W. 1974. Coot attacking Herring Gull. Brit. Birds 67: 242.

Jonkel, G. M. and O. S. Pettingill, Jr. 1974. Retraction of a longevity record for a 36-year-old Herring Gull. Auk 91: 432.

Jorgensen, O. H. and I. Kraul. 1974. Eggshell parameters and residues of PCB and DDE in eggs from Danish Herring Gulls <u>Larus</u> <u>a</u>. <u>argentatus</u>. Ornis Scand. 5: 173-179.

Jouanin, C. 1974. Note sur <u>Larus</u> <u>argentatus</u> <u>atlantis</u> aux iles Selvagens. Cyanopica 1: 19-24. [In French.]

Kihlman, J. and L. Larsson. 1974. On the importance of refuse dumps as a food source for wintering Herring Gulls <u>Larus</u> <u>argentatus</u> Pont. Ornis Scand. 5: 63-70.

Melville, D. 1974. Analysis of Herring Gull pellets collected in Co. Antrim. Seabird Rep. 4: 40-46.

Michaelsen, J. 1974. Innlandshekking av Gramake. [Inland breeding of Herring Gull.] Fauna 27: 95. [In Norwegian with English summary.]

Patten, S., Jr. and A. R. Weisbrod. 1974. Sympatry and interbreeding of Herring and Glaucous-winged Gulls in southeastern Alaska. Condor 76: 343-344.

Ree, V. 1974. Tidlig kroppsmyting hos Gramake. [Early body moult in the Herring Gull.] Fauna 27: 93-94. [In Norwegian with English summary.]

Reperant, J. and J.-P. Raffin. 1974. Les projections visuelles le goeland argente (Larus argentatus argentatus Pontopp.) et le goeland brun (Larus fuscus graellsii Brehm). C. R. Hebd. Seances Acad. Sci. Ser. D. Sci. Nat. 278: 2335-2338.

Ryder, J. P. 1974. Organochlorine and mercury residues in gulls' eggs from western Ontario. Can. Field-Nat. 88: 349-352.

Scanes, C. G., P. Cheeseman, J. G. Phillips, and B. K. Follett. 1974. Seasonal and age variation of circulating immunoreactive luteinizing hormone in captive Herring Gulls, Larus argentatus. J. Zool. (Lond.) 174: 369-375.

Scharf, W. C. and B. Buckingham. 1974. Congenital foot abnormality in a Herring Gull. Inl. Bird Banding News 46: 30-32.

Sturmhoefel, E. 1974. Silvermowe schmarotz bei Turmfalken. Falke 21: 140.

Threlfall, W., E. Eveleigh and J. E. Maunder. 1974. Seabird mortality in a storm. Auk 91: 846-849.

Williams, T. C., J. M. Williams, J. M. Teal and J. W. Kanwisher. 1974. Homing flights of Herring Gulls under low visibility conditions. Bird-Banding 45: 106-114.

Witt, H. 1974. Zur Nahrungsokologie der Mittelmeersilbermowe (Larus argentatus michahellis) an einem Brutplatz auf Sardinien. [On the feeding ecology of a Sardinian colony of Mediterranean Herring Gulls (Larus argentatus michahellis).] Vogelwelt 95: 148-150. [In German with English summary.]

1973

Andrle, R. F. 1973. A second probable hybrid of Larus marinus and L. argentatus on the Niagara River. Can. Field-Nat. 87: 170-171.

Angles, R. 1973. Herring Gull (Larus argentatus) taking adult Storm Petrel (Hydrobates pelagicus). Brit. Birds 66: 495-496.

Anon. 1973. An adventurous Herring Gull. Brit. Trust Ornithol. News 55: 9.

Bourget, A. A. 1973. Relation of eiders and gulls nesting in mixed colonies in Penobscot Bay, Maine. Auk 90: 809-820.

Chan, S. W. C. and J. G. Phillips. 1973a. Secretion of 17-deoxycorticosteroids by Herring Gull (Larus argentatus) adrenals. Gen. Comp. Endocrinol. 20: 274-282.

_____. 1973b. Variations in the vitro production of corticosteroids by the Herring Gull (Larus argentatus) adrenal glands. Gen. Comp. Endocrinol. 20: 283-290.

Delius, J. D. 1973. Agonistic behaviour of juvenile gulls, a neuroethological study. Anim. Behav. 21: 236-246.

Drury, W. H. 1973-74. Population changes in New England seabirds. Bird-Banding 44: 267-313; 45: 1-15.

Evans, R. M. 1973. Differential responsiveness of young Ring-billed Gulls and Herring Gulls to adult vocalizations of their own and other species. Can. J. Zool. 51: 759-770.

Fitzgerald, G. R. and J. C. Coulson. 1973. The distribution and feeding ecology of gulls on the tidal reaches of the rivers Tyne and Wear. Vasculum 58: 29-47.

Forsythe, D. M. 1973. Gull populations at Charleston, S.C., June 1971 to June 1972. Chat 37: 57-62.

Franzmann, N.-E. 1973. Gulbenet Solvmage (Larus argentatus omissus) ynglende pa Christianso. Feltornithologen 15: 209.

Godfrey, W. E. 1973. More presumed hybrid gulls: Larus argentatus X L. marinus. Can. Field-Nat. 87: 171-172.

Goethe, F. and E. Schuz. 1973. Zum "Typus" von Larus argentatus heuglini Bree im Staatlichen Museum fur Naturkunde zu Stuttgart. Stuttg. Beitr. Naturkd. Ser. A. (Biol.) 261: 1-8. [In German with English summary.]

Hedgren, S. and L. Larsson. 1973. 'Labbliknande' trutar. Var Fagelvarld 32: 288. [In Swedish with English summary.]

Hunt, G. L., Jr. and M. W. Hunt. 1973. Habitat partitioning by foraging gulls in Maine and northwestern Europe. Auk 90: 827-839.

Isenmann, P. 1973a. Dispersion hivernale du goeland argente (Larus argentatus) sur le littoral atlantique de l'estuaire de la Loire au pays Basque. Ar Vran 5: 101-108.

_____. 1973b. Biometrische Untersuchungen an der Gelbfussigen Silbermowe (Larus argentatus michahellis) aus der Camargue. [Biometrical study of the population of the Yellow-legged Herring Gull (Larus argentatus michahellis) in the Camargue.] Vogelwarte 27: 16-24. [In German with English summary.]

Isenmann, P. 1973c. Donnees sur les deplacements erratiques de Goelands argentes a pieds jaunes (Larus argentatus michahellis) nes en Mediterranee. Oiseau Rev. Fr. Ornithol. 43: 187-195. [In French with English summary.]

_____. 1973d. Distribution hivernale en 1972-1973 du Goeland argente a pieds jaunes (Larus argentatus michahellis) sur le littoral atlantique du Morbihan au Pays Basque. Oiseau Rev. Fr. Ornithol. 43: 260-262.

Jorgensen, O. H. 1973. Some results of Herring Gull ringing in Denmark 1958-1969. Dan. Ornithol. Foren. Tidsskr. 67: 53-63.

Macdonald, D. 1973. Herring Gull colony in pine wood. Brit. Birds 66: 228.

Macdonald, S. M. and C. F. Mason. 1973. Predation of migrant birds by gulls. Brit. Birds 66: 361-363.

MacRoberts, M. H. 1973. Extramarital courting in Lesser Black-backed and Herring Gulls. Z. Tierpsychol. 32: 62-74.

McLannahan, H. M. C. 1973. Some aspects of the ontogeny of cliff nesting behaviour in the Kittiwake (Rissa tridactyla) and the Herring Gull (Larus argentatus). Behaviour 44: 36-88.

Moore, F. R. 1973. Herring Gull postbreeding dispersal and related chick orientation behavior. M.S. thesis, N. Illinois Univ./Dekalb, IL. 80 pp.

Noseworthy, C., S. Stoker and J. Lien. 1973. Habitat preferences in Herring Gull chicks. Auk 90: 193-194.

Nystrom, M. 1973. Extinction, disinhibition and spontaneous recovery of the pecking response in young Herring Gulls. Behaviour 45: 271-281.

Podmore, A. 1973. Herring Gull piracy. Bird Life 1973: 36.

Sanger, G. A. 1973. Pelagic records of Glaucous-winged and Herring Gulls in the north Pacific Ocean. Auk 90: 384-393.

Van Zurk, H. 1973. Le goeland argente mediterraneen (Larus argentatus michahellis). Riviera Sci. 8: 55-56.

Vermeer, K. 1973b. Food habits and breeding range of Herring Gulls in the Canada prairie provinces. Condor 75: 478-480.

_____. 1973c. Comparison of egg-laying chronology of Herring and Ring-billed Gulls at Kawinaw Lake, Manitoba. Can. Field-Nat. 87: 306-308.

Williams, T. C. and J. M. Neal. 1973. The flight of blindfolded birds. Bird-Banding 44: 102-109.

1972

Anderson, R. B. 1972. Gulls, gulls and more gulls - are they telling us something? Maine Fish Game 14: 8-10.

Andrle, R. F. 1972. Another probable hybrid of *Larus marinus* and *L. argentatus*. Auk 89: 669-671.

Blus, L. J., C. D. Gish, A. A. Belisle and R. M. Prouty. 1972. Logarithmic relationship of DDE residues to egg shell thinning. Nature (Lond.) 235: 376-377.

Brackbill, H. 1972. Fowl that don't befoul. Md. Conserv. 48: 4-7.

Cooke, F. and R. K. Ross. 1972. Diurnal and seasonal activities of a post-breeding population of gulls in southeastern Ontario. Wilson Bull. 84: 164-172.

Dexter, R. W. 1972. Recoveries of Herring Gulls banded at Cape Ann, Massachusetts. (Abstract only.) Proc. Internatl. Ornithol. Congr. 15: 639.

Dittberner, H. 1972. Die Grossmowen (*Larus marinus*, *L. fuscus* and *L. argentatus*) als Gastvogel markischer Gewasser. Beitr. Vogelkd. 18: 141-155.

Drury, W. H. and I. C. T. Nisbet. 1972. The importance of movements in the biology of Herring Gulls in New England. Pp. 173-212 *in* Population Ecology of Migratory Birds: A Symposium. U.S. Fish Wildl. Serv. Wildl. Res. Rep. 2. 278 pp.

Ensor, D. M. and J. G. Phillips. 1972a. The effect of age and environment on extrarenal salt secretion in juvenile gulls (*Larus argentatus* and *L. fuscus*). J. Zool. (Lond.) 168: 119-126.

_____. 1972b. The effect of dehydration on salt and water balance in gulls (*Larus argentatus* and *L. fuscus*). J. Zool. (Lond.) 168: 127-137.

Forsythe, D. M. 1972. Ring-billed and Herring Gull recoveries from South Carolina. Bird-Banding 43: 276-281.

Frankum, R. 1972. Herring Gulls in Uganda. Bull. East Afr. Nat. Hist. Soc. 1972: 81-82.

Haarmann, K. 1972. Das Brutvorkommen der Silbermowe (*Larus argentatus*) an der Niederelbe. Vogelkd. Ber. Nieders. 4: 79-81.

Hunt, G. L., Jr. 1972a. Influence of food distribution and human disturbance on the reproductive success of Herring Gulls. Ecology 53: 1051-1061.

_____. 1972b. Herring Gull population dynamics: the significance of man's waste products. (Abstract only.) Proc. Internatl. Ornithol. Congr. 15: 652.

Karlsson, K.-A., B. E. Samuelsson and G. O. Stern. 1972. Identification of a xylose-containing cerebroside in the salt gland of the Herring Gull. J. Lipid Res. 13: 169-175.

Kumari, E. 1972. Distribution changes and living conditions of the Herring Gull (Larus argentatus) in the East Baltic area. (Abstract only.) Proc. Internatl. Ornithol. Congr. 15: 663.

Lyster, I. H. J. 1972. Mole kills Herring Gull. Scott. Birds 7: 207-208.

MacRoberts, B. R. and M. H. MacRoberts. 1972a. The relationship between laying date and incubation in Herring and Lesser Black-backed Gulls. Ibis 114: 93-97.

_____. 1972b. Social stimulation of reproduction in Herring and Lesser Black-backed Gulls. Ibis 114: 495-506.

Mill, P. J. 1972. An ultrastructural study of the body wall muscles of the pentastomid Reighardia sternae Dies. 1864, parasitic of the Herring Gull Larus argentatus Pontopp. Z. Zellforsch. Mikrosk. Anat. 130: 12-17.

Mollering, K. 1972. Quantitative Untersuchungen zur Brutbiologies der Silbermowe (Larus argentatus) auf der Vogelinsel Mellum. Abh. Landesmus. Naturkd. Munster 34: 79-87. [In German.]

Nisbet, I. C. T. and W. H. Drury. 1972. Post-fledging survival in Herring Gulls in relation to brood-size and date of hatching. Bird-Banding 43: 161-172.

Nystrom, M. 1972. On the quantification of pecking responses in young gulls (Larus argentatus). Z. Tierpsychol. 30: 36-44.

Parsons, J. 1972. Egg size, laying date and incubation period in the Herring Gull. Ibis 114: 536-541.

Seymour, N. R. 1972. Success of three gull species feeding on swarming ants in Antigonish County, Nova Scotia. Can. Field-Nat. 86: 391-392.

Spaans, A. L. 1972. Human influence on the food-supply of the Herring Gull (Larus argentatus) in Holland. (Abstract only.) Proc. Internatl. Ornithol. Congr. 15: 688.

Stenman, O., R. Komu and A. Ermala. 1972. Kloraloosi harmaa- ja merilokki-myrkkyna. [Finnish experience of poisoning Herring Gulls and Great Black-backed Gulls with chloralose.] Suomen Riista 24: 107-116. [In Finnish with English summary.]

Thomas, G. J. 1972. A review of gull damage and management methods at nature reserves. Biol. Conserv. 4: 117-127.

Tuaev, D. G., V. I. Vasilev, and F. A. Abushev. 1972. [On the occurrence of mass destruction of the Herring Gull in a nesting colony on Glinyan Island in the Azerbaidjan SSR.] Ornitologiya 10: 394-395. [In Russian.]

Voipio, P. 1972. Silbermowen der _Larus argentatus cachinnans_--Gruppe als Beseidler des baltischen Raumes. [_Larus argentatus cachinnans_ as a colonizer of the Baltic area.] Ann. Zool. Fenn. 9: 131-136. [In German.]

Winkler, R. 1972. La pneumatisation du crane chez _Larus argentatus michahellis_. Alauda 40: 272-277. [In French with English summary.]

1971

Bednorz, J. 1971. Mewa pospolita (_Larus canus_), mewa srebrzysta (_Larus argentatus_) i rybitwa wielkodzioba (_Hydroprogne caspia_) gniezdza sie na polskim wybrzezu. [Common Gull (_Larus canus_), Herring Gull (_Larus argentatus_), and Caspian Tern (_Hydroprogne caspia_) nesting on Polish sea coast.] Notatki Ornitol. 12: 67-71. [In Polish with English summary.]

Bjerk, J. E. and G. Holt. 1971. Residues of DDE and PCB in eggs from Herring Gull (_Larus argentatus_) and Common Gull (_Larus canus_) in Norway. Acta Vet. Scand. 12: 429-441.

Blosch, M. 1971. Uber den Einfluss von Phenobarbital auf das Brutuerhaltender Silbermowe (_Larus argentatus argentatus_ Pontopp.). [Effects of phenobarbitol on brood care behaviour of the Herring Gull (_Larus argentatus argentatus_ Pontopp.).] Z. Tierpsychol. 28: 487-493. [In German with English summary.]

Brackbill, H. 1971. Herring and Ring-billed Gulls paired or courting in Maryland in January and February. Auk 88: 438-440.

Cuss, J. and H. M. Blair. 1971. Erythrism in eggs of Herring Gull in Scotland. Scott. Birds 6: 282.

Delius, J. D. 1971a. Foraging behaviour patterns of Herring Gulls elicited by electrical forebrain stimulation. Experientia 27: 1287-1289.

_____. 1971b. Neural substrates of vocalizations in gulls and pigeons. Exp. Brain. Res. 12: 64-80.

Drury, W. H. and I. C. T. Nisbet. 1971. The importance of movements in the biology of Herring Gulls in New England. Symp. Population Ecology of Migratory Birds, Patuxent Wildl. Res. Cent., October 1969.

Erwin, R. M. 1971. The breeding success of two sympatric gulls, the Herring Gull and the Great Black-backed Gull. Wilson Bull. 83: 152-158.

Goldman, P. 1971. Herring Gull predation on common water snake in Lake Erie. Wilson Bull. 83: 196-197.

Hafft, J. H. 1971. Herring Gull attacks Eared Grebe. Condor 73: 253.

Harris, M. P. 1971. Ecological adaptations of moult in some British gulls. Bird Study 18: 113-118.

Ivanovs, M. 1971. Nesting of Ring-billed and Herring Gulls at Mille Lacs Lake, 1970. Loon 43: 58-59.

Jehl, J. R. 1971. A hybrid Glaucous X Herring Gull from San Diego. Calif. Birds 2: 27-32.

Kadlec, J. A. 1971. Effects of introducing foxes and raccoons on Herring Gull colonies. J. Wildl. Manage. 35: 625-636.

Kask, E. 1971. [A sea-gull (*Larus argentatus omissus*) nest in a tree top.] Eesti Loodus 14: 352. [In Estonian.]

Loos-Frank, B. 1971. Zur Trematodenfauna del Silbermowe (*Larus argentatus*) an der sudlichen Nordsee. Vogelwarte 26: 202-212. [In German with English summary.]

Nisbet, I. C. T. and W. H. Drury. 1971. Strategy of management of a natural population: the Herring Gull in New England. Pp. 441-454 *in* World Conf. Bird Hazards to Aircraft, Sept. 1969. Natl. Res. Counc., Kingston, Ontario. 542 pp.

Parsons, J. 1971a. Cannibalism in Herring Gulls. Brit. Birds 64: 528-537.

_____. 1971b. The breeding biology of the Herring Gull, *Larus argentatus*. Ph.D. thesis, Univ. Durham/Durham, England.

Pearson, J. C. and G. Prevot. 1971. *Galactosomum timondavidi* sp. n. (Trematoda: Heterophyidae) from *Larus argentatus*, with a note on the metacercaria. J. Parasitol. 57: 1227-1230.

Prevot, G. 1971a. Contribution a l'etude des Microphallidae Travassos, 1920 (Trematoda). Cycle evolutif de *Microphallus pachygrapsi* Deblock & Prevot, 1969. Parasite du Goeland a pieds jaunes (*Larus argentatus*). Ann. Parasitol. Hum. Comp. 46: 453-461. [In French with English summary.]

_____. 1971b. Cycle evolutif d' *Aporchis massiliensis* Timon-David, 1955 (Digenea Echonostomatidae), parasite du goeland *Larus argentatus michahellis* Naumann. Bull. Soc. Zool. Fr. 96: 197-208. [In French with English summary.]

Spaans, A. L. 1971. On the feeding ecology of the Herring Gull *Larus argentatus* Pont. in the northern part of the Netherlands. Ardea 59: 73-188.

Thompson, G. 1971. The photopic spectral sensitivity of gulls measured by electroretinographic and pupillometric methods. Vision Res. 11: 719-731.

Tinbergen, N. 1971. Clever gulls and dumb ethologists--or: the trackers tracked. Vogelwarte 26: 232-238.

Vermeer, K. 1971a. Some breeding aspects of Herring Gulls at Kawinaw Lake, Manitoba. Blue Jay 29: 207-208.

_____. 1971b. A survey of mercury residues in aquatic birds eggs in the Canadian prairie provinces. Trans. N. Am. Wildl. Nat. Res. Conf. 36: 138-152.

Winkel, W. 1971. Uber den Bruttreib der Silbermowe (Larus argentatus) in Beziehung zur Farbe der Eier. [On the breeding drive of the Herring Gull (Larus argentatus) in relation to the color of the eggs.] Vogelwarte 26: 249-254. [In German with English summary.]

1970

Anderson, D. W. 1970. Chlorinated hydrocarbons: their dynamics and eggshell effects on Herring Gulls and other species. Ph.D. thesis, Univ. Wisconsin/Madison, WI. 168 pp.

Andersson, A. 1970. Food habits and predation of an inland-breeding population of the Herring Gull Larus argentatus in southern Sweden. Ornis Scand. 1: 75-81.

Baerends, G. P., R. H. Drent, P. Glas and H. Groenewold. 1970. An ethological analysis of incubation behaviour in the Herring Gull. Pp. 135-235 in G. P. Baerends and R. H. Drent (eds.). The Herring Gull and its egg. Behaviour Suppl. 17. ix and 312 pp.

Corkhill, P. 1970. Effect of egg-puncturing on limiting chick production in Herring Gulls. Bird Study 17: 340-342.

Davis, J. W. F. 1970. Eggs sizes and hatching weights in the Herring and Lesser Black-backed Gulls. Rep. Skokholm Bird Obs. 1970: 24-31.

Delius, J. D. and G. Thompson. 1970. Brightness dependence of colour preferences in Herring Gull chicks. Z. Tierpsychol. 27: 842-849.

Drenckhahn, D. 1970. Untersuchungen an regio olfactoria und nervus olfactorius der Silbermowe (Larus argentatus). Z. Zellforsch. Mikorsk. Anat. 106: 119-124.

Drent, R. H. 1970. Functional aspects of incubation in the Herring Gull. Pp. 1-132 in G. P. Baerends and R. H. Drent (eds.). The Herring Gull and its egg. Behaviour Suppl. 17. ix and 312 pp.

Drent, R. H., K. Postuma and T. Joustra. 1970. The effect of egg temperature on incubation behaviour in the Herring Gull. Pp. 235-261 in G. P. Baerends and R. H. Drent (eds.). The Herring Gull and its egg. Behaviour Suppl. 17. ix and 312 pp.

Gobeil, R. E. 1970. Arterial system of the Herring Gull (Larus argentatus). J. Zool. (Lond.) 160: 337-354.

Hakansson, C. H. and B. Malcus. 1970. Secretive pressure exerted by the stimulated nasal salt gland in Larus argentatus (Herring Gull). Acta Physiol. Scand. 78: 249-254.

Harris, M. P. 1970a. Rates and causes of increases of some British gull populations. Bird Study 17: 325-335.

_____. 1970b. Abnormal migration and hybridization of Larus argentatus and L. fuscus after interspecic fostering experiments. Ibis 112: 488-498.

Hatch, J. J. 1970. Predation and piracy by gulls at a ternery in Maine. Auk 87: 244-254.

Holley, A. J. F. 1970. Some aspects of rearing the young in Larus gulls at Stert Island--an interim report. Bristol Ornithol. 3: 100-117.

Ingolfsson, A. 1970b. Hybridization of Glaucous Gulls Larus hyperboreus and Herring Gulls L. argentatus in Iceland. Ibis 112: 340-362.

Komnick, H. and E. Kniprath. 1970. Morphometrische Untersuchungen an der Salzdruse von Silbermowen. Cytobiologie 1: 228-247. [In German with English summary.]

Kumerloeve, H. 1970. Weitere Nachweise der Silbermowe, Larus argentatus als Kleinasiatischer Binnenland-Brutvogel. Vogelwarte 25: 267-268.

Lina, P. H. C. 1970. Observations on the infection of young Herring and Lesser Black-backed Gulls by ectoparasites. Ardea 58: 258-261.

Lippens, L. 1970. La presence au Zwin, a Knokke (littoral Belge), d'un hybride probable de Goeland bourgmeste (Larus hyperboreus) et du Goeland argente (Larus argentatus). Aves 7: 105-106.

Lohmer, K. and G. Vauk. 1970. Ein weiterer Beitrag zur Ernahrung Helgolander Silbermowen (Larus argentatus). Vogelwarte 25: 242-245. [In German with English summary.]

Mikkola, H. 1970. Identification of albino Herring Gulls Larus argentatus. Ornis Fenn. 47: 172-176.

Parsons, J. 1970. Relationship between egg size and post-hatching chick mortality in the Herring Gull (Larus argentatus). Nature (Lond.) 228: 1221-1222.

Ryden, O. 1970. On the behaviour in an alarm provoking, constant stimulus situation of a "natural experiment". Observations on a pair of Herring Gulls (Larus argentatus) and Common Terns (Sterna hirundo) breeding on the same islet. J. Ornithol. 111: 48-53.

Southern, W. E. 1970a. En route behavior of homing Herring Gulls as determined by radiotracking. Wilson Bull. 82: 189-200.

_____. 1970b. Orientation in gulls: effect of distance, direction of release, and wind. Living Bird 9: 75-95.

Stromar, L. 1970. Prilog poznavanju biologije galebova klaukavaca, Larus argentatus Pontopp., i cigra obicnih, Sterna hirundo L., te njihovih medusobnih odnosa na nekim Kornatskim otocima. [The biology of the Herring Gull, Larus argentatus Pontopp., and Common Tern, Sterna hirundo L. and interrelationships on some Kornat Islands.] Larus 21-22: 87-93. [English translation from Serbo-Croatian.]

Stunkard, H. W. 1970. Species of Renicola (Trematoda) in the kidneys of the gull, Larus argentatus. Woods Hole Mar. Biol. Lab. Bull. 139: 438-439.

Thompson, G. 1970. Colour vision in birds, with special reference to Herring and Lesser Black-backed Gull (Larus argentatus and Larus fuscus). Ph.D. thesis, Oxford Univ./Oxford, England.

Vermeer, K. 1970. Breeding records of Herring Gulls in Alberta and California Gulls in Manitoba. Can. Field-Nat. 84: 182.

Weaver, D. K. 1970. Parental behavior of the Herring Gull (Larus argentatus smithsonianus) and its effect on reproductive success. Ph.D. thesis, Univ. Mich./Ann Arbor, MI. 87 pp.

Weaver, D. K. and J. A. Kadlec. 1970. A method for trapping breeding adult gulls. Bird-Banding 41: 28-31.

1969

Able, J. H. 1969. Electron microscopic demonstration of adenosine triphosphohydrolase activity in Herring Gull salt glands. J. Histochem. Cytochem. 17: 570-584.

Beer, J. V. 1969. Observations on the dispersal of gulls marked on Steep Holm and the Denny. Steep Holm Gull Res. Stn. Rep. 1968: 4-9.

Bongiorno, S. F. and J. Swinebroad. 1969. Increase in Herring Gull colony in Cape May, New Jersey. Wilson Bull. 81: 99-100.

Chinery, D. J. 1969. Great Skua entangled with Herring Gull. Brit. Birds 62: 116-117.

Cleeves, T. R. 1969. Herring Gull catching and eating bat. Brit. Birds 62: 333.

Dyck, J. 1969. Traekkende dvaegfalk (Falco columbarius) druknet af Mager. [Migrating Merlin (Falco columbarius) drowned by gulls.] Dan. Ornithol. Foren. Tidsskr. 63: 130-131. [In Danish with English summary.]

Felton, C. 1969. Herring Gull entering window for food. Brit. Birds 62: 76.

Friend, M. and D. O. Trainer. 1969. Aspergillosis in captive Herring Gulls. Bull. Wildl. Dis. Assoc. 5: 271-275.

Goertz, M. and F. Goethe. 1969. Ringfunde deutscher Nordsee-Silbermowen (Larus argentatus). Teil 1: Beringungen auf der Insel Memmert. Auspicium 3: 305-317.

Guillou, J. J. 1969. Differences ecologiques entre Larus a. argentatus et Larus fuscus graellsi en hivernage dans des mileux 'naturels'. Alauda 37: 338-345.

Hakansson, C. H. and B. Malcus. 1969. Secretive response of the electrically stimulated nasal salt glands in Larus argentatus (Herring Gull). Acta Physiol. Scand. 76: 385-392.

Harms, W. 1969. Eine weitere Ansiedlung der Sturmmowe (Larus canus) und Brut einer Silbermowe (Larus argentatus) in Hamburg. Ornithol. Mitt. 21: 165.

Harris, M. P. 1969. Effect of laying date on chick production in Oyster-catchers and Herring Gulls. Brit. Birds 62: 70-75.

Harris, M. P. and P. Hope-Jones. 1969. Sexual differences in measurements of Herring and Lesser Black-backed Gulls. Brit. Birds 62: 129-133.

Ingolfsson, A. 1969a. Behaviour of gulls robbing eiders. Bird Study 16: 45-52.

_____. 1969b. Sexual dimorphism of large gulls (Larus spp.). Auk 86: 732-737.

Kadlec, J. A. and W. H. Drury, Jr. 1969. Loss of bands from adult Herring Gulls. Bird-Banding 40: 216-221.

Kadlec, J. A., W. H. Drury, Jr., and D. K. Onion. 1969. Growth and mortality of Herring Gull chicks. Bird-Banding 40: 222-233.

King, B. 1969. Herring Gulls feeding on algae. Brit. Birds 62: 333.

Kumerloeve, H. 1969. Die Silbermowe, Larus argentatus, als Binnenland-Brutvogel im ostlichen Kleinasien. Vogelwarte 25: 47-49.

Lohmer, K. and G. Vauk. 1969. Nahrungsokologische Untersuchungen an ubersommernden Silbermowen (Larus argentatus) auf Helgoland im August/September 1967. Bonn. Zool. Beitr. 20: 110-114. [In German.]

Ludwig, J. P. and C. E. Ludwig. 1969. The effects of starvation on insecticide contaminated Herring Gulls removed from a Lake Michigan colony. Proc. Conf. Great Lakes Res. 1969: 53-60.

Parsons, J. 1969. Chick mortality in Herring Gulls. Ibis 111: 443-444.

Rea, S. C. 1969. Plastic device causes gull mortality. Wilson Bull. 81: 105-106.

Southern, W. E. 1969. Sky conditions in relation to Ring-billed and Herring Gull orientation. Trans. Ill. State Acad. Sci. 62: 343-349.

Vauk, G. and K. Lohmer. 1969. Ein weiterer Beitrag zur Ernahrung der Silbermowe (Larus argentatus) in der Deutschen Bucht. Veroeff. Inst. Meeresforsch. Bremerhaven 12: 157-160. [In German with English summary.]

Wallace, D. I. M. 1969. Herring Gulls at Tarkwa, Lagos: a species new to Nigeria. Bull. Nigerian Ornithol. Soc. 6: 59-60.

Walters, M. P. 1969. Herring and Lesser Black-backed Gulls following boats at night. Brit. Birds 62: 387.

1968

Andersson, A. 1968a. Gratrutens naringsekologi och inverkan pa kustfagelfaunan med sarskild hansyn till ejdern. [Ph.D.] thesis, Univ. Lund/Lund, Sweden. 103 pp.

_____. 1968b. Gratrutarna pa Hallands Vadero och deras grannar. Skanes Nat. 56: 100-109.

Barth, E. K. 1968a. Egg dimensions and laying dates of Larus marinus, L. argentatus, L. fuscus, and L. canus. Nytt Mag. Zool. 15: 5-34.

_____. 1968b. The circumpolar systematics of Larus argentatus and Larus fuscus with special reference to the Norwegian populations. Nytt Mag. Zool. 15 (Suppl. 1) : 1-50.

Bourne, W. R. P. 1968c. The wing-tip patterns of gulls. Brit. Birds 61: 138-141.

Campbell, R. W. 1968. Status of breeding Herring Gulls at Bridge Lake, British Columbia from 1933 to 1963. Can. Field-Nat. 82: 217-219.

Cowan, P. J. 1968. Feeding relationship between mullet and Herring Gulls. Brit. Birds 61: 31.

Drost, R. 1968. Dressur von Silbermowen Larus argentatus auf akustische Signale. Vogelwarte 24: 185-187. [In German.]

Drury, W. H., Jr. and W. J. Smith. 1968. Defense of feeding areas by adult Herring Gulls and intrusion by young. Evolution 22: 193-201.

Focke, E. 1968. Zum Verhalten junger Silbermowen (Larus argentatus) bei Bedrohung durch adule Artgenossen. Vogelwarte 24: 262-266. [In German.]

Geroudet, P. 1968. L'expansion du Goeland argente Larus argentatus michahellis dans le bassin du Rhone et en Suisse. Nos Oiseaux 29: 313-335. [In French.]

Kadlec, J. A. and W. H. Drury. 1968a. Structure of the New England Herring Gull population. Ecology 49: 644-676.

_____. 1968b. Aerial estimation of the size of gull breeding colonies. J. Wildl. Manage. 32: 287-293.

Karpovich, V. N. and I. P. Tatarinkova. 1968. [Population dynamics of Great Black-backed and Herring Gulls at the islands on the Murman coast and their influence on the efficiency of the reproduction of the Common Eider.] Pp. 85-104 in E. Kumari (ed.). [The Common Eider (Somateria m. mollissima L.) in the U.S.S.R.] Valgus Tallin. [In Russian with English summary.]

Rabinowitch, V. E. 1968. The role of experience in the development of food preferences in gull chicks. Anim. Behav. 16: 425-428.

Rogers, A. E. F. 1968. Herring Gull taking small passerine at sea. Brit. Birds 61: 467.

Roux, G. and W. Thonen. 1968. La nidification du Goeland argente Larus argentatus michahellis au Fanel. Nos Oiseaux 29: 335-338.

Schreiber, R. W. 1968. Seasonal population fluctuations of Herring Gulls in central Maine. Bird-Banding 39: 81-106.

Southern, W. E. 1968. Dispersal patterns of subadult Herring Gulls from Rogers City, Michigan. Jack-Pine Warbler 46: 2-6.

Threlfall, W. 1968a. The food of three species of gulls in Newfoundland. Can. Field-Nat. 82: 176-180.

_____. 1968b. Studies of the helminth parasites of the American Herring Gull (Larus argentatus Pont.) in Newfoundland. Can. J. Zool. 46: 1119-1126.

_____. 1968c. The food of Herring Gulls in Anglesey and Caernarvonshire. Nat. Wales. 11: 67-73.

Threlfall, W. 1968d. A Herring Gull chick (Larus argentatus) with an abnormal bill. Auk 85: 506-508.

van Impe, J. 1968. Een paar Zilvermeeuwen (Larus argentatus) broedend op een knotwilg. [Herring Gulls breeding in a headed willow.] Limosa 41: 62-63. [In Dutch with English summary.]

van Tets, G. F. 1968. Seasonal fluctuations in the mortality rates of three northern and three southern-hemisphere gulls. CSIRO Wildl. Res. 13: 1-9.

Voipio, P. 1968. Zur Verbreitung der argentatus und cachinnans-Mowen. [The distribution of the groups of argentatus and cachinnans Herring Gulls.] Ornis Fenn. 45: 73-83. [In German with English and Finnish summaries.]

1967

Abel, J. H. 1967. Cellular changes in the adenohypophysis of the Herring Gull during osmotic stress. (Abstract only.) Anat. Rec. 157: 201.

Barth, E. K. 1967. Standard body measurements in Larus argentatus, L. fuscus, L. canus, and L. marinus. Nytt Mag. Zool. 14: 7-83.

Blum, V. 1967. 80 Silbermowen im Seewinkel. Egretta 10: 31.

Brosset, A. 1967. Le Goeland argente, Larus argentatus michahellis destructeur de sa propre ponte. Alauda 35: 73-74.

Brown, R. G. B. 1967b. Species isolation between the Herring Gull Larus argentatus and Lesser Black-backed Gull L. fuscus. Ibis 109: 310-317.

_____. 1967c. Breeding success and population growth in a colony of Herring and Lesser Black-backed Gulls, Larus argentatus and L. fuscus. Ibis 109: 502-515.

Drent, R. H. 1967. Functional aspects of incubation in the Herring Gull (Larus argentatus Pont.). Ph.D. thesis, Univ. Groningen/Netherlands.

Griffiths, J. 1967. Herring and Lesser Black-backed Gulls nesting on roofs inland. Brit. Birds 60: 426.

Ingolfsson, A. 1967. The feeding ecology of five species of large gulls (Larus) in Iceland. Ph.D. thesis, Univ. Mich./Ann Arbor, MI. xii and 186 pp.

MacMillan, A. T. 1967. The "Carrick" gull and others--Iceland or albino ? Scott. Birds 4: 493-502.

McLaughlin, F. L. 1967 ms. Behavior study of the interrelationships of gulls and eiders in mixed breeding colonies on Penobscot Bay, Maine. Unpubl. file rep., Maine Coop. Wildl. Res. Unit, Orono, ME.

Moisan, G. and J.-M. Poulin. 1967. Deplacements saisonniers et taux de mortalite du goeland argente (Larus argentatus) des Iles Razades, Quebec. Nat. Can. (Que.) 94: 421-435.

Pettingill, O. S., Jr. 1967. A 36-year-old Herring Gull. Auk 84: 123.

Schreiber, R. W. 1967. Roosting behavior of the Herring Gull in central Maine. Wilson Bull. 79: 421-431.

Southern, W. E. 1967. The role of environmental factors in Ring-billed and Herring Gull orientation. Ph.D. thesis, Cornell Univ./Ithaca, NY.

Stromar, L. 1967. Four years of banding Herring Gulls (Larus argentatus Pontopp.) on the islets of Mrkan and Bobara. Larus 19: 123-130. [English translation of the Serbo-Croatian.]

Threlfall, W. 1967a. Studies on the helminth parasites of the Herring Gull Larus argentatus Pontopp., in northern Caernarvonshire and Anglesey. Parasitology 57: 431-453.

_____. 1967b. Diseases and pathological conditions of the Herring Gull (Larus argentatus Pontopp.) excluding helminth infestations. Bull. Wildl. Dis. Assoc. 3: 62-67.

Viellard, J. 1967. Guignettes et Goelands argentes dans les Alpes. Oiseau Rev. Fr. Ornithol. 37: 148-149.

Weaver, D. K. 1967. The Herring Gull, with emphasis on mortality of the eggs and young. M.S. thesis, Univ. Mich./Ann Arbor, MI.

Wolk, R. G. and J. Bull. 1967. Differential nesting schedules of Herring Gulls on Long Island, New York. Kingbird 17: 5-6.

1966

Abel, J. H. 1966. A physiological and cytochemical study of compensory growth in the nasal glands of the Herring Gull, Larus argentatus. Ph.D. thesis, Brown Univ./Providence, RI.

Barth, E. K. 1966. Mantle colour as a taxonomic feature in Larus argentatus and Larus fuscus. Nytt Mag. Zool. 13: 56-82.

Bernis, F. 1966. Penetracion de Larus argentatus hasta la provincia de Toledo. Ardeola 12: 239.

Blosch, M. 1966. Die Aktivitat der Salzdrusen. Eine Untersuchung an freilebenden und gefangenen Silbermowen, Larus argentatus. Vogelwarte 23: 225-231. [In German.]

Busnel, R.-G. and J. Giban. 1966. Reactions d'un population de Larus argentatus atlantis de l'ile de Madere a des signaux acoustiques de detresse d'oiseaux europeens. Bocagiana 11: 1-9. [In French with English and German summaries.]

Delius, J. D. 1966a. Pentobarbital anaesthesia in the Herring and Lesser Black-backed Gull. J. Small Anim. Pract. 7: 605-609.

_____. 1966b. Displacement activities and arousal. Nature (Lond.) 214: 1259-1260.

Harriman, A. E. and M. R. Kare. 1966. Tolerance for hypertonic saline solutions in Herring Gulls, Starlings and Purple Grackles. Physiol. Zool. 39: 117-122.

Keith, J. A. 1966a. Reproduction in a population of Herring Gulls (Larus argentatus) contaminted by DDT. J. Appl. Ecol. 3 (Suppl.): 57-70.

_____. 1966b. Reproduction in a population of Herring Gulls, Larus argentatus, contaminated by DDT. M.S. thesis, Univ. Wisconsin/Madison, WI.

King, B. 1966. Herring Gulls trying to snatch fish from Great Northern Divers. Brit. Birds 59: 247.

Ludwig, J. P. 1966. Herring and Ring-billed Gull populations of the Great Lakes 1960-1965. Great Lakes Res. Div. Univ. Mich. Publ. 15: 80-89.

Ludwig, J. P. and C. S. Tomoff. 1966. Reproductive success and insecticide residues in Lake Michigan Herring Gulls. Jack-Pine Warbler 44: 77-85.

Miller, J. C. 1966a. Herring Gulls nesting at Stone Harbor, New Jersey. Cassinia 49: 31.

_____. 1966b. The Great Black-backed Gull nesting in New Jersey and additional notes on nesting Herring Gulls. Cassinia 49: 31.

Paynter, R. A. 1966. A new attempt to construct life tables for Kent Island Herring Gulls. Bull. Mus. Comp. Zool. 133: 491-528.

Schoennagel, E. 1966. Lachmowen (Larus ridibundus) und Silbermowen (Larus argentatus) fangen Dreistachlige Stichlinge (Gasterosteus aculeatus). Ornithol. Mitt. 18: 144.

Segre, A., R. Noble and J. P. Hailman. 1966. A five-egg Herring Gull nest. Bird-Banding 37: 290.

Smith, N. G. 1966. Adaptations to cliff-nesting in some Arctic gulls (Larus). Ibis 108: 68-83.

Temme, M. 1966. Uber das Verhaltens repertoire der Mantelmowe (*Larus marinus* L.) im Winterhalbjahr sowie einige Bemerkungen uber das Verhalten der Silbermowe (*Larus argentatus* Pontopp.) im gleichen Zeitraum. J. Ornithol. 107: 70-84. [In German.]

Threlfall, W. 1966. The helminth parasites of the Herring Gull (*Larus argentatus* Pontopp.). Tech. Commun. Commonw. Bur. Helminthol. 37. 23 pp.

1965

Abel, J. H. and R. A. Ellis. 1965. A physiological and histochemical study of regeneration in the nasal (salt) glands of Herring Gulls. Bull. Mt. Desert Isl. Biol. Lab. 5: 1.

Bergman, G. 1965. Trutarnas konkurrensforhallanden fodobehov och relationer till andra skargardsfagler. [Competition and feeding ecology of gulls in a south Finnish skerrygard.] Zool. Revy 27: 58-77. [In Swedish with German summary.]

Brisbin, I. L., Jr. 1965. A quantitative analysis of ecological growth efficiency in the Herring Gull. M.S. thesis, Univ. Georgia/Athens, GA.

Cobb, J. L. S. 1965. Abnormal nesting behaviour of eiders and Herring Gulls. J. Scott. Ornithol. Club 3: 252-253.

Drury, W. H. 1965a. Results of a study of Herring Gull populations and movements in southeastern New England. Pp. 207-219 *in* R. G. Bushnel and J. Giban (eds.). Colloque: le probleme des oiseaux sur les aerodromes. Inst. Natl. Rech. Agron. Paris. 326 pp.

_____. 1965b. Gulls vs. terns: clash of coastal nesters. Mass. Audubon 64: 207-211.

Harris, M. P. 1965. The food of some *Larus* gulls. Ibis 107: 43-53.

Harris, M. P. and W. J. Plumb. 1965. Experiments on the ability of Herring Gulls *Larus argentatus* and Lesser Black-backed Gulls *L. fuscus* to raise larger than normal broods. Ibis 107: 250-257.

Rogers, C. H. 1965. Herring Gull nesting colony in Barneget Bay. Cassinia 48: 38.

Schreiber, R. W. 1965. Seasonal population fluctuations and roosting behavior of the Herring Gull in central Maine. M.S. thesis, Univ. Maine/Orono, ME.

Thomas, L. P. and S. B. Thomas. 1965. Herring Gulls diving for starfish. Q. J. Fla. Acad. Sci. 28: 195-196.

Vass, S. E. 1965. Gull breeding records from Prince Edward Island. Can. Field-Nat. 79: 152-154.

Williams, I. C. and M. P. Harris. 1965. The infection of the gulls *Larus argentatus* Pont., *L. fuscus* L., and *L. marinus* L. with cestoda on the coast of Wales. Parasitology 55: 237-256.

1964

Andersson, S. 1964. Ett gratrut material from Vasterviks skargard. [A material of Herring Gull from the Archipelago of Vastervik.] Var Fagelvarld 23: 337-347. [In Swedish with English summary.]

Baerends, G. P. 1964. La reconnaissance de l'oeuf par le Goeland argente. Bull. Soc. Sci. Bretagne 37: 193-208.

Barth, E. K. 1964. Variation in the mantile color of *Larus argentatus* and *Larus fuscus*. Preliminary report. K. Nor. Vidensk. Selsk. Forh. 37: 119-121.

Bonting, S. L., L. L. Caravaggio, M. R. Canady, and N. M. Hawkins. 1964. Studies on the sodium-potassium-activated adenosinetriphosphate. XI. The salt gland of the Herring Gull. Arch. Biochem. Biophys. 106: 49-56.

Bowes, E. and P. W. Schwalbe. 1964. Great Blue Heron chasing a Herring Gull. Cassinia 47: 37-38.

Brackbill, H. 1964. Pseudo-sleeping by a Herring Gull. Condor 66: 309.

Goethe, F. 1964. Mittelmeer-Silbermowe (*Larus argentatus michahellis* Naum.) in Cuxhaven gefangen. Bietr. Naturkd. Nieders. 17: 28-31.

Gross, A. O. 1964. Albinism in the Herring Gull. Auk 81: 551-552.

Harris, M. P. 1964a. Aspects of the breeding biology of the gulls *Larus argentatus*, *L. fuscus*, and *L. marinus*. Ibis 106: 432-456.

_____. 1964b. The incidence of some species of trematodea in three species of *Larus* gulls in Wales. Ibis 106: 532-536.

_____. 1964c. Recoveries of ringed Herring Gulls. Bird Study 11: 183-191.

Hudec, K. 1964. Durchzug und Uberwintern der Silber- und Sturmmowe (*Larus argentatus*, *Larus canus*) an der Donau. Zool. Listy 13: 363. [In Czech with German summary.]

Hunt, C. L., Jr. and W. J. Smith. 1964. The swallowing of fish by young Herring Gulls *Larus argentatus*. Ibis 106: 457-461.

Jarback, A. 1964. Gratrut (*Larus argentatus*) fangande grasparv (*Passer domesticus*) i flykten. [Herring Gull (*Larus argentatus*) catches House Sparrow (*Passer domesticus*) in flight.] Var Fagelvarld 23: 324. [In Swedish with English summary.]

Kadlec, J. A. 1964 ms. The effect of amplified sounds on movements of Herring Gulls. Unpubl. prog. rep. U.S. Fish Wildl. Serv.

Komnick, H. 1964. Elektronenmikroskopische Untersuchungen zue funktionellen Morphologie des Ionen-transportes in der Salzdruse von *Larus argentatus*. IV Teil: Funktionelle Morphologie der Epithelzellen des Sammelkanals. Protoplasma 58: 96-127.

Mathiasson, S. 1964. Gratrut och gratruts-bekampning. Zool. Revy 26: 41-51. [In Swedish with English summary.]

Nickell, W. P. 1964a. Fatal entanglements of Herring Gulls (*Larus argentatus*) and Common Terns (*Sterna hirundo*). Auk 81: 555-556.

_____. 1964b. Two albino Herring Gulls found at Rogers City, Michigan. Auk 81: 560.

Pomeroy, M. K. and M. D. B. Burt. 1964. Cestodes of the Herring Gull, *Larus argentatus* Pontoppidan, 1763, from New Brunswick. Can. J. Zool. 42: 959-973.

Pricam, R. 1964. Premiere nidification du Goeland argente (*Larus argentatus*) sur les rives du lac Leman. Oiseau Rev. Fr. Ornithol. 34: 151-153.

Rawson, D. 1964. Sequences in the maturation of the genitalia in *Tetrabochrius erostris* (Loennberg, 1889) from the intestine of *Larus argentatus argentatus* Pontoppidan. Parasitology 54: 453-465.

Richards, G. A. 1964. Fulmar incubating eggs of Herring Gull with its own. Brit. Birds 57: 31.

Southern, W. E. and G. D. Schnell. 1964. Herring Gulls feeding on sea lamprey. Jack-Pine Warbler 42: 231.

Steinbacher, G. 1964. Zum Nahrungsbedarf der Silbermowe (*Larus argentatus*). Vogelwelt 85: 23-24.

1963

Ames, J. E. 1963. Herring Gull nesting on the North Carolina coast. Chat 27: 29.

Blondel, J. 1963. Le probleme du controle des effectifs du Goeland argente (*Larus argentatus michahellis* Naumann) en Camargue. Terre Vie 110: 301-315. [In French.]

Drury, W. H., Jr. 1963a. Herring Gull populations and movements in southeastern New England. Mass. Audubon Soc. cyclostyled rep. to U.S. Fish Wildl. Serv. 68 pp.

Emlen, J. T. 1963. Determinants of cliff edge and escape responses in Herring Gull chicks in nature. Behaviour 22: 1-15.

Goethe, F. 1963. Verhaltensunterschiede swischen europaischen Forman der Silbermowengruppe (Larus argentatus-cachinnans-fuscus). J. Ornithol. 104: 129-141. [In German with English summary.]

Hailman, J. P. 1963. Herring Gull extends breeding range south to North Carolina. Auk 80: 375-376.

Komnick, H, 1963. Elektronenmikroskopische Untersuchungen zur funktionellen Morphologie des Ionen-transportes in der Salzdruse von Larus argentatus. I Teil: Bau und Feinstruktur der Salzdruse. Protoplasma 56: 274-314.

Lemmetyinen, R. 1963. Lokkien esiintymisesta ja ravinnosta Gullkronan selan koillisosassa. [Occurrence and feeding habits of gulls in the northeastern part of the area of Gullkrona.] Suomen Riista 16: 69-82. [In Finnish with English summary.]

Libby, W. L. and W. T. van Velzen. 1963. The effect of amplified sounds on movements of Herring Gulls. U.S. Dep. Int. Bur. Sport Fish Wildl., Patuxent Wildl. Res. Cent., Section Animal Depredations Ctrl. Studies. Prog. Rep. Aug. 1, 1962-July 31, 1963. Work Unit F-34.3. 20 pp.

Ludwig, J. P. 1963. Return of Herring Gulls to natal colony. Bird-Banding 34: 68-72.

Minoranskii, V. A. 1963. [Nesting of the Herring Gull (Larus argentatus) in Lake Manych-Gudilo.] N.D.V.S. Biol. Nauki 3: 51-53. [In Russian.]

Paynter, R. A., Jr. 1963. North American Herring Gulls nesting on a building. Wilson Bull. 75: 88.

Pemberton, R. T. 1963. Helminth parasites of three species of British gulls, Larus argentatus Pont., L. fuscus L. and L. ridibundus L. J. Helminthol. 37: 57-88.

Williamson, F. S. L. and L. J. Peyton. 1963. Interbreeding of Glaucous-winged and Herring Gulls in the Cook Inlet region, Alaska. Condor 65: 24-28.

1962

Clement, R. C. and R. E. Woodruff. 1962. A history of the nesting gulls and terns of Rhode Island, 1889-1961. Narragansett Nat. 5: 108-111, 125-128.

Dennis, J. V. and W. Pepper. 1962. More on the travels of Herring Gulls. EBBA News 25: 139-144.

Gerdes, K. 1962. Richtungstendenzen vom Brutplatz verfrachter Lichmowen (Larus ridibundus) unter Ausschluss visueller Gelande- und Himmelsmarken. Z. Wiss. Zool. 166: 352-410. [In German.]

Harris, M. P. 1962a. Difficulties in the ageing of the Herring Gull and Lesser Black-backed Gull. Bird Study 9: 100-103.

_____. 1962b. Herring Gull with abnormal bill. Brit. Birds 55: 236.

_____. 1962c. The Larus gulls breeding on Skomer, Skokholm and Grassholm islands. Nat. Wales 8: 56-58.

Ludwig, C. C. 1962. Herring Gulls--1961 recoveries. Inl. Bird Banding News 34: 55-56.

Ludwig, J. P. 1962b. A survey of the gull and tern populations of Lakes Huron, Michigan, and Superior. Jack-Pine Warbler 40: 104-119.

Riley, J. W. and D. L. Miller. 1962. Unusual death of Herring Gull. Brit. Birds 55: 590-591.

Smith, W. J. 1962. Drifting gulls. Nat. Hist. 71: 54-59.

Thesleff, S. and K. Schmidt-Nielsen. 1962. An electro-physiological study of the salt gland of the Herring Gull. Am. J. Physiol. 202: 597-600.

Vauk, G. 1962. Das Silbermowenproblem auf Helgoland. Ber. Internatl. Rat. Vogelschutz Helgol. 2: 1-6.

Voous, K. H. 1962. Another presumed hybrid of Lesser Black-backed Gull and Herring Gull in the Netherlands. Ardea 50: 171-172.

1961

Baerends, G. P. 1961. Perceptic-perikelen bij de Zilver-meeuw. Versl. Gewone Vergad. Akad. Amst. 70: 133-138.

Drost, R., E. Frocke and G. Freytag. 1961. Entwicklung und Aufbau einer Population der Silbermowe, Larus argentatus argentatus. J. Ornithol. 102: 404-429. [In German with English summary.]

Ehlert, W. 1961. Weitere Untersuchungen uber die Nahrungswelt der Silbermowe (Larus argentatus) auf Mellum. Vogelwarte 21: 48-50. [In German.]

Gillespie, M. 1961. Travels of Herring Gulls. EBBA News 24: 88.

Goethe, F. 1961. Zur Taxonomie der Silbermowe (*Larus argentatus*) im sudlichen deutschen Nordseegebiet. Vogelwarte 21: 1-24. [In German with English summary.]

Isenmann, P. and B. Schmidt. 1961. Observations a propos d'un hybride *Larus a. argentatus* X *Larus marinus*. Oiseau Rev. Fr. Ornithol. 31: 341-344.

Lesperance, T. 1961. Herring Gulls catching flying ants. Kingbird 11: 150.

Ludwig, C. C. and F. E. Ludwig. 1961. Herring Gulls and Caspian Terns--1960 recoveries. Inl. Bird Banding News 33: 28-29.

Macpherson, A. H. 1961. Observations on Canadian Arctic *Larus* gulls, and on the taxonomy of *L. thayeri* Brooks. Arct. Inst. N. Am. Tech. Pap. 7: 1-40.

Nero, R. W. 1961. Dry land gull colony. Blue Jay 19: 166-168.

Rooke, K. B. 1961. A probable hybrid Great Black-backed Gull X Herring Gull in Devon. Brit. Birds 54: 161-163.

Spitzenberger, F. 1961. Zur Ernahrung einer istrischen Silbermowen-Kolonie (*Larus argentatus michahellis*). Vogelwarte 21: 50-52. [In German.]

Stevens, C. J. 1961. Unusual nest-sites of Herring Gulls in Cornwall, including a tree and various buildings. Brit. Birds 54: 244-245.

Tinbergen, N. 1961. The Herring Gull's World. (Revised edition.) Basic Books, New York.

Voous, K. H. 1961. Micro-geographical variation in Netherlands Herring Gulls, *Larus argentatus*. Ardea 49: 69-72.

Wilcox, L. 1961. Herring Gulls catch flying ants. Kingbird 11: 199.

1960

Baerends, G. P., K. H. Postuma and T. Joustra. 1960. Die Reaktion der brutenden Silbermowe auf die Temperatur des Eies. Arch. Neerl. Zool. 13: 586-588. [In German.]

Bergman, G. 1960. Uber neue Futtergewohnheiten der Mowen an den Kusten Finnlands. Ornis Fenn. 37: 11-28. [In German with Finnish summary.]

Brown, P. B. 1960. Fulmar incubating eggs of Herring Gull. Brit. Birds 53: 127.

Drury, W. H., Jr. 1960. Breeding activities of Long-tailed Jaeger, Herring Gull and Arctic Tern on Bylot Island, Northwest Territories, Canada. Bird-Banding 31: 63-79.

Goethe, F. 1960. Felsbrutertum und weitere beachienswerte Tendenzen bei der Silbermowe. Proc. Internatl. Ornithol. Congr. 12: 252-258. [In German.]

Grahn, Y. 1960. Hackning av strandskata (Haematopus ostralegus) och gratrut (Larus argentatus) i sjon Salen, Kronobergs lan. [Breeding of Oystercatcher (Haematopus ostralegus) and Herring Gull (Larus argentatus) at Lake Salen, Smaland.] Var Fagelvarld 19: 243-244, 251. [In Swedish with English summary.]

Hansen, L. 1960. Krydsning mellum Solvmage (Larus argentatus Pont.) og Sildemage (Larus fuscus L.) fundet ynglende sammen med en Solvmage. [A hybrid between Herring Gull (Larus argentatus Pont.) and Lesser Black-backed Gull (Larus fuscus L.) breeding with a Herring Gull.] Dan. Ornithol. Foren. Tidsskr. 54: 85-87. [In Danish with English summary.]

Jehl, J. R., Jr. 1960. A probable hybrid of Larus argentatus and L. marinus. Auk 77: 343-345.

Johansen, H. 1960. Die Vogelfauna Westsiberiens. Teil III. (Non Passeres). 9. Fortsetzung: Alcidae, Laridae. J. Ornithol. 101: 316-339. [In German.]

Mylne, C. K. 1960. Techniques of Herring Gulls and Jackdaws preying on Puffins. Brit. Birds 53: 86-88.

Stegmann, B. 1960. Zur Systematik des Rassenkreises Larus argentatus. J. Ornithol. 101: 498-499. [In German.]

1959

Baerends, G. P. 1959. The ethological concept "releasing mechanism" illustrated by a study of the stimuli eliciting egg-retrieving in the Herring Gull. Anat. Rec. 128: 518-159.

Borg, K. 1959. Nabblangd och kroppsvikt hos gratrut (Larus argentatus), havstrut (L. marinus) och silltrut (L. fuscus). [Bill lengths and body weights for Herring Gulls (Larus argentatus), Great Black-backed Gulls (L. marinus) and Lesser Black-backed Gulls (L. fuscus).] Var Fagelvarld 18: 311-317. [In Swedish with English summary.]

Elliott, J. J. 1959. Ways of the "Sea Gulls". Kingbird 9: 116-120, 142-148.

Focke, E. 1959. Zur Ernahrung der Silbermowe (Larus argentatus). Vogelwarte 20: 86-88. [In German.]

Hobbs, J. N. 1959. Gulls attacking migrant thrushes. Brit. Birds 52: 313.

Hofslund, P. B. 1959. Fall migration of Herring Gulls from Knife Island, Minnesota. Bird-Banding 30: 104-114.

Smith, W. J. 1959. Movements of Michigan Herring Gulls. Bird-Banding 30: 69-104.

Spaans, A. L. 1959. Het Zilvermeeuwenproblem of Vlieland. Levende Nat. 62: 25-29

Voous, K. H. 1959. Geographical variation of the Herring Gull, Larus argentatus, in Europe and North America. Ardea 47: 176-187.

1958

Amadon, D. 1958. The encroachment of Herring Gulls (Larus argentatus) on more desirable sea-fowl in the eastern United States. Internatl. Comm. Bird Preserv. Bull. 7: 114.

Drost, R. 1958. Uber die Ansiedlung von jung ins Binnenland verfrachteten Silbermowen (Larus argentatus). Vogelwarte 19: 169-173. [In German.]

Duchrow, H. 1958. Stosstauchen und Beuterauben bei Mowen. Vogelwelt 79: 183-184.

Fange, R., K. Schmidt-Nielsen and H. Osaki. 1958. The salt gland of the Herring Gull (Larus argentatus). Biol. Bull. (Woods Hole) 115: 162-171.

Frings, H., M. Frings, J. Jumber, R. G. Bushnel, J. Gibon and P. Gramet. 1958. Reactions of American and French species of Corvus and Larus to recorded communication signals tested reciprocally. Ecology 39: 125-131.

Goethe, F. 1958. Anhaufungen unversehrter Muscheln durch Silbermowen. [Mussels and Larus argentatus.] Nat. Volk 88: 181-187. [In German.]

Kohl, I. 1958. Contributions to systematic studies of the Black Sea's Herring Gulls. Aquila 65: 127-143.

Kruijt, J. P. 1958. Speckling of the Herring Gull egg in relation to brooding behavior. Arch. Neerl. Zool. 12: 565-567.

Morzer Bruyns, M. F. 1958. Gulls which are a menace to other species. The Herring Gull problem in the Netherlands. Internatl. Comm. Bird Preserv. Bull. 7: 103-107.

Olsson, V. 1958. Dispersal, migration, longevity and death causes of *Strix aluco*, *Buteo buteo*, *Ardea cinerea*, and *Larus argentatus*. A study based on recoveries of birds ringed in Fenno-Scandia. Acta Vertebr. 1: 91-189.

Salmon, H. M. 1958. Lesser Black-backed and Herring Gulls nesting on a factory-roof inland in Glamorgan. Brit. Birds 51: 399-401.

1957

Andersen, F. S. 1957. Egg size and the age composition of bird population. Vidensk. Medd. Dan. Naturhist. Foren. 119: 1-24.

Andersson, R. 1957. Gratrutar (*Larus argentatus*) och hornugglor (*Asio otus*) med ovanliga jaktmetoder. [Herring Gulls (*Larus argentatus*) and Long-eared Owls (*Asio otus*) with unusual methods of hunting.] Var Fagelvarld 16: 307-308. [In Swedish with English summary.]

Borg, K. 1957. Om nabblangden hos gratruten (*Larus a. argentatus* Pont.). [On the bill length of the Herring Gull (*Larus a. argentatus* Pont.).] Var Fagelvarld 16: 36-43. [In Swedish with English summary.]

Dutemeyer, C. 1957. Silbermowenbruten auf Hausdachern in Bremerhaven. Ornithol. Mitt. 9: 135.

Ehlert, W. 1957. Zur Ernahrung der Silbermowe (*Larus argentatus* Pontopp.) in der Vorbrutzeit. [The food of the Herring Gull in the prebreeding season.] Ornithol. Mitt. 9: 201-203. [In German.]

Hickling, R. A. O. 1957. The social behavior of gulls wintering inland. Bird Study 4: 181-192.

Kumerloeve, H. 1957. Silbermowenbruten auf Hausdachern. Ornithol. Mitt. 9: 112.

Mills, D. H. 1957. Herring Gulls and Common Terns as possible predators of lobster larvae. J. Fish. Res. Board Can. 14: 729-730.

Poulding, R. H. 1957. Tuberculosis in gulls: a preliminary investigation. Bull. Br. Ornithol. Club 77: 144-149.

Uspenskii, S. M. 1957. Sezonnoe razmeshchenie i migratsii skandinavskoi serebristol chaiki (*Larus argentatus omissus* Pleske) po dannym kol'tsevaniya v SSSR. [Seasonal distribution and migrations of the Scandinavian Herring Gull (*Larus argentatus omissus* Pleske) according to banding data in the USSR.] Trudy Byuro Kol'tsevaniya 9. Moskva.

1956

Davis. T. A. W. 1956. Gulls feeding on grain. Brit. Birds 49: 400-404.

Emlen, J. T., Jr. 1956. Juvenile mortality in a Ring-billed Gull colony. Wilson Bull. 68: 232-238.

Goethe, F. 1956a. Die Silbermowe. Wittenberg Lutherstadt: A. Ziemsen Verlag. 95 pp. [In German.]

_____. 1956b. Fuchs, Vulpes vulpes (Linne, 1758), reibt Schlafgesellschaft von etwa sechzig jugenlichen Silbermowen (Larus argentatus Pontopp.) auf. Saugetierkd. Mitt. 4: 58-60. [In German.]

_____. 1956c. Fremde Silbermowen formen an deutschen Kusten. Doch sibirische Silbermowe (Larus argentatus birulae Pleske) bei Helgoland. Vogelwarte 18: 152-154.

_____. 1956d. Eine aberannte Silbermowe von Helgoland ("Larus argentatus drosti Kleinschmidt"). Vogelwarte 18: 154-156.

_____. 1956e. Eismeer-Silbermowen als Wintervogel in Eckernforde und auf Wanderoog. Vogelwarte 18: 156.

Jungfer, W. 1956. Schwarzmeer-Silbermowe (Larus argentatus ponticus Stegm.) auf Helgoland. Vogelwarte 18: 156-157.

Moynihan, M. 1956a. Notes on the behavior of some North American gulls. I. Aerial hostile behavior. Behaviour 10: 126-178.

_____. 1956b. California Gulls and Herring Gulls breeding in the same colony. Auk 73: 453-454.

Pricam, R. 1956a. Le Goeland argente ravisseur de canetons. Nos Oiseaux 23: 218-219. [In French.]

_____. 1956b. Un Goeland argente mediterraneen sur la Loire. Alauda 24: 73. [In French.]

Tinbergen, N. 1956. On the functions of territory in gulls. Ibis 98: 401-411.

1955

Drost, R. 1955. Neue Beitrage zur Soziologie der Silbermowe Larus a. argentatus. Proc. Internatl. Ornithol. Congr. 11: 564-569. [In German.]

Frings, H., M. Frings, B. Cox and L. Peissner. 1955a. Auditory and visual mechanisms in food-finding behavior of the Herring Gull. Wilson Bull. 67: 155-170.

_____. 1955b. Recorded calls of Herring Gulls (Larus argentatus) as repellants and attractants. Science 121: 340-341.

Gladkov, N. A. and V. S. Zaletaev. 1955. O rybokhozyaistvennom znachenii serebristoi chaiki na Kaspiikom more. [The importance of the Herring Gull to the fishing industry of the Caspian Sea.] Vopr. Ikhtiol. 4. [In Russian.]

Goethe, F. 1955a. Beobachtungen bei der Aufzucht junger Silbermowen. [Observations on the development of behavior in young Larus argentatus.] Z. Tierpsychol. 12: 402-433. [In German with English summary.]

_____. 1955b. Verglichende Beobachtungen zum Verhalten der Silbermowe (Larus argentatus) und der Heringsmowe (Larus fuscus). Proc. Internatl. Ornithol. Congr. 11: 577-582. [In German.]

Gross, A. O. 1955. Changes of certain seabird populations along the New England coast of North America. Proc. Internatl. Ornithol. Congr. 11: 446-449.

Haan, H. J. H. de. 1955. De zilvermeeuw Larus argentatus argentatus Brehm. broedend in de Ospeler Peel (Limburg). Natuurhist. Maandbl. 44: 112-114.

Huntington, C. E. 1955. Age discrimination in a breeding colony of the Herring Gull Larus argentatus. Proc. Internatl. Ornithol. Congr. 11: 467-469.

Tinbergen, N. 1955. Zilvermeeuwennieuws. Levende Nat. 58: 21-30. [In Dutch.]

Took, G. E. 1955. Nesting of Herring Gulls on roof-tops in Dover. Brit. Birds 48: 88-89.

Voipio, P. 1955. The population of the Yellow-legged Herring-Gull on a large lake in Finland. Proc. Internatl. Ornithol. Congr. 11: 537-539.

1954

Baerends, G. P. 1954. Egg recognition in the Herring Gull. Proc. Internatl. Congr. Psychol. 14: 93-94.

Bodenstein, G. 1954. Sommerbeobachtungen von Larus argentatus antelius und Larus hyperboreus in der Sudlichten Ostsee. Vogelwarte 17: 44.

Jungfer, W. 1954. Die Entslehung eines Warstnestes der Silbermowe. Nat. Volk 84: 432-433.

King, B. 1954. Unusual behavior of Herring Gull. Brit. Birds 47: 26.

Maschlanka, H. 1954. Proportionsmessungen an Silbermowen. Zool. Jahrb. Abt. Allg. Zool. Physiol. Tiere 65: 209-218. [In German.]

Meijering, M. P. 1954. Zur Frage der Variationen in der Ernahrung der Silbermowe, Larus argentatus Pont. Ardea 42: 163-175. [In German.]

Poulding, R. H. 1954a. Loss of rings by marked Herring Gulls. Bird Study 1: 37-40.

_____. 1954b. Parasitism of a Herring Gull by the duck leech. Brit. Birds 47: 306-307.

_____. 1954c. Some results of marking gulls on Steepholm. Proc. Bristol Nat. Soc. 29: 49-56.

Schmidt, G. 1954. Zum Rauben der Schmarotzer-Raubmowe. Vogelwelt 75: 147-151. [In German.]

Stokoe, R. 1954. A black Herring Gull in Cumberland. Brit. Birds 47: 132-133.

Taber, W. 1954. Herring Gulls and the hurricane. Bull. Maine Audubon Soc. 10: 62-63.

Voipio, P. 1954a. Uber die gelbfussigen Silbermowen Nordwesteuropas. Acta Soc. Fauna Flora Fenn. 71: 1-56. [In German.]

_____. 1954b. Beobachtungen uber die Silbermowe, _Larus argentatus_ Pont., am Gross-Saimaa und ihre Beziehungen zu den anderen Mowenvogeln. Ornis Fenn. 31: 57-80. [In German.]

Young, C. 1954. Immature Herring Gull soliciting food from adult in December. Brit. Birds 47: 25.

1953

Bauer, K. 1953. Die Mittelmeer-Silbermowe (_Larus argentatus michahellis_) im Oesterreich. Vogelkd. Nachrichtenbl. Oesterr. 3: 1-2.

Cross, A. 1953b. Inland nesting of Herring Gull. Scott. Nat. 65: 195.

Eggeling, W. J. 1953. Herring Gull nesting on a roof top. Scott. Nat. 65: 195.

Goethe, F. 1953a. Soziale Hierarchie in Aufzuchtschwarm der Silbermowen. Z. Tierpsychol. 10: 44-50. [In German.]

_____. 1953b. Experimentelle Brutbeendigung und andere brutethologische Beobachtungen bei Silbermowen (_Larus a. argentatus_ Pontopp.). J. Ornithol. 94: 160-174.

Paludan, K. 1953. Nogle resultater af Kobenhavns Zoologiske Museums ringmaerkning af _Larus argentatus_. Vidensk. Medd. Dan. Naturhist. Foren. 115: 181-204. [In Danish with English summary.]

Rapp, W. F., Jr. 1953. Field separation of the Herring, California and Ring-billed Gulls. Nebr. Bird Rev. 21: 32-33.

Tinbergen, N. 1953. The Herring Gull's World. A Study of the Social Behavior of Birds. Collins, London. New Nat. Monogr. xvi and 255 pp.

1952

Boase, H. 1952. Notes on the courtship display of gulls. Brit. Birds 45: 320-323.

Dawn, W. 1952. Herring Gull regurgitates upon Black-backed Gull's demand. Linn. Newsl. 6(6/7): 2-3.

Drost, R. and E. Schuz. 1952. Das Verhalten der mannlichen und weiblichen Silbermowen (Larus a. argentatus Pont.) ausserhalb der Brutzeit. Vogelwarte 16: 108-116.

Geroudet, P. 1952. Le Goeland argente sur le cours superieur du Rhone. Alauda 20: 171-173.

Kroneisl, R. 1952. Contribution to the study of the taxonomy of the gulls of the Adriatic coast. Larus argentatus Pontoppidan--Herring Gull. Larus 4-5: 105-118. [English translation.]

Nisbet, I. 1952. Herring Gull dropping and catching object in bill. Brit. Birds 45: 74.

Pimlott, D. H. 1952. The economic status of the Herring Gulls of the Grand Manan Archipelago, New Brunswick, 1949. Can. Wildl. Serv. Wildl. Manage. Bull. (Ser. 2) 5: 1-76.

Steiniger, F. 1952. Bilder vom Tauchen der Silbermowe. Vogelwelt 73: 157-159. [In German.]

Tinbergen, N. 1952. On the significance of territory in the Herring Gull. Ibis 94: 158-159.

1951

Bergman, G. 1951. Untersichiede von Silvermowe (Larus a. argentatus) und Heringsmoewe (Larus f. fuscus) in Lebensweise und Stimme. Vogelwarte 16: 17-18. [In German.]

Bronoel, J. K. 1951. Herring Gull census on Knife Island. Flicker 23: 58.

Drost, R. 1951. Beobachtungen an einer kleiner Silbermowen-Population Jahreslauf. Vogelwarte 16: 44-48.

Fritsch, R. H. 1951. Beobachtungen an einer neugebildeten Brutkolonie der Silbermowe (Larus a. argentatus Pontopp.). Z. Tierpsychol. 8: 252-273. [In German.]

Gross, A. O. 1951. The Herring Gull-cormorant control project. Proc. Internatl. Ornithol. Congr. 10: 532-536.

Paludan, K. 1951. Contributions to the breeding biology of Larus argentatus and Larus fuscus. Vidensk. Medd. Dan. Naturhist. Foren. 114: 1-128.

Peters, H. M. and R. Muller. 1951. Die junge Silbermowe (Larus argentatus) als "Platzhocker". Vogelwarte 16: 62-69. [In German.]

Vleugel, D. A. 1951. A case of Herring Gulls learning by experience to feed after the explosion of mines. Brit. Birds 44: 180.

1950

Adams, R. G. 1950. Herring-Gull "paddling" on grass. Brit. Birds 43: 163.

Harberd, R. T. 1950. Herring-Gulls eating charcoal. Brit. Birds 43: 381.

Harberd, R. T. and K. J. Witts. 1950. Bathing behavior of Herring Gull. Brit. Birds 43: 381-382.

Hofslund, P. B. 1950. Herring Gull nests on Knife Island. Flicker 22: 128.

Meinertzhagen, R. 1950. On a race of the Larus argentatus-fuscus group new to the British Isles. Bull. Br. Ornithol. Club 70: 17.

Nordberg, S. 1950. Researches in the bird fauna of the marine zone in the Aland Archipelago. Acta Zool. Fenn. 63: 1-59.

Peters, H. M. and H. Lange. 1950. Uber das Verhalten dor Silbermowe (Larus a. argentatus) zu ihrem Gelege. (Zur Frage des Kannibalismus.) Z. Tierpsychol. 7: 121-130.

Simmons, K. E. L. 1950. "Up-ending" of Herring Gull. Brit. Birds 43: 163.

Spencer, K. G. and A. Welch. 1950. First-year Herring Gull soliciting food in May. Brit. Birds 43: 135.

Stevens, C. J. 1950. Inland breeding and subterranean nesting of Herring Gull in Cornwall. Brit. Birds 43: 94-95.

Tinbergen, N. and A. C. Perdeck. 1950. On the stimulus situation releasing the begging response in the newly hatched Herring Gull chick (Larus argentatus B.) [sic]. Behaviour 3: 1-39.

Yeager, L. E. 1950. Bald Eagle attacks crippled gull. Wilson Bull. 62: 210.

1949

Hazelwood, A. 1949. Agile flight manoeuvre of Herring Gull. Brit. Birds 42: 159.

Ingram, C. and G. T. Kay. 1949. Great Skua's method of killing large birds. Brit. Birds 42: 223-224.

Krug, H. H. 1949. Recovery of 19-year-old Herring Gull. Bird-Banding 20: 103.

Medcof, J. C. 1949. "Puddling"--a method of feeding by Herring Gulls. Auk 66: 204-205.

Parks, G. H. 1949. Diving Herring Gulls. Bird-Banding 20: 149.

Paynter, R. A., Jr. 1949. Clutch-size and the egg and chick mortality of Kent Island Herring Gulls. Ecology 30: 146-166.

Poulding, R. H. 1949. Herring Gull with yellow legs in Gloucestershire. Brit. Birds 42: 335.

Rooke, K. B. 1949. Herring Gull with yellow legs in Dorset. Brit. Birds 42: 29-30.

Walker, A. B. 1949. Herring Gull "paddling" on grass field. Brit. Birds 42: 222-223.

1948

Bronoel, J. K. 1948. Herring Gull nests on Knife Island, Lake Superior. Flicker 20: 110-111.

Buckalew, J. H. 1948. Nesting of the Herring Gull in Virginia. Wood Thrush 4: 22.

Hunt, O. D. 1948. Unusual nesting-site of Herring Gull. Brit. Birds 41: 125-126.

Isakov, Yu. A. 1948. O kolonial'nom gnezdovanii chaek khokhotunii na ostrove Taraba. [On the colonial breeding of Herring Gulls on Taraba Island.] _in_ Sbornik "Chaika khokhotun'ya i flamingo na Kaspiiskom more", Moskva. [In Russian.]

Manville, R. H. 1948. The Huron Island rookery. Jack-Pine Warbler 26: 152-155.

Otterlind, G. 1948a. Till gratrutens (_Larus a. argentatus_ Pont.) naringsoch spridningsekologi. [On food habits and distribution of the Herring Gull (_Larus a. argentatus_ Pont.).] K. Fysiogr. Sallsk. Lund Forh. 18: 36-56. [In Swedish with English summary.]

_____. 1948b. Till gratrutens (_Larus a. argentatus_ Pont.) naringsoch spridningsekologi. [On food habits and distribution of the Herring Gull (_Larus a. argentatus_ Pont.).] Fauna Flora 43: 116-137. [In Swedish with English summary.]

White, M. and C. J. Stevens. 1948. "Smoke-bathing" of Starling and of Herring and Black-headed Gulls. Brit. Birds 41: 244.

Wilmahn, B. 1948. Ringmerkningsresultatur av saeing, Larus argentatus Pont. Stavenger Mus. Arbok 57: 40-46. [In Swedish.]

1947

Boswall, J. H. 1947. Herring-Gulls nesting on buildings. Brit. Birds 40: 255-256.

Eaton, R. J. 1947. An old Herring Gull. Bird-Banding 18: 79.

Elliott, H. F. I. and R. E. Moreau. 1947. Start of incubation by Herring Gull. Brit. Birds 40: 286.

Jacobson, M. A. 1947. An impeded Herring Gull. Auk 64: 619.

Marshall, H. 1947. Longevity of the American Herring Gull. Auk 64: 188-198.

McMullen, T. E. 1947. Nesting of Herring Gull in New Jersey. Auk 64: 321.

Meiklejohn, M. F. M. 1947. Courtship of Herring Gull on water. Brit. Birds 40: 285-286.

Paynter, R. A., Jr. 1947a. The fate of banded Kent Island Herring Gulls. Bird-Banding 18: 156-170.

_____. 1947b. Preliminary report on the effects of egging on the clutch size of Kent Island Herring Gulls. Annu. Rep. Bowdoin Sci. Stn. 8: 11-12.

Salomonsen, F. 1947. Maagekolonierne paa Hirsholmene. [The gull-colonies on Hirsholmene.] Dan. Ornithol. Foren. Tidsskr. 41: 174-186. [In Danish with English summary.]

Stresemann, E. and N. W. Timofeeff-Ressovsky. 1947. Artentstehung in geographischen Formenkreisen. 1. Der Formenkreis Larus argentatus-cachinnans-fuscus. Biol. Zentralbl. 66: 57-76. [In German.]

Woodward, B. 1947. Notes on the loons and Herring Gulls of the west Moosehead Lake region, Maine. Bull. Maine Audubon Soc. 3: 41-44.

1946

Bunker, A. 1946. Gulls taking fish from mergansers. Can. Field-Nat. 60: 115.

Crowell, E. M. and S. Crowell. 1946. The displacement of terns by Herring Gulls at the Weepecket Islands. Bird-Banding 17: 1-10.

Lindroth, S. 1946. Ett bidrag till fragan om gratrutens (Larus argentatus Pontopp.) stallning som marin relikt i vara insjoar. [A contribution to the question of the Herring Gull (Larus argentatus Pontopp.) as a marine remnant in our lakes.] Var Fagelvarld 5: 97-114. [In Swedish with English summary.]

Poor, H. H. 1946a. Plumage and soft-part variations in the Herring Gull. Auk 63: 135-151.

_____. 1946b. Breeding of the Herring Gull in Connecticut. Proc. Linn. Soc. N.Y. 54-57: 43-44.

Voous, K. 1946. Sur un cas d'hybridation naturelle entre Larus fuscus et Larus argentatus dans les Pays-Bas. Alauda 14: 21-32. [In French.]

1945

Beaudette, F. R. 1945. Aspergillosis and parasitism in a gull. Bird-Banding 16: 99-101.

Brown, R. H. 1945. Herring Gull feeding independent young. Brit. Birds 38: 217-218.

Ellison, N. F. and W. Wilson. 1945. Herring-Gull nesting in Cheshire. Brit. Birds 38: 376.

Johnston, F. J. 1945. Herring-Gulls robbing Lapwings. Brit. Birds 38: 278.

Jones, E. 1945. Herring Gulls nesting at Beaver Bay. Flicker 17: 35.

Lovell, H. B. 1945. Reaction of American Mergansers to Herring Gull depredations. Wilson Bull. 57: 202.

Poor, H. H. 1945. Primaries of a nine-year-old Herring Gull. Bird-Banding 16: 102-103.

1944

Gross, A. O. 1944. Herring Gull recoveries. Bowdoin Coll. Bull. 9. Brunswick, ME.

Haartman, L. V. 1944. Masfragen Enkritik oven kritiker. Fin. Nat. IV.

Leach, E. P. 1944. Scandinavian Herring-Gulls in Scotland and Lincolnshire. Brit. Birds 37: 159.

Lloyd, B. 1944. Herring Gulls feeding independent young. Brit. Birds 38: 39-40.

Mason, A. G. 1944. Herring Gulls' behavior. Irish Nat. J. 8: 1-8.

Poor, H. H. 1944. Color-banded adult Herring Gulls. Bird-Banding 15: 112-114.

Rollin, N. 1944. Winter measurements of gulls' testes. Ibis 86: 550-551.

White, W. W. 1944. Herring-Gulls nesting on a house roof. Brit. Birds 38: 120.

1943

Dexter, R. W. 1943. Shell heaps of the Herring Gull. Nautilus 57: 69.

Griffin, D. R. 1943. Homing experiments with Herring Gulls and Common Terns. Bird-Banding 14: 7-33.

Hennessey, T. R. 1943. Banded Herring Gull No. 40-656624. Can. Field-Nat. 57: 97.

Poor, H. H. 1943. Color-banded immature Herring Gulls in the New York region. Bird-Banding 14: 101-115.

Ross, W. R. 1943. Hormonal determination of adult characters and sexual behaviour in Herring Gulls. J. Exp. Zool. 94: 181-203.

Trautman, M. B. 1943. Herring Gull attack on normal golden-eye. Wilson Bull. 55: 192.

van Marle, J. G. and K. H. Voous, Jr. 1943. Geographische vormen van Larus argentatus en Larus fuscus in Nederland. Limosa 16: 146-149. [In Dutch.]

1942

Behle, W. 1942. Records of the Herring Gull, Sanderling and Lark Bunting in Utah. Condor 44: 230-231.

Dathe, H. 1942. Uber die Rassenzugehorrigkeit der Silbermowe an der Kuste der Darsshalbinsel in Herbst. Ornithol. Monatsber. 50: 127.

Davis, D. E. 1942. Number of eggs laid by Herring Gulls. Auk 59: 549-554.

Rand, A. L. 1942. Larus kumlieni and its allies. Can. Field-Nat. 56: 123-126.

Spear, I. M. 1942. Herring Gull control experiments. Bowdoin Sci. Stn. Bull. 8: 15-31.

1941

Aldous, C. M. 1941. Report of a wholesale die-off of young Herring Gulls, Hogback Island, Moosehead Lake, Maine. Bird-Banding 12: 30-32.

Bodenstein, G. and E. Schuz. 1941. Erstnachweis von Larus argentatus antelius Ired. Fur Deutschland. Ornithol. Monatsber. 49: 49-56.

Brandt, M. 1941. Ueber das Brutvorkommen der Silbermowe (Larus argentatus omissus) und des Sterntauchers (Colymbus stellatus) im Ostbaltikum. J. Ornithol. 89: 257-267. [In German.]

Brown, M. 1941. Gulls eat fruit of the cabbage palmetto. Auk 58: 579.

Hoff, C. C. 1941. A case of correlation between infection of snail hosts with Cryptocotyle lingua and the habits of gulls. J. Parasitol. 27: 539.

Latham, R. 1941. Herring Gulls as vegetable eaters on Long Island, N. Y. Oologist 58: 12.

Lippens, L. 1941. Moeurs de Goeland argente. Larus a. argentatus Pontopp. Gerfaut 31: 137. [In French.]

Slijper, H. J. 1941. Twee waarnemingen in Nederland van geelpotige Zilvermeeuwen. Ardea 30: 270-271. [In Dutch.]

Van Oordt, G. J. 1941. Een Zilvermeeuw, Larus argentatus Pont., broedend in het polderland. Ardea 30: 269-270. [In Dutch.]

Wetmore, A. 1941. Herring Gull in Guatemala. Auk 58: 257.

1940

Bergman, G., E. Fabricius, and L. von Haartman. 1940. En preliminar undersokning over silltrutens, Larus f. fuscus L., och gratrutens, Larus a. argentatus Pontopp., Naringsbiolog., sarskilt ur jakvardssynpunkt. Ornis Fenn. 17: 33-41.

Berthel, R. M. 1940. Herring Gulls eat grasshoppers. Flicker 12: 35.

Cooke, M. T. 1940. Winter range of the Herring Gull. Auk 57: 250-251.

Davis, W. A. and L. S. McClung. 1940. Aspergillosis in wild Herring Gulls. J. Bacteriol. 40: 321-323.

Drost, R. and L. Schilling. 1940. Ueber der Lebensraum deutscher Silbermowen, Larus a. argentatus Pontopp. auf Grund von Beringungsergebnissen. Vogelzug 11: 1-22. [In German.]

Gross, A. O. 1940. The migration of Kent Island Herring Gulls. Bird-Banding 11: 129-155.

Harriot, S. C. and J. J. Hickey. 1940. A Christmas census of banded Herring Gulls. Proc. Linn. Soc. N. Y. 50-51: 33-34.

Helmuth, W. T. 1940. The Herring Gull on Long Island. Univ. State N.Y. Bull. Schools 26: 256-257, 259.

Koch, J. C. 1940. Geelpootige Zilvermeeuwen, Larus argentatus subspec., in Nederland. Ardea 29: 227-230. [In Dutch.]

Lowe, W. P. 1940. Herring Gull and snake. Ibis (14th Ser.) 4: 728.

Mayaud, N. 1940. Considerations sur les affinites et la systematique de Larus fuscus et Larus argentatus. Alauda 12: 80-98.

McKeever, C. K. 1940. The breeding of the Herring Gull (Larus argentatus smithsonianus) on Long Island in 1939. Proc. Linn. Soc. N.Y. 50-51: 32-33.

Throne, A. L. 1940. A feeding habit of the Herring Gull. Wilson Bull. 52: 34.

Woodcock, A. H. 1940. Observations on Herring Gull soaring. Auk 57: 219-224.

1939

Deusing, M. 1939. The Herring Gulls of Hat Island, Wisconsin. Wilson Bull. 51: 170-175.

Harrington, R. W., Jr. 1939. Parasites of the Herring Gull Larus argentatus smithsonianus. Bowdoin Coll. Bull. 6: 14-18.

Kuhlemann, P. 1939. Beobachtungen an einer durch Flusseeschwalben (Sterna h. hirundo L.) aus vertauschtem Ei erbruteten und aufgezogenen Silbermowe (Larus a. argentatus Pontopp.). Z. Tierpsychol. 3: 75-84. [In German.]

Latham, R. 1939. Herring Gulls on ploughed lands. Oologist 56: 77-79.

McClanahan, R. C. 1939. Protecting blueberries from damage by Herring Gulls. U.S. Dep. Int. Biol. Surv. Wildl. Leafl. 141. 4 pp.

Mendall, H. L. 1939. Food habits of the Herring Gull in relation to fresh-water game fishes in Maine. Wilson Bull. 51: 223-226.

Meylan, O. 1939. Note sur le Goeland argente Larus fuscus (argentatus) michahellis Naumann. Arch. Suisse Ornithol. 1: 456-465.

Richter, R. 1939. Weitere Beobachtungen an einer gemischten Kolonie von Larus fuscus graellsi Brehm und Larus argentatus Pontopp. J. Ornithol. 87: 75-86. [In German.]

Salomonsen, F. 1939. Oological studies in gulls. I. Egg-producing powers of Larus argentatus Pont. Dan. Ornithol. Foren. Tidsskr. 33: 113-133.

1938

Cruickshank, A. D. 1938. Herring Gulls following the plow. Auk 55: 672.

Drost, R. 1938. Geschlechsunterschiede am Schnabel der Silbermowe, *Larus a. argentatus* Pont. Ornithol. Monatsber. 46: 129-131. [In German.]

Geyr von Schweppenburg, H. 1938. Zur Systematik der *fuscus-argentatus*-Mowen. J. Ornithol. 86: 345-365. [In German.]

Harris, A. T. 1938. Nesting of the Herring Gull and Common Tern. Oologist 55: 102-104.

Hickey, J. J. and R. P. Allen. 1938. First sight-recoveries of marked Herring Gulls. Bird-Banding 9: 51-54.

Kozlova, E. V. 1938. Field observations on the breeding of the Herring-Gull (*Larus argentatus ponticus*) on the Caspian Sea. Ibis (14th Ser.) 2: 245-254.

Lyon, W. I. 1938. Albinistic Herring Gulls. Bird-Banding 9: 102.

Richter, R. 1938. Beobachtungen an einer gemischten Kolonie von Silbermowe (*Larus argentatus* Pont.) und Heringsmowe (*Larus fuscus graellsii* Brehm). J. Ornithol. 86: 366-373.

Shelley, L. O. 1938. Some detailed history of Herring Gull 37-652822. Bird-Banding 9: 54-55.

1937

Bodenstein, G. 1937. Von der Wanderungen der Seemowen (*Larus hyperboreus*, *L. marinus*, *L. argentatus*, *L. fuscus*, und *L. canus*) in Ostlichen Ostsee nach den Beringungsergebnissen. Schr. Phys.-Okon. Ges. Konigsberg 69: 223-234.

Booy, H. L. and N. Tinbergen. 1937. Nieuwe feiten over de sociologie van de Zilvermeeuwen. Levende Nat. 41: 325-334.

Broekhuysen, G. J., Jr. 1937. Gedragingen van geslachtsrijpe en nog niet geslachsrijpe Zilver- en Grote Mantelmeeuwen (*Larus argentatus* Pont. et *Larus marinus* L.) buiten de broedtijd. Ardea 26: 159-172. [In Dutch with English summary.]

Dewar, J. M. 1937. Herring Gulls feeding on starfish. Scott. Nat. 1937: 32.

Goethe, F. 1937. Beobachtungen und Untersuchungen zur Biologie der Silbermowe (*Larus a. argentatus* Pontopp.) auf der Vogelinsel Memmertsand. J. Ornithol. 85: 1-119. [In German.]

Holmes, P. F. 1937. Gulls taking ants off surface of lake. Brit. Birds 30: 261.

Lockley, R. M. 1937. Black-backed and Herring-Gulls and Ravens feeding on ants. Brit. Birds 30: 325-326.

Lowe, W. P. 1937. Can gulls dive? Ibis (14th Ser.) 1: 175.

McLeod, J. A. 1937. Two new schistosomid trematodes from water-birds. J. Parasitol. 23: 456-466.

Steinbacher, G. 1937. Das Wiederkennen des Geleges bei der Silbermowe (_Larus a. argentatus_ Pont.). Beitr. Fortpfl. Vogel 13: 23-25.

Very, N. T. 1937. Behavior of young Herring Gulls. Bird-Banding 8: 77-78.

1936

Campbell, J. W. 1936. Spotted Flycatcher, Great Tit and gulls taking moths. Brit. Birds 30: 172.

Ivanenko, I. D. 1936. Biolohiya i sil'sko-hospodarske znachen'ya chaiky rehotukhy. [The biology and agricultural importance of the Herring Gull.] Zb. Nauk. Pr. Azov. Zapov. 1936. [In Ukrainian.]

Mitchell, M. 1936. Herring Gulls feeding on larvae of moths. Brit. Birds 30: 92.

Ringleben, H. 1936. Uber die Nahrung der alten und jungen Silbermowen. Beitr. Fortpfl. Vogel 12: 165. [In German.]

Tinbergen, N. 1936. Zur Soziologie der Silbermowe, _Larus a. argentatus_ Pont. Beitr. Fortpfl. Vogel 12: 89-96. [In German.]

1935

Broekhuysen, G. J., Jr. 1935. Gedragingen van nog niet geslachsrijpe doch reeds zelfstandige Zilver- en Grote Mantelmeeuwen (_Larus argentatus_ Pont. et _Larus marinus_ L.). Ardea 24: 239-250. [In Dutch with German summary.]

Drost, R. 1935. Silbermowe, _Larus a. argentatus_ Pont., im 5 Jahr noch nicht ausgefarbt. Ornithol. Monatsber. 43: 116. [In German.]

Grant, C. H. B. and C. W. Mackworth-Praed. 1935. [On the races of the Herring-Gull visiting eastern Africa in the non-breeding season.] Bull. Br. Ornithol. Club 56: 33-34.

Makkink, G. F. 1935. British Lesser Black-backed Gull X Herring Gull in Texel. Ardea 24: 208-209.

Meinertzhagen, R. 1935. The races of Larus argentatus and Larus fuscus with special reference to Herr B. Stegmann's recent paper on the subject. Ibis (13th Ser.) 5: 762-773.

Mendall, H. L. 1935. The relationship of certain sea birds to the fishing industry of the state of Maine. Bull. Dep. Sea Shore. Fish. Maine. 28 pp.

Munro, J. A. 1935. Nesting colonies of the Herring Gull in British Columbia. Condor 37: 214-215.

Pearson, T. G. 1935. A Herring Gull of great age. Bird-Lore 37: 412-413.

Ritchie, J. 1935. Great age of Herring Gull. Scott. Nat. 1935: 69-70.

Schuz, E. 1935. Silbermowen (Larus a. argentatus) fast 25 und 26 Jahre alt. Vogelzug 6: 134-135.

1934

Eaton, R. J. 1934a. The migratory movements of certain colonies of Herring Gulls in eastern North America. Part II. Bird-Banding 5: 1-19.

_____. 1934b. The migratory movements of certain colonies of Herring Gulls in eastern North America. Part III. Bird-Banding 5: 70-84.

Gabrielson, I. N. 1934. The Herring Gull on the Columbia River. Murrelet 15: 25.

Hinchman, R. M. 1934. A few Herring Gull recoveries. Bird-Banding 5: 189-190.

Hytonen, U. 1934. Harmaalokin (Larus a. argentatus Pontopp.) pesimisesta soillame. Ornis Fenn. 11: 61-75. [In Finnish with German summary.]

Junge, G. C. A. 1934. A difference in time between the egg laying of Larus fuscus L. and Larus argentatus Pont. in the Shetlands. Ardea 23: 169-171.

Saunders, A. A. 1934. A curious habit of gulls. Auk 51: 234.

Shelley, L. O. 1934a. Herring Gull recovery from Panama. Bird-Banding 5: 189.

_____. 1934b. Gull notes from the New Hampshire and Maine coasts. Auk 51: 83.

van Dobben, W. H. 1934. Bijdrage tot het meeuwenvraagstuk. Org. Club Ned. Vogelkd. 7: 63-78.

1933

Allen, R. P. 1933. Breeding range of Herring Gull extended. Auk 50: 433-434.

Eaton, R. J. 1933. The migratory movements of certain colonies of Herring Gulls (*Larus argentatus smithsonianus* Coues) in eastern North America. Bird-Banding 4: 165-176.

Lonnberg, E. 1933. Some remarks on the systematic status of the Yellow-legged Herring-Gulls. Ibis (13th Ser.) 3: 47-50.

Tomkins, I. R. 1933. Ring-billed and Herring Gulls at the Savannah River mouth in July and August. Auk 50: 103.

Schuz, E. 1933. Von den Wanderungen der Eismeer- und Ostsee-Silbermowen (*Larus a. argentatus*). Ornis Fenn. 10: 17-19.

1932

Austin, O. L. 1932d. The occurrence of botulism in a Herring Gull. Bird-Banding 3: 178.

Duse, A. 1932. La colonia di gabbiani reali del lago di Garda. Riv. Ital. Ornitol. 2: 1-4.

Lockley, R. M. 1932. Incubation-periods of Lesser and Great Black-backed and Herring-Gulls. Brit. Birds 25: 310-313.

Tinbergen, N. 1932. Waarnemingen aan Zilvermeeuen in de broed-kolonie te Wassenaar. Levende Nat. 37: 248-252.

1931

Marcot, C. 1931. Au sujet des oeufs du Goeland argente a pieds jaunes de la Mediterranee, *Larus argentatus michahellesii* Bruch. et du Goeland d'Audouin, *Larus audouinii* Payr. Oiseau Rev. Fr. Ornithol. 1: 391-392.

Schuz, E. 1931. Alte Ringvogel: Silbermowe (*Larus a. argentatus*) von 21 und 22 Jahren. Vogelzug 2: 176-177.

Steinbacher, G. 1931. Beitrage zur Brutbiologie von Silbermowe and Brand-seeschwalbe. J. Ornithol. 79: 349-353. [In German.]

van Dobben, W. H. 1931. Einzelheiten uber Farbe und Brutbiologie der auf Terschelling nistenden Heringsmowen (*Larus fuscus* subspec.) Ardea 20: 143-147. [In German.]

1930

Hortling, I. 1930. En gulfotad gratrut Larus argentatus omissus Sushkin? hackande in S. Finland. Ornis Fenn. 7: 61-67. [In Swedish with German summary.]

Oldham, C. 1930. The shell-smashing habits of gulls. Ibis (12th Ser.) 6: 239-243.

van Someren, V. D. 1930. Curious changes of diet in Black-headed and Herring Gulls. Scott. Nat. 1930: 132.

von Hedemann, K. 1930. Die Nahrung der Silbermowe. Ornithol. Monatsschr. 55: 160. [In German.]

1929

Ruthke, P. 1929. Von der Silbermowe. Gefiederte Welt 52: 612-621. [In German.]

Sprunt, A., Jr. 1929. The Herring Gull (Larus argentatus) in the North Carolina mountains. Auk 46: 100.

Tinbergen, N. 1929. A breeding pair of Herring Gull (Larus a. argentatus Pont.) X Lesser Black-backed Gull (Larus fuscus subspec.). Ardea 18: 1.

1928

Brouwer, G. A. 1928. Voorkomen van dwergeieren bij Larus argentatus Pont. Ardea 17: 72-73. [In Dutch.]

Dietrich, F. 1928. Die Abanderungen der Silvermoweneier. Beitr. Fortpfl. Vogel 4: 157-160.

Lincoln, F. C. 1928a. The migration of young North American Herring Gulls. Auk 45: 49-59.

_____. 1928b. Herring Gulls: a correction. Auk 45: 366.

Portielje, A. F. J. 1928. Zur Ethologie Psychologie der Silbermowe Larus argentatus Pont. Ardea 17: 112-149. [In German.]

Taning, A. V. 1928. Solvmagen Larus argentatus argentatus Pontopp. ny for Island. Dan. Ornithol. Foren. Tidsskr. 22: 91-96.

Tweedale, V. 1928. Herring-Gull nesting on occupied house. Brit. Birds 22: 147.

1927

Rapine, J. 1927. Differenciation des jeunes oiseaux des especes Larus argentatus argentatus (Pontopp.) et Larus fuscus affinis Reinhardt. Rev. Fr. Ornithol. 19: 96-97.

Shipman, C. M. 1927. Nesting of the Herring Gull and some other birds on Lake Erie Islands. Auk 44: 242-243.

Skovgaard, P. 1927. Maerkende Havmaager II. [Marking experiments with Larus argentatus.] Dan. Fugle 8: 108-120.

1926

Lawson, R. 1926. Herring Gulls nesting in Salem Bay. Bull. Essex Co. Ornithol. Club 1926: 52.

Lonnberg, E. 1926. Den gulfotade gratrutens, Larus cachinnans Pall., systematiska stallning. Fauna Flora 21: 218-222. [In Swedish with English summary.]

1925

Mackay, G. H. 1925. Breeding of the Herring Gull (Larus argentatus) in Massachusetts. Auk 42: 517-518.

1924

Thomson, A. L. 1924. The migrations of the Herring Gull and Lesser Black-backed Gull. Brit. Birds 18: 34-44.

1923

Bean, R. A. 1923. A black Herring Gull. Yearb. Milwaukee Public Mus. 3: 178-181.

Moreau, R. E. 1923. Herring-Gull eating its own chick. Brit. Birds 16: 221-222.

Strong, R. M. 1923. Further observations on the habits and behavior of the Herring Gull. Auk 40: 609-621.

Wolfe, T. R. 1923. The Herring Gulls of Lake Champlain. Auk 40: 621-626.

1922

Colthrup, C. W. 1922. Herring Gulls hawking for winged ants. Brit. Birds 16: 139.

1921

Lonnberg, E. 1921. Den gulfotade gratruten, Larus argentatus cachinnans Pallas, en for Sverige ny fagel. Fauna Flora 16: 126-130. [In Swedish.]

1920

Dwight, J. 1920. The plumages of gulls in relation to age as illustrated by the Herring Gull (Larus argentatus) and other species. Auk 37: 262-268.

1918

Palmgren, R. 1918. Larus argentatus Brunn [male] X marinus (L.) [female]. Helsingfors Medd. Soc. Fauna Flora Fenn. 44: 125-127.

1917

Leege, O. 1917. Die Nahrung die Silbermowen an der ostfrieschen Kuste. Ornithol. Monatsschr. 42: 2-24. [In German.]

1915

Nichols, J. T. 1915. Estimated average age of the Herring Gull. Condor 17: 181-183.

Strong, R. M. 1915. On the habits and behavior of the Herring Gull, Larus argentatus Pont. Smithson. Rep. 1914: 479-509.

1914

Strong, R. M. 1914. On the habits and behavior of the Herring Gull, Larus argentatus Pont. Auk 31: 22-49, 178-199.

1913

Cummings, S. G. 1913. Herring Gulls diving. Brit. Birds 7: 201-202.

1912

Strong, R. M. 1912. Observations on the breeding behavior of the Herring Gull. Science 35: 936.

1906

Ward, H. L. 1906a. Notes on the Herring Gull and the Caspian Tern (Larus argentatus and Sterna caspia). Bull. Wis. Nat. Hist. Soc. 4: 113-134.

_____. 1906b. Why do Herring Gulls kill their young? Science 24: 593-594.

1903

Dutcher, W. and W. L. Bailey. 1903. A contribution to the life history of the Herring Gull (Larus argentatus) in the United States. Auk 20: 417-431.

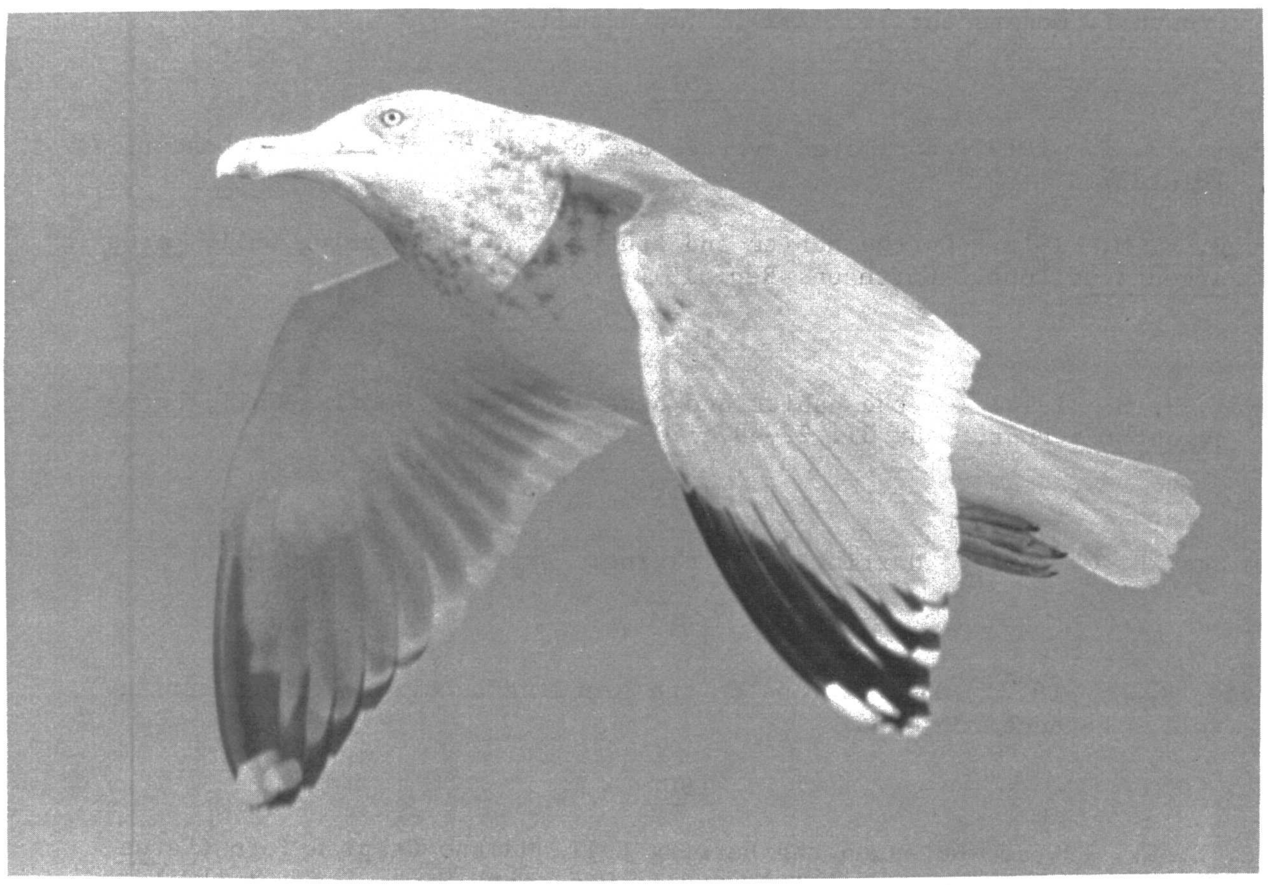
Rodger, A. M. 1903. Herring Gull (Larus argentatus) capturing a bat. Ann. Scott. Nat. Hist. Soc. 1903: 51.

1893

Mackay, G. H. 1893. Larus argentatus smithsonianus. Auk 10: 76.

1892

Mackay, G. H. 1892. Habits of the American Herring Gull (Larus argentatus smithsonianus) in New England. Auk 9: 221-228.



Adult Herring Gull in winter plumage. Photograph by Roger B. Clapp.

GREAT BLACK-BACKED GULL

(*Larus marinus*)

[DA: Svartbag, DU: Mantelmeeuw, FI: Merilokki, FR: Goeland marin, GE: Mantelmowe, IC: Svartbakur, IT: Mugnaiaccio, NW: Svartbak, PO: Mewa siodlata, SP: Gavion, SW: Havstrut]

GENERAL DISTRIBUTION

North America In southeastern Canada, Great Black-backed Gulls breed along the coast of Labrador, in south coastal Quebec, in Newfoundland, and in the Maritime Provinces. In the interior, they breed rarely and locally on the Great Lakes in southern Ontario (Godfrey 1966). In the United States, Great Black-backed Gulls breed from the coast of Maine south to North Carolina (AOU 1957, Parnell and Soots 1975, Map 7).

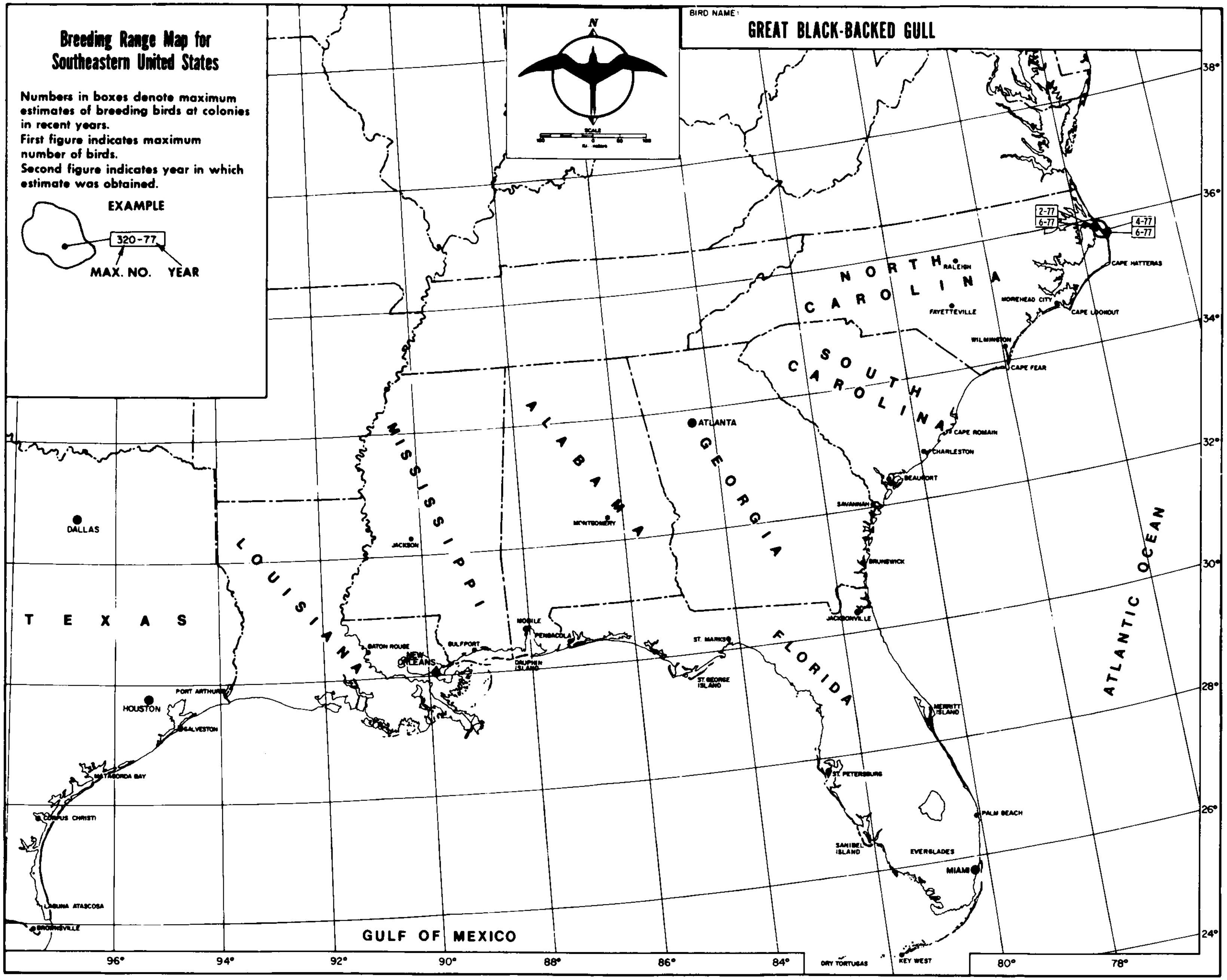
North American birds winter regularly in the breeding range south to the Great Lakes and along the Atlantic coast to North Carolina (AOU 1957). This species has occurred more and more commonly in recent years as a winter resident along the coast in states south of North Carolina and has been recorded as far west as Texas. Although steadily recorded in greater numbers each year south of North Carolina, they are still uncommon winter visitors in that area.

Great Black-backed Gulls are less likely to wander far from their breeding and wintering ranges than are many other North American gulls, but they have wandered as far north as Baffin Island and Hudson Bay (Godfrey 1966), and as far east and southeast as Bermuda, Aruba (in the Netherlands Antilles), Puerto Rico, Cuba, St. Bartholomew, and Barbados (Vaurie 1965, Bond 1971, Voous 1977, Raffaele 1981).

World Distribution In the Old World, Great Black-backed Gulls breed only in western Eurasia between about 42° and 77°N (Voous 1960, BOU 1971). They breed in Greenland, Iceland, the Faeroes, Great Britain, northwest France, northern Denmark, on the Atlantic and Baltic coasts of Norway, Sweden, and Finland, and in part of Estonia; they also breed on the Murmansk coast of Russia, offshore in Spitsbergen, and on Bear Island (Vaurie 1965, BOU 1971, Cramp et al. 1974). European populations are both sedentary and migratory, moving south as far as the Mediterranean and the Black and Caspian Seas and wandering casually to Madeira, the Canaries, and the Azores (Vaurie 1965).

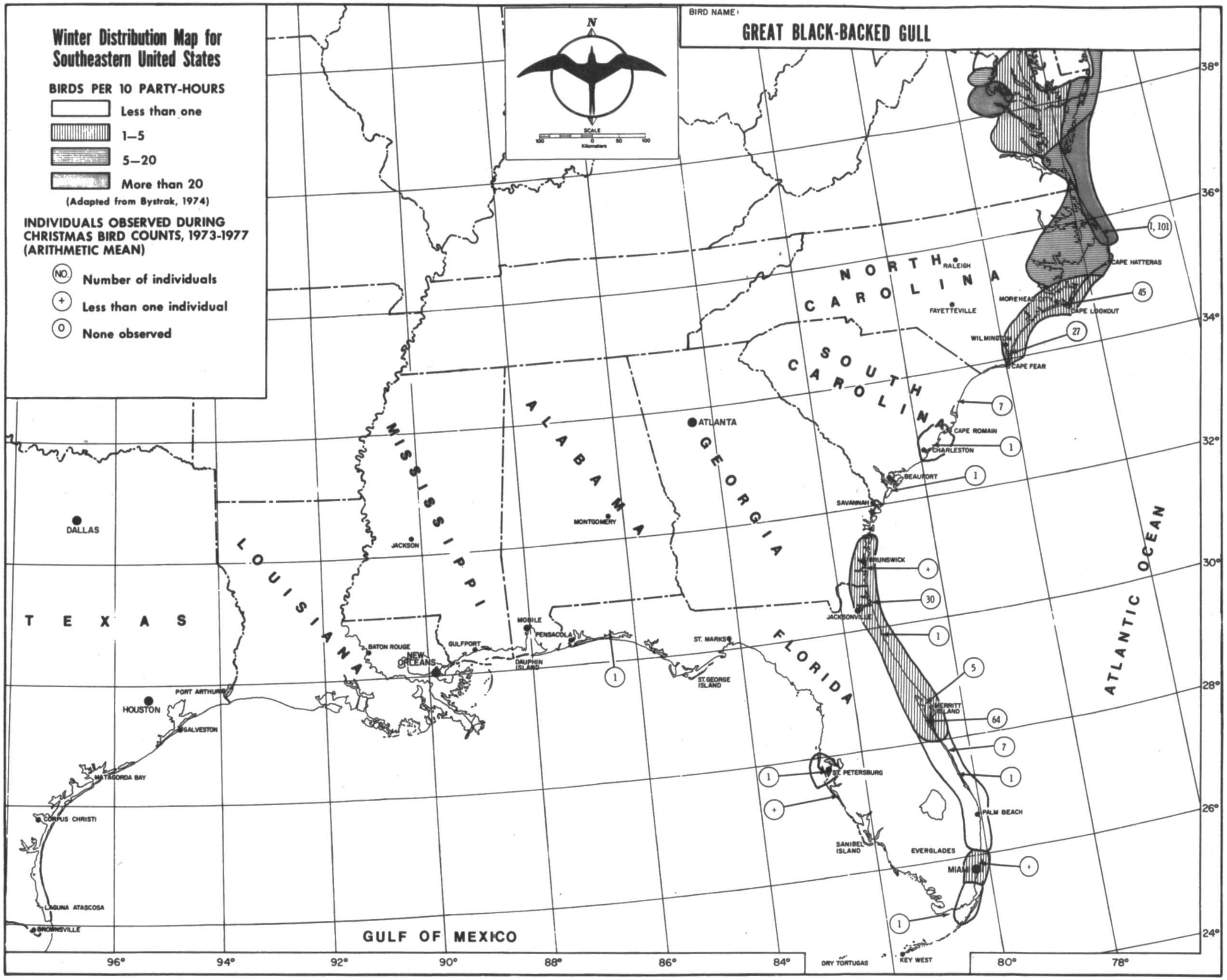
DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

North Carolina First recorded from North Carolina on 5 February 1901 (Pearson et al. 1942), the Great Black-backed Gull has gradually become a common to abundant winter resident along the coast (Map 8). They are most abun-



Breeding Range Map for Southeastern United States
Numbers in boxes denote maximum estimates of breeding birds at colonies in recent years.
First figure indicates maximum number of birds.
Second figure indicates year in which estimate was obtained.
EXAMPLE
320-77
MAX. NO. YEAR
N
BIRD NAME:
GREAT BLACK-BACKED GULL
2-77
6-77
4-77
6-77
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI
LOUISIANA
TEXAS
FLORIDA
ATLANTIC OCEAN
GULF OF MEXICO
RALEIGH
FAYETTEVILLE
MOREHEAD CITY
CAPE HATTERAS
CAPE LOOKOUT
WILMINGTON
CAPE FEAR
CAPE ROMAIN
CHARLESTON
BEAUFORT
SAVANNAH
BRUNSWICK
JACKSONVILLE
ATLANTA
MONTGOMERY
JACKSON
DALLAS
HOUSTON
PORT ARTHUR
GALVESTON
MATAGORDA BAY
CORPUS CHRISTI
LAGUNA ATASCOSA
BROWNSVILLE
BATON ROUGE
NEW ORLEANS
GULFPORT
MOBILE
PENSACOLA
DAUPHIN ISLAND
ST. MARKS
ST. GEORGE ISLAND
MERRITT ISLAND
ST. PETERSBURG
SANIBEL ISLAND
EVERGLADES
PALM BEACH
MIAMI
KEY WEST
DRY TORTUGAS
38°
36°
34°
32°
30°
28°
26°
24°
96°
94°
92°
90°
88°
86°
84°
80°
78°

Map 7


Winter Distribution Map for Southeastern United States
BIRDS PER 10 PARTY-HOURS
Less than one
1–5
5–20
More than 20
(Adapted from Bystrak, 1974)
INDIVIDUALS OBSERVED DURING CHRISTMAS BIRD COUNTS, 1973-1977 (ARITHMETIC MEAN)
NO. Number of individuals
+ Less than one individual
0 None observed
BIRD NAME:
GREAT BLACK-BACKED GULL
N
SCALE
Kilometers
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI
LOUISIANA
TEXAS
FLORIDA
ATLANTIC OCEAN
GULF OF MEXICO
RALEIGH
FAYETTEVILLE
MOREHEAD
CAPE HATTERAS
CAPE LOOKOUT
WILMINGTON
CAPE FEAR
CAPE ROMAIN
CHARLESTON
BEAUFORT
SAVANNAH
BRUNSWICK
JACKSONVILLE
MERRITT ISLAND
ST. PETERSBURG
PALM BEACH
SANIBEL ISLAND
EVERGLADES
MIAMI
KEY WEST
DRY TORTUGAS
ATLANTA
MONTGOMERY
JACKSON
MOBILE
PENSACOLA
GULFPORT
DAUPHIN ISLAND
BATON ROUGE
NEW ORLEANS
ST. MARKS
ST. GEORGE ISLAND
DALLAS
HOUSTON
PORT ARTHUR
GALVESTON
MATAGORDA BAY
CORPUS CHRISTI
LAGUNA ATASCOSA
BROWNSVILLE
1,101
45
27
7
1
1
+
30
1
5
64
7
1
1
+
+
1
1
38°
36°
34°
32°
30°
28°
26°
24°
96°
94°
92°
90°
88°
86°
84°
80°
78°

Map 8

dant north of Cape Hatteras (Map 8). The first known instance of breeding within the state was reported 24-25 June 1972, when Parnell and Soots (1975) found four adults and four flightless juveniles in a colony of Herring Gulls at Oregon Inlet. Four adults were present at the same site the following summer, and a nest with three eggs was found 1 June 1973. Three pairs were found nesting on a dredge-spoil island in 1976 (Portnoy et al. 1981) and ten pairs of Great Black-backed Gulls nested at five sites in 1977 (Parnell and Soots 1979 ms). Nine of the nests found in 1977 were in Roanoke Sound on four dredge-spoil islands (Map 7) where the Great Black-backed Gulls were always found nesting in association with nesting Herring Gulls (Parnell and Soots 1979 ms).

South Carolina Burton (1970) considered these gulls to be rare winter visitors to South Carolina, but suggested that they would be seen more frequently in the future. Through 12 December 1968 there were only 13 sightings of 16 birds; most of the observations were made in January (3) and December (6) (Sprunt and Chamberlain 1949, Burton 1970). Great Black-backed Gulls are uncommon in winter in South Carolina, but recent Christmas Counts indicate that they are gradually becoming more common in northern areas of the state (Map 8). Forsythe (1973) recorded a maximum count of 20 birds at Charleston in February in a period extending from June 1971 to June 1972.

Georgia As recently as 1958 Great Black-backed Gulls were known from Georgia only on the basis of a single specimen taken in Chatham County probably about 1910 (Burleigh 1958). Denton et al. (1977) considered it an uncommon visitor along the coast from December to March. An unusually large recent concentration consisted of 20 to 25 immature birds seen on and offshore Jekyll Island on 11 February 1979 (LeGrand 1979b). Great Black-backed Gulls have become more common in Georgia in recent years.

Florida - Atlantic Coast In Florida, as in other states along the southeastern seaboard, the Great Black-backed Gull has become more common recently. Howell (1932) knew it only from two 19th-century records from the northeastern coast of Florida; one of them had been made by Audubon. Sprunt (1954) knew of another six records, all from the Atlantic coast and one from as far south as Lower Matecumbe Key. Sprunt (1963) later noted that there were records from most years since 1954. At present, small numbers of this species are commonly seen south to Cape Canaveral, but this gull is uncommon from there south to the Keys (Kale 1979 ms a).

The recent increase in the number of wintering birds is documented by high counts made along the northeast coast. As many as five were seen near Cocoa in the winter of 1955-56 (Stevenson 1956b), but only three years later, during the winter of 1958-59, at least 13 were present at Canaveral (Stevenson 1959a). In 1960-61 at least 28 Great Black-backed Gulls wintered at Canaveral; this was the highest count for Florida yet made (Stevenson 1970). The average number seen on some of recent Christmas Counts (1973-77) (Map 8) suggests that the total population wintering on the Atlantic coast is still increasing.

Most records are from 7 November to 27 March; a few others (9 October;

18, 25 April) probably represent early-arriving or late-departing winter residents. There are now about a dozen records for May through August of summering Great Black-backed Gulls. Almost all records are from the coast, but we know of two reports of birds seen about 20 mi (32 km) inland. One was seen 25 April 1963 on the St. John's River near Jacksonville (Stevenson 1963b); the other was seen on the same river at Mandarin, 9 February 1979 (Stevenson 1979a).

Florida - Gulf Coast Great Black-backed Gulls are uncommon to rare on the Florida Gulf coast, but scattered individuals are seen with increasing frequency each winter. This species was first recorded from the Gulf coast in 1948 when a banded bird was recovered at Panama City on 17 February (Imhof 1974); we know of approximately 22 records since then. Two to three individuals were seen in 1959, at least seven were seen in the 1960's, and about 12-14 individuals were reported during the 1970's. This species was present in at least seven of the past nine winters.

All but seven of the records known to us fall between 13 October and 29 March. Four others (20 August-28 September) may have been of birds that summered on the Gulf coast. Three late spring records (15 April-22 May) may have been of very late spring migrants or of birds that remained in Florida; we know of no reports for June or July.

Alabama The Great Black-backed Gull is an occasional winter visitor along the Alabama coast. Imhof (1976b) listed 7 records from coastal areas; we know of an additional two records, both from well inland.

1956	28 Dec.	1	imm. seen at Blakely Island	Imhof 1962b
1959	28 Dec.	1	imm. seen at Cochrane Causeway	Imhof 1962b
1963	21 Nov.	1	ad. seen at Cochrane Causeway	Imhof 1976b
1963	28 Dec.	1	seen on Dauphin Island	Imhof 1976b
1971	24 Apr.	1	seen on W Dauphin Island	Imhof 1971, 1976b
1972	30 Dec.	1	seen at Fort Morgan	Imhof 1976b
1974	5 Nov.	1	ad. seen at Cochrane Causeway	Imhof 1976b
1974	11 Nov.	1	imm. seen inland at Wheeler NWR	Hamilton 1975
1977	1 Jan.	2	seen inland near Decatur	Hamilton 1977

Texas Oberholser (1974) listed the occurrence of this gull in Texas as hypothetical on the basis of two sight records. There have been at least five sight records since then, all made during the 1970's when the species was extending its range in other southeastern states.

1949	21-27 Feb.	1	imm. seen at Rockport	Oberholser 1974
1953	23 Feb.	1	imm. seen at Rockport	Oberholser 1974
1973	ca. 6 Mar.	1	seen at Laguna Atascosa NWR	Webster 1973c
1973	11 Nov.	1	ad. seen at Laguna Atascosa NWR	Webster 1974a
1974 -- 1975	24 Mar.- 23 July, 18 Mar.	1	imm. seen, photogr. at Bolivar Flats [The bird seen in 1975 was believed to be the same one seen in 1974.]	Webster 1974b, 1974d, 1975b
1976	4 Jan.	2	seen at Freeport jetties	Webster 1976b
1978-79	winter	1	seen at Laguna Atascosa NWR	Webster 1979b

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

Breeding The Great Black-backed Gull breeds in the New World from Labrador to North Carolina, becoming progressively less common from north to south. In the Old World, the species breeds in Greenland and Iceland, and from the Faeroe Islands and northwestern France north and east through Scandinavia to the Murmansk coast of the U.S.S.R. The breeding distribution in the New World is considerably more southerly than in the Old World; it extends from about 62^{o} to about 34^{o} N (Voous 1960).

The size of the world population is unknown but some recent information is available for parts of the range. Erwin and Korschgen (1979) indicated that about 17,405 pairs nested from Maine to Virginia in 1977. This figure represents all but an insignificant proportion of the total number breeding within the United States. In contrast, about 22,000 pairs bred in Great Britain and Ireland in 1969-70 (Cramp et al. 1974). An estimated 410 pairs nested on the north coast of the Gulf of Finland in 1980 (Kilpi et al. 1980).

Most of the Great Black-backed Gulls in the United States breed in Maine and Massachusetts, which held 56.6% and 26.8%, respectively, of the total reported by Erwin and Korschgen (1979). The four largest colonies were those at Gardiner's Island, New York (1,200 pairs); Monomoy Island, Massachusetts (900); and Smuttynose (960) and Duck (800) Islands, Maine (Erwin 1979a). Together these colonies held approximately 22% of the breeding Great Black-backed Gulls of the northeastern United States in 1977.

Winter and Migration Except for Mississippi and Louisiana, the Great Black-backed Gull has now been recorded in all the southeastern United States (Table 36), where it occurs as a common (in North Carolina) to scarce or rare (northern Gulf coast) winter visitor. As in the Old World, populations are both sedentary and migratory; most birds move only short distances.

Table 36. Dates of occurrence for Great Black-backed Gulls in the coastal southeastern United States (a).

State	Approximate number of occurrences	Dates of occurrence
North Carolina	many	throughout year, winter peak
South Carolina	uncommon, regular	12 Nov. - 12 May
Georgia	uncommon	Dec. - Mar.
Florida - Atlantic coast	50 +	7 Nov. - 27 Mar. (9 Oct.; 18,25 Apr.)
Florida - Gulf coast	23	13 Oct. - 29 Mar. (20 Aug. - 28 Sep.) (15 Apr. - 22 May)
Alabama	9	5 Nov. - 24 Apr.
Mississippi	unrecorded	-----
Louisiana	unrecorded	-----
Texas	8	11 Nov. - 31 Mar. (summer 1975)

(a) Exceptional or unseasonal records are given in parentheses.

In the Old World, most birds breeding in Great Britain winter there; a few move to northwest France and Iberia. Great Black-backed Gulls from Norway, northwestern Russia, and Iceland also winter to some extent in Great Britain (Cramp et al. 1974). The wintering areas of Fenno-Scandinavian Great Black-backed Gulls are similar to those of Herring Gulls. Most Baltic birds winter in the southwestern Baltic Sea, and Danish and west Swedish birds winter in the Skagerrak, Kattegat, and the Great Belt; Norwegian birds and those from the Murmansk region of Russia winter in the eastern and western portions of the North Sea, respectively (Bianki 1967).

HABITAT

Nesting Great Black-backed Gulls are predominantly residents of coastal areas (Cramp et al. 1974) and nest mostly on small islands. North American birds have been recorded on low, rocky islands in coastal areas and on islands in freshwater lakes. Those nesting on islands in Lake George, Nova Scotia, used a variety of sites; some nested on rocky peninsulas, others in vegetation back from the shore, and yet others nested among boulders or stumps near the water (Bent 1921). Those at Little Duck Island, Maine, nested in two large meadows with large, exposed granite outcroppings and vegetated mostly with grasses, stinging nettle (*Urtica dioica*), angelica (*Angelica lucida*), and raspberry (*Rubus idaeus*) (Butler and Trivelpiece 1981).

Birds in Great Britain usually nest in the interior of the "tops of stacks, small islands, and holms" (Cramp et al. 1974). Verbeek (1979) noted that Great Black-backed Gulls at Walney, England, nested near the edges of ponds created by dredging. Of 53 nests, 51 were within 12.2 m (40.0 ft) of the ponds (mean distance = 4.9 m [16.1 ft]); the two exceptions were 39.3 and 45.7 m (129 and 150 ft) away. They preferred to nest on slightly elevated gravel piles and ridges (62%, n = 50); the rest of the nests were in flat grassy or sandy areas. A similar preference for elevated nesting situations was found in Wales (Harris 1964a). In both areas, most (87%) of these gulls nest on islands, but some nest on moors, along lakes and estuaries, and on cliffs in a variety of situations. Less commonly used nesting habitats include shingle banks and salt marsh (Davis 1958). Nesting on salt marsh is also uncommon in the eastern United States. Burger (1978) reported salt-marsh nesting in New Jersey where these gulls usually nested on grass under bushes (*Iva frutescens*) amid the greatest density of Herring Gull nests.

Nesting habitats used elsewhere are similar (Dement'ev and Gladkov 1951, Gudmunsson 1954, Godfrey 1966), although the degree to which one habitat or another is used varies somewhat from area to area.

Great Black-backed Gulls nest solitarily or in diffuse colonies (Harris 1964a) but tend to be more solitary in their nesting habits than many other larids. Colonies along the northeastern seaboard of the United States are small. An average of 73.7 breeding pairs was found in 147 colonies censused from southern Maine to Virginia in 1977 (Erwin and Korschgen 1979). Although eight northeastern colonies contained 1,000 or more breeding birds, 81.7% of 350 east coast colonies contained 50 pairs or less.

<u>Feeding</u> Great Black-backed Gulls use a wide variety of mostly coastal feeding habitats. These include beaches, open ocean, and estuaries. The gulls often congregate where offal or other refuse can be readily obtained (e.g., garbage dumps, slaughterhouses, fishing piers, sewers, fishing trawlers). They also feed in tidal pools and in shallow parts of lakes and rivers (Gudmundsson 1954).

Hunt and Hunt (1973) compared habitat used by foraging gulls in Maine and northwestern Europe and found that substrates used for feeding by Great Black-backed Gulls were similar in both areas. More of these gulls were seen feeding on dumps in both Maine (45.2%, n = 735) and northwest Europe (32.9%, n = 137) than in any other habitat. Areas in which wastes were discharged from sewers and fish-processing plants were also frequently used (25.9% and 32.1%, respectively). The Hunts thought that the intertidal zone was unimportant as feeding habitat for this species as few individuals fed there. However, Ingolffsson's (1976) analysis of the origin of foods eaten by these gulls in western Iceland suggested that Great Black-backed Gulls take much food from the surface of the sea as well as from the intertidal zone and from refuse dumps. Birds breeding at Walney Island, England, feed frequently in the intertidal zone, but also feed (by predation and kleptoparasitism) within the colony, and on a garbage dump (Verbeek 1979).

<u>Nonbreeding and Offshore</u> Nonbreeding Great Black-backed Gulls are mostly found along shorelines; they are found inshore more often and are less pelagic than most other species of *Larus* (Dement'ev and Gladkov 1951, Watson 1966). They have been seen following fishing vessels as far offshore as 12 or 15 mi

(19-24 km) in England (Davis 1958), and Lee and Booth (1979) reported that Great Black-backed Gulls (mostly immatures) occurred regularly 20 mi (32 km) or more off North Carolina. Rowlett (1980) found only immatures offshore during the summer in the Chesapeake Bight north of North Carolina. Observations made off the coasts of Nova Scotia (Brown 1967a), Newfoundland (Brown 1968, Nettleship and Tull 1970), and Greenland (Brown 1968) also indicate that Great Black-backed Gulls remain close to the coasts, but may move offshore to feed. These gulls are only occasionally reported well out at sea. Sage (1968) saw three birds about 70 mi (110 km) from the west coast of Ireland and another individual 550 mi (885 km) west of Saint Kilda; Rankin and Duffy (1948) found them common to about 100 mi (160 km) off Cape Sable, Nova Scotia, and at 100-150 mi (160-240 km) off the coast of Norway.

FOOD AND FEEDING BEHAVIOR

Great Black-backed Gulls feed opportunistically. They were considered the least specialized feeders of five species of *Larus* studied in Iceland (Ingolfsson 1969a) and obtain their food by a wide variety of techniques. When in marine situations they surface-seize, sitting on the water and immersing head and neck to seize both live and dead food. Great Black-backed Gulls also surface-plunge by hovering over the water and dropping to seize food at or less than a foot below the surface (Ingolfsson 1969a). Such surface-plunging usually is performed from heights of only a few feet, but Seymour (1974) witnessed these gulls diving on eels (*Anguilla rostrata*) from heights of 50 to 100 ft (15-30 m); the gulls partially folded their wings, dropped 5 to 10 ft (1.5-3 m) above the surface, broke their dive with their wings, and plunged into the water without entirely submerging.

Great Black-backed Gulls also kleptoparasitize other birds. Kock (1974) saw these gulls stealing fish from Common Murres (*Uria aalge*) at Helgoland in the North Sea. They also steal mussels from Common Eiders (*Somateria mollissima*) (Roberts 1934, Ingolfsson 1969a) and Tufted Ducks (*Aythya fuligula*) (Harrisson and Hurrell 1933), but apparently do so less frequently than some other larids such as Herring Gulls (Ingolfsson 1969a, Prys-Jones 1973). Occasionally, kleptoparasitism is the primary way in which food is obtained. Great Black-backed Gulls at Walney Island, England, obtain most of their food from other gulls, mostly Herring Gulls, and to a lesser extent Lesser Black-backed Gulls (*Larus fuscus*) (Verbeek 1979). Verbeek suggested that all food eaten by Great Black-backed Gulls at a local garbage dump was obtained through kleptoparasitism.

Other instances of kleptoparasitism by Great Black-backed Gulls include a bird that robbed a Peregrine Falcon (*Falco peregrinus*) of a Common Teal (*Anas crecca*) (Tinbergen 1953), others that stole prey from herons (*Ardea cinerea* [Harrison and Hurrell 1933, Carlsson 1979, Forsberg 1979] and *A. herodias* [Quinney et al. 1981]), and one that even stole a fish (*Pollachius virens*) from the mouth of a shark (probably *Lamna nasus* [French 1982]). Attempted kleptoparasitism of Ospreys (*Pandion haliaetus*) has also been reported (Leck 1973).

Foods obtained through kleptoparasitism vary widely and may include shellfish, crustacea, birds, or other items. Tolonen (1976) identified 20 items stolen from Herring Gulls in Rhode Island, Connecticut, and New Jersey during a study conducted 1968-72. Half were flatfish and most of the rest (8) were crabs (Callinectes, Cancer, Carcinus, Libinia).

Gulls readily scavenge food, and such food may form a major part of the diet. The extent to which this species scavenges from fishing vessels varies considerably. Kock 1974 (in Verbeek 1979) reported that Great Black-backed Gulls in the North Sea at Helgoland feed behind fishing vessels to a large extent; in contrast, Verbeek (1979) did not see any of these gulls around the boats during a two-day sojourn in the Irish Sea.

On several occasions Great Black-backed Gulls have been seen foot-paddling (King 1976), a behavior in which gulls tramp on the substrate (Buckley 1966) and that may bring earthworms to the surface. The scarcity of records, however, suggests that Great Black-backed Gulls foot-paddle considerably less often than do other larids such as the Herring Gull.

Like several other species of gulls, Great Black-backed Gulls drop objects to shatter them for easier consumption. They do this rather rarely (Ingolfsson 1967), but have been recorded dropping Dovekies (Alle alle) on a hard-top parking lot in Massachusetts (Snyder 1960); a northern quahog (Mercenaria mercenaria) on an ice-covered pond in Connecticut (Tolonen 1976); a rat in a field in Sussex (Harber and Johns 1947); and eggs of the Pink-footed Goose (Anser brachyrhynchus) in Iceland (Fisher in Tinbergen 1953).

Verbeek (1979) mentioned that the foraging times of Great Black-backed Gulls at Walney Island, England, were affected by the tides; prior to laying, few or no birds remained within the colony during low tide.

Differences in diet in relation to the age of the bird have been noted in several instances. Adults and unfledged young in northern Scotland fed more often on sandeels, and immatures took more scavenged fish offal (Beaman 1978). Adults in Connecticut ate more flatfish than did immatures (Tolonen 1976); Tolonen attributed this difference to more efficient handling of prey by adults. Belopol'skii (1957) indicated that young Great Black-backed Gulls feed to a greater extent on fish and molluscs than do adults; adults eat more berries and birds and their eggs.

Size of the breeding colony and season may also help determine the diet of the Great Black-backed Gull. Birds nesting solitarily in northern Scotland fed more frequently on other seabirds than did those nesting colonially (Beaman 1978). Belopol'skii (1957) reported that the amount of molluscs eaten in the Barents Sea area decreased towards the end of summer, and that the proportion of birds taken increased in mid-summer when fledging young of other species became more available.

Great Black-backed Gulls sometimes eat other marine birds, and at times the depredations have been so great that control measures were instituted (Harris 1964a). They have been a considerable source of mortality to Manx Shearwaters (Puffinus puffinus), Atlantic Puffins (Fratercula arctica), and young Herring and Lesser Black-backed Gulls on Skomer Island, Wales (Harris 1965). Manx Shearwaters were among the most frequently found (20.1%) food items in 174 stomachs of adult Great Black-backed Gulls collected at Skomer and Skokholm Islands (Harris 1965). At St. Kilda, Scotland, some 35-40 pairs of Great Black-backed Gulls kill about 2,700 Atlantic Puffins from a colony of about 40,000 pairs, but at another locality (North Rona) only about 400 of approximately 8,000 pairs are taken by some 1,800 pairs of gulls (Beaman 1978). Eggs, chicks, and adults of the puffin are also taken in Iceland (Ingolfsson 1967), but predation on the latter is light; most adults taken are birds that are already dead or disabled.

Great Black-backed Gulls often feed on ducklings in the Gullkrona area of Finland; 19 of 34 samples contained the remains of young birds (Lemmetyinen 1963). Bourget (1973) considered predation by this species and the Herring Gull to be the major cause of egg loss for nesting Common Eiders (Somateria mollissima) in Penobscot Bay, Maine. These gulls also feed on the eggs and young of the eider in Iceland (Ingolfsson 1967) and elsewhere. Gross (1935) believed that predation by this species was the cause of a marked decline in the number of Leach's Storm-Petrels (Oceanodroma leucorhoa) breeding in the Bay of Fundy.

Great Black-backed Gulls prey on wide variety of other birds. A partial list of those killed and eaten is as follows: Storm Petrel (Hydrobates pelagicus) (Seton 1931, Harrisson and Hurrell 1933); Shag (Phalacrocorax aristotelis) (Harris 1965); Black Duck (Anas rubripes) (Addy 1945); European Wigeon (Anas penelope) (Halliday 1977); Common Goldeneye (Bucephala clangula) (Cleghorn 1942); an injured Ruddy Duck (Oxyura jamaicensis) (Cobb 1957); Red-breasted Merganser (Mergus serrator) (Kuerzi 1937); American Coot (Fulica americana) (Armistead 1975); Coot (Fulica atra) (Thomsen and Meltofte 1980); Oystercatcher (Haematopus ostralegus) [wounded by Gyrfalcon (Falco rusticolus)] (Ingolfsson 1976); Sandwich Tern (Tinbergen 1953); Black-legged Kittiwake (Rissa tridactyla) (Harris 1965, Beaman 1978); Razorbill (Alca torda) (Robinson 1923, Harris 1965); Carrion Crow (Corvus corone) (Harris 1965); and Starling (Sturnus vulgaris) (Verbeek 1979). Great Black-backed Gulls have also been seen attacking and killing Horned Grebes (Podiceps auritus); Lesser Scaup (Aythya affinis) (Mansueti 1961); Greater Scaup (Aythya marila) (Andersson and Fridzen 1970); and Blackbirds (Turdus merula) (Gamble 1959, Karmborg 1979). They also take the eggs of many species, among them Northern Fulmar (Fulmarus glacialis) (Ingolfsson 1967), Northern Gannet (Sula bassanus); Herring Gull; Razorbill; Shag; Great Cormorant (Phalacrocorax carbo) (Davis 1958); and Double-crested Cormorant (Phalacrocorax auritus) (Bourget 1973). Eggs are apparently not as important in the diet as are young birds (Davis 1958).

Much has been written about the food habits of the Great Black-backed Gull, but little specific information is available for the eastern United States. We summarize North American information by area below.

Newfoundland Threlfall (1968a) examined 32 stomachs collected in June-August 1966 and in May-September 1967. Fish were found in the most stomachs (34.0%); vegetation (20.8%), miscellaneous material (17.0%), bird remains (5.7%), molluscs (3.8%), seed and berries (3.8%), echinoderms (1.9%), annelids (1.9%), and insects (1.9%) were found in descending order of frequency. Little of this material was identified to species, but Threlfall (1968a) noted that Salmon (Salmo salar) had been eaten, as had Common Murres (Uria aalge) that had been caught in gill nets. The only other food items identified to species were two Atlantic Puffin chicks and an Atlantic tomcod (Microgadus tomcod).

Maine Observations from a blind at Little Duck Island in 1979 revealed that the young are fed on a variety of fish and crustaceans, goose-necked barnacles (Lepas sp.), squid (Loligo borealis), edible mussels (Mytilus edulis), and the chicks of Herring Gulls and Common Eiders (Butler and Trivelpiece 1981).

Studies of food habits made in the Old World include reports from Wales (Harris 1965), England (Verbeek 1979), Scotland (Seton 1931, Harrisson and Hurrell 1933, Beaman 1978), West Germany (Kock 1974) and the U.S.S.R. (Belopol'skii 1957). Additional information on specific foods eaten by Great Black-backed Gulls may be found in these papers and in others listed in the species bibliography.

Genera or species of fish eaten at various Old World localities include capelin (Mallotus villosus) (Ingolfsson 1976), sand lance (Ammodytes spp.) (Ingolfsson 1967, Kock 1974, Beaman 1978), Atlantic herring (Clupea harengus) (Ingolfsson 1967), cod (Gadus morhua), poorcod (Trisopterus minutus) (Kock 1974), Norway pout (Trisopterus esmarkii), haddock (Melanogrammus aeglefinus) (Beaman 1978), whiting (Merlangus merlangus) (Kock 1974, Beaman 1978), dab (Limanda limanda), sea scorpions (Cottus scorpius), lumpfish (Cyclopterus lumpus) (Ingolfsson 1967), and eels (Anguilla anguilla) (Kock 1974).

Other vertebrates eaten include rabbits (Oryctolagus cuniculus), voles (Aplodemus sylvaticus), and amphibians (Harris 1965).

Crabs (Hyas areneus [Ingolfsson 1967], Carcinus maenus [Harris 1965, Kock 1974], Crangon crangon [Kock 1974]) and molluscs (Mytilus edulis [Harris 1965, Ingolfsson 1967, Kock 1974], Modiolus modiolus [Ingolfsson 1967], Helix nemoralis, Arenicola sp., Patella spp. [Harris 1965], Cardium edule, Buccinum undulatum [Kock 1974]) are often eaten and are sometimes important in the diet.

Other invertebrates eaten include insects (Belopol'skii 1957, Harris 1965, Ingolfsson 1967), polychaetes (Ingolfson 1967), oligochaetes (Harris 1965), echinoderms (Belopol'skii 1957, Ingolfsson 1967), balanid and lepadid barnacles (Ingolfsson 1967), cirripedes, lamellibranchs (Harris 1965),and land-snails (Verbeek 1979).

Plants are sometimes consumed, particularly berries such as crowberry (Empetrum nigrum) and blueberries (Vaccinium uliginosum) (Ingolfsson 1967). Berries are an important food in the U.S.S.R., amounting to 9.2% of all foods eaten (Belopol'skii 1957).

SUSCEPTIBILITY TO OIL POLLUTION

Oiled Great Black-backed Gulls have been reported frequently in both the Old and New Worlds (Table 37), but in only one instance has a large number of birds been affected adversely. This occurred when floating oil contaminated gulls roosting at night in the Medway Estuary (Harrison and Buck 1967 in Vermeer and Vermeer 1974). Like other species of *Larus*, these gulls usually are unaffected by oiling incidents. Corkhill (1973) reported three instances in which Great Black-backed Gulls survived oiling. In two of these instances, however, no successful reproduction occurred during the following breeding season, in one instance because no attempt was made to breed, and in the other because the eggs failed to hatch. Corkhill suggested that the hatching failure was caused by oiling of the eggs that could have occurred when the oiled plumage of the adult came in contact with the eggs.

Several recent experimental studies explored the effects of oil on the eggs of the Great Black-backed Gull. Coon et al. (1979) found that embryonic death in a field situation in Maine was significantly higher in eggs that had been treated with 20 microliters of No. 2 fuel oil. These authors found no difference in hatching weights between treated and untreated eggs incubated in the laboratory. On the other hand, treated eggs hatched significantly fewer young than the untreated ones. Of 64 eggs in each treated sample, 71.95% of the controls hatched; 43.8% of the eggs treated with 5 microliters of oil hatched; and 20.3% of the eggs treated with 20 microliters of oil hatched.

McGill and Richmond (1979) used a dosage of 20 microliters of No. 2 fuel oil on eggs from other colonies in the same area and found a significant reduction in hatching success among treated eggs; 78% of 83 control eggs hatched in contrast to 24% of 84 treated eggs. By backdating from an assumed incubation period of 29 days, McGill and Richmond were able to state that all oil-treated eggs that survived were at least 7-9 days old when exposed to oil. They pointed out that oil contamination of eggs may be a more serious threat than oiling of adults; they also commented that oil contamination would present a greater hazard to reproduction early in the breeding season.

The only area in the southeast where this species occurs in any abundance is along the North Carolina coast in winter. Consequently, the effect of oiling on this species in the southeastern United States is probably minimal. Great Black-backed Gulls are still expanding their range southward and it is conceivable that this gull may one day breed in numbers significant enough to warrant more concern.

BIBLIOGRAPHY

1982

Bergman, G. 1982. Population dynamics, colony formation and competition in *Larus argentatus*, *fuscus* and *marinus* in the archipelago of Finland. *Ann. Zool. Fenn.* 19: 143-164.

Table 37. Number of oiled birds and number and percentage of dead Great Black-backed Gulls found after major oiling incidents.

Area	Dates	Number of oiled birds	Number of dead Great Black-backed Gulls	Percentage of Great Black-backed Gulls	Source
Island Beach, New Jersey	Jan. 1945	92 (a)	4	4.35	Kramer and Kramer 1945
Northeast England	Jan. 1966	805	15	1.86	Parrack 1967
Medway Estuary, Kent, England	Sept. 1966	2,748 (b)	927	33.73	Bourne 1968a
Northeast Britain	Jan.-Feb. 1970	10,992 (a,b)	41	0.37	Greenwood et al. 1971
Off eastern Canada	Feb.-Apr. 1970	1,276 (b,c)	1	0.08	Brown et al. 1973
North-central Kattegat, Denmark	Mar. 1972	4,759 (b)	1	0.02	Joensen and Hansen 1977
Waddensea, Denmark	Dec. 1972	9,151 (b)	2	0.02	Joensen and Hansen 1977

(a) Total includes some birds that were not oiled.
(b) Total includes only those birds identified to species.
(c) Total includes both live and dead oiled birds.

Butler, R. G. and S. Janes-Butler. 1982. Territoriality and behavioral correlates of reproductive success of Great Black-backed Gulls. Auk 99: 58-66.

French, T. W. 1982. Piracy by a Great Black-backed Gull on a shark. Wilson Bull. 94: 96.

Gotmark, F. 1982. Coloniality in five *Larus* gulls: a comparative study. Ornis Scand. 13: 211-224.

Hudson, A. 1982. Great Black-backed Gulls on Great Saltee Island, 1980. Irish Birds 2: 167-175.

Mudge, G. P. and P. N. Ferns. 1982. The feeding ecology of five species of gulls (Aves: Larini) in the inner Bristol Channel. J. Zool. (Lond.) 197: 497-510.

Parsons, K. C. 1982. Nest-site habitat and hatching success of gulls. Colonial Waterbirds 5: 131-138.

1981

Andrews, R. 1981. The gull population on Monomoy Island, Massachusetts, USA. (Abstract only.) Colonial Waterbirds 4: 194.

Burger, J. and M. Gochfeld. 1981c. Discrimination of the threat of direct vs. tangential approach to the nest by incubating Herring *Larus argentatus* and Great Black-backed Gulls *Larus marinus*. J. Comp. Physiol. Psychol. 95: 676-684.

Butler, R. G. and W. Trivelpiece. 1981. Nest spacing, reproductive success, and behavior of the Great Black-backed Gull (*Larus marinus*). Auk 98: 99-107.

Duncan, R. A. 1981. The Great Black-backed Gull: a Gulf coast status review. Am. Birds 35: 233-234.

Heer, P. de. 1981. On Great Black-backed Gull with orange legs. Dutch Birding 3: 9.

McGill-Harelstad, P. 1981. The effects of interspecific competition on reproductive success of Great Black-backed and Herring Gulls. (Abstract only.) Colonial Waterbirds 4: 197.

Portnoy, J. W. and M. A. Soukup. 1981. Gull use of a freshwater kettle hole pond: quantification and seasonal variation. (Abstract only.) Colonial Waterbirds 4: 200.

Quinney, T. E., B. N. Miller and K. R. S. Quinney. 1981. Gulls robbing prey from Great Blue Herons (*Ardea herodias*). Can. Field-Nat. 95: 205-206.

Raffaele, H. A. 1981. New records of bird species for Puerto Rico and one for the West Indies. Am. Birds 35: 142-143.

1980

Burger, J., M. Fitch, G. Shugart and W. Werther. 1980. Piracy in *Larus* gulls at a dump in New Jersey. Proc. 1979 Conf. Colonial Waterbird Group 3: 87-98.

Grant, P. J. 1980. Field identification of West Palearctic gulls. Part 3. Audouin's, Herring, Lesser Black-backed, Great Black-backed and Great Black-headed Gulls. Brit. Birds 73: 113-158.

Hjernquist, B. 1980. Hackningsframgang for kolni-hackende havstrutar Larus marinus. Blacku 6: 18-28.

Kilpi, M., H. Puntii and T. Toivenen. 1980. Numbers of gulls nesting on the northern coast of the Gulf of Finland. Ornis Fenn. 57: 153-160. [In English with Finnish summary.]

Miller, J. C. 1980. Increased nesting of Great Black-backed Gulls in New Jersey. Cassinia 58: 22.

Parkes, K. C. 1980. Great Black-backed Gull towing food item ashore. Brit. Birds 73: 586-587.

Plotz, J. 1980. Parasitosen durch Nematodenbefall bei Silbermowen (Larus argentatus) und Mantelmowen (Larus marinus) von der Insel Helgoland. [Parasitosis through nematode infection in Herring Gulls (Larus argentatus) and Great Black-backed Gulls (Larus marinus) from Helgoland.] Angew. Ornithol. 4: 195-200. [In German with English summary.]

Pulliainen, E. and A. Marjakangas. 1980. Eggshell thickness in eleven sea and shore bird species of the Bothnian Bay. Ornis Fenn. 57: 65-70.

Southern, W. E. 1980a. Comparative distribution and orientation of North American gulls. Pp. 449-498 in J. Burger, B. C. Olla and H. E. Winn (eds.). Behavior of Marine Animals. Vol. 4: Marine Birds. Plenum Press, N.Y. xvii and 515 pp.

Thomsen, J. B. and H. Meltofte. 1980. Svartbage Larus marinus draeber og aeder Blishons Fulica atra. [Great Black-backed Gulls Larus marinus killing and eating Coots Fulica atra.] Dan. Ornithol. Foren. Tidsskr. 74: 147-154. [In Danish with English summary.]

van Kreuningen, J. 1980. Great Black-backed Gull Larus marinus with orange legs. Dutch Birding 2: 14.

Whilde, A. 1980. The numbers of gulls breeding in the west of Ireland. Irish Nat. J. 19: 328.

1979

Angehrn, P. A. M., H. Blokpoel and P. Courtney. 1979. A review of the status of the Great Black-backed Gull in the Great Lakes area. Ont. Field Biol. 33: 27-34.

Carlsson, L. 1979. Trutar som naringsparasit pa hagar. [Gulls kleptoparasitizing heron.] Var Fagelvarld 38: 50. [In Swedish with English summary.]

Cooke, A. S. 1979. Egg shell characteristics of Gannets Sula bassana, Shags Phalacrocorax aristotelis, and Great Black-backed Gulls Larus marinus exposed to DDE and other environmental pollutants. Environ. Pollut. 19: 47-65.

Coon, N. C., P. H. Albers and R. C. Szaro. 1979. No. 2 fuel oil decreases embryonic survival of Great Black-backed Gulls. Bull. Environ. Contam. Toxicol. 21: 152-156.

Forsberg, B. 1979. Havstrut som naringsparasit pa hagar. [Great Black-backed Gull Larus marinus kleptoparasitizing heron, Ardea cinerea.] Var Fagelvarld 38: 107. [In Swedish with English summary.]

Foxall, R. A. 1979. Presumed hybrids of the Herring Gull and the Great Black-backed Gull. Am. Birds 33: 838.

Kallander, H. 1979. Labben pa truten och truten pa labben eller hunden pa katten och katten pa hunden del 2. [Secondary kleptoparasitism by gulls on Arctic Skuas.] Anser 18: 299. [In Swedish with English summary.]

Karmborg, T. 1979. Trutar dodar koltrast. [Herring Gull and Great Black-backed Gull killing Blackbird.] Var Fagelvarld 38: 50. [In Swedish with English summary.]

King, B. 1979. Roof-nesting by Great Black-backed Gulls. Brit. Birds 72: 340-343.

McGill, P. A. and M. E. Richmond. 1979. Hatching success of Great Black-backed Gull eggs treated with oil. Bird-Banding 50: 108-113.

Nunnally, S., D. Nunnally, R. Needham and R. Lennon. 1979. Nocturnal feeding of gulls at a lighted pier. Chat 43: 63.

Pierotti, R. 1979. The behavior of Herring and Great Black-backed Gulls in a mixed colony. (Abstract only.) Pac. Seabird Group Bull. 6: 46.

Szaro, R. C., N. C. Coon and E. Kolbe. 1979. Pesticide and PCB of Common Eider, Herring Gull, and Great Black-backed Gull eggs. Bull. Environ. Contam. Toxicol. 22: 394-399.

Verbeek, N. A. M. 1979. Some aspects of the breeding biology and behavior of the Great Black-backed Gull. Wilson Bull. 91: 575-582.

1978

Beaman, M. A. S. 1978. The feeding and population ecology of the Great Black-backed Gull in northern Scotland. Ibis 120: 126-127.

Burger, J. 1978. Great Black-backed Gulls breeding in salt marsh in New Jersey. Wilson Bull. 90: 304-305.

Fisk, E. J. 1978c. The growing use of roofs by nesting birds. Bird-Banding 49: 134-141.

Fritze, E. 1978. Ringmaerkning af Solvmage (Larus argentatus) og Svartbag (Larus marinus) pa kobenhavns Kommunale Losseplads, Amager i 1970-71. Feltornithologen 20: 7-9.

Johansen, O. 1978. [DDE, PCB and Hg in eggs of Larus marinus and Larus argentatus from colonies in More and Romsdal.] Stavenger Mus. Arbok 1978: 67-71. [In Norwegian with English summary.]

Moller, A. P. 1978. Magernes Larinae yngleudbredelse, bestandsstorelse og -aendringer i Danmark, med supplerende om forholdene i det ovrige Europa. [Distribution, population size and changes in gulls Larinae breeding in Denmark, with a review of the situation in other parts of Europe.] Dan. Ornithol. Foren. Tidsskr. 72: 15-39.

Tatarincova, I. P. and F. N. Shklyarevich. 1978. [The head length as a diagnostic feature for sex determination in the Laridae.] Zool. Zh. 57: 1446-1447. [In Russian with English summary.]

1977

Grimm, P. 1977. Beitrag zum Nahrungserwerb der Mantelmowe, Larus marinus. Beitr. Vogelkd. 23: 63-63.

Halliday, K. C. R. 1977. Great Black-backed Gull killing Wigeon. Scott. Birds 9: 348.

Houde, P. 1977a. Low productivity of terns on Hicks Island, 1975. Proc. Linn. Soc. N.Y. 73: 49-57.

Ljunggren, L. 1977. Havstruten soker sig till Olandsbron. Fauna Flora 72: 175-181. [In Swedish.]

McGill, P. A. 1977. Breeding ecology and competition between Great Black-backed and Herring Gulls. M.S. thesis, Cornell Univ./Ithaca, NY.

Monaghan, P. and J. C. Coulson. 1977. Status of large gulls nesting on buildings. Bird Study 24: 89-104.

Spikkeland, I. 1977. Svartbak, Larus marinus, ved inns joer pa Sorlandet forekomst og biologi. [Occurrence and biology of the Great Black-backed Gull, Larus marinus, in freshwater habitats in southern Norway.] Fauna (Oslo) 30: 75-87. [In Norwegian with English summary.]

Stamm, A. L. 1977. Great Black-backed Gull in Kentucky. Kentucky Warbler 53: 18.

Voous, K. H. 1977. Northern gulls in Aruba, Netherlands Antilles. Ardea 65: 80-82.

1976

de Ridder, M. 1976. Mantelmeeuw - Larus marinus. Wielewaal 42: 161.

Flegg, J. J. M. and R. A. Morgan. 1976. Mortality in British gulls. Ringing Migr. 1: 65-74.

Fleige, K. D. 1976. Mantelmowe schlagt Blessralle. Falke 23: 175.

Fritze, E. 1976. Ringing of Herring Gulls Larus argentatus and Greater Black-backed Gulls Larus marinus on Copenhagen dump. Ring 8: 22-24.

Ingolfsson, A. 1976. The feeding habits of Great Black-backed Gulls, Larus marinus, and Glaucous Gulls, L. hyperboreus, in Iceland. Acta Nat. Isl. 24. 19 pp.

King, B. 1976. Further records of foot-paddling by gulls on grassland. Brit. Birds 69: 180-181.

Stromar, L. 1976. The ecological aspect and consequences of banding the Black-headed Gull--in Yugoslavia. Ring 8: 19-22.

Tolonen, K. E. 1976. Behavioral ecology of Larus argentatus and Larus marinus: age specific differential in feeding efficiency, a probable factor in the evolution of delayed breeding. Ph.D. thesis, Yale Univ./New Haven, CT. 275 pp.

Wendland, V. 1976. Mantelmowe (Larus marinus) totet Blessralle (Fulica atra). Vogelwelt 97: 150-151.

1975

Armistead, H. T. 1975. Breeding of Greater Black-backed Gull, Herring Gull, and Gadwall at Smith Island, Maryland. Md. Birdlife 31: 131-134.

King, B. 1975. Gull behaviour during sea-mist in the Bristol Channel. Bristol Ornithol. 8: 111-112.

Kury, C. R. and M. Gochfeld. 1975. Human interference and gull predation in cormorant colonies. Biol. Conserv. 8: 23-34.

Lien, J. 1975. Aggression between Great Black-backed Gulls and Bald Eagles. Auk 92: 584-585.

Parnell, J. F. and R. F. Soots. 1975b. Herring and Great Black-backed Gulls nesting in North Carolina. Auk 92: 154-157.

1974

Barth, E. K. 1974a. Svartbak druknet Gramake. [Great Black-backed Gull drowns a Herring Gull.] Fauna 27: 95-96. [In Norwegian with English summary.]

Eggers, J. 1974. Vorkommen und Herkunft der Lechmowe (*Larus ridibundus*) im Hamburger Raum im Vergleich zur Sturm-, Silber-, und Mantelmowe (*Larus canus*, *L. argentatus*, *L. marinus*). Hamburg. Avifauna Beitr. 12: 95-144. [In German with English summary.]

Firth, R., Jr. 1974. Experimental cross-fostering of Herring Gull and Great Black-backed Gull chicks. Auk 91: 139-144.

Gochfeld, M. 1974c. Gull predation on migrant passerine birds. Engelhardtia 6: 12-13.

Hogg, R. H. 1974. Great Black-backed Gull attacking Common Gull. Brit. Birds 67: 242-243.

Kock, K. H. 1974. Nahrungsokologische Untersuchungen an Mantelmowen (*Larus marinus*) auf Helgoland. [Studies on the feeding ecology of the Great Black-backed Gull (*Larus marinus*) on Helgoland.] Helgol. Wiss. Meeresunters. 26: 88-95. [In German with English abstract.]

Love, J. A. 1974. Status of the Kittiwake and Great Black-backed Gull on North Rona. Seabird Rep. 4: 29-35.

Seymour, N. R. 1974. Great Black-backed Gulls feeding on live eels. Can. Field-Nat. 88: 352-353.

1973

Andrle, R. F. 1973. A second probable hybrid of *Larus marinus* and *L. argentatus* on the Niagara River. Can. Field-Nat. 87: 170-171.

Birkhead, T. R., C. Lloyd and P. Corkhill. 1973. Oiled seabirds successfully cleaning their plumage. Brit. Birds 66: 535-537.

Bourget, A. A. 1973. Relations of eiders and gulls nesting in mixed colonies in Penobscot Bay, Maine. Auk 90: 809-820.

Corkhill, P. 1973. Manx Shearwaters on Skomer: population and mortality due to gull predation. Brit. Birds 66: 126-143.

Drury, W. H. 1973-74. Population changes in New England seabirds. Bird-Banding 44: 267-313; 45: 1-15.

Fitzgerald, G. R. and J. C. Coulson. 1973. The distribution and feeding ecology of gulls on the tidal reaches of the rivers Tyne and Wear. Vasculum 58: 29-47.

Forsythe, D. M. 1973. Gull populations at Charleston, S.C., June 1971 to June 1972. Chat 37: 57-62.

Godfrey, W. E. 1973. More presumed hybrid gulls: *Larus argentatus* X *L. marinus*. Can. Field-Nat. 87: 171-172.

Hunt, G. L., Jr. and M. W. Hunt. 1973. Habitat partitioning by foraging gulls in Maine and northwestern Europe. Auk 90: 827-839.

King, B. 1973. Great Black-backed Gull attacking a sleeping man. Bristol Ornithol. 6: 37.

Leck, C. F. 1973. Attempts of gulls to rob a Common Egret and an Osprey. Cassinia 54: 32.

Macdonald, S. M. and C. F. Mason. 1973. Predation of migrant birds by gulls. Brit. Birds 66: 361-363.

Parslow, J. L. F. and W. R. P. Bourne. 1973. Great Black-backed Gulls and other birds on Am Balg, West Sutherland. Seabird Rep. 3: 15-24.

Pasquier, R. 1973. Recent Christmas Count increases of Great Black-backed Gulls and Mourning Doves in the N.Y. area. Linn. Newsl. 26: 3.

Prys-Jones, O. E. 1973. Interactions between gulls and eiders in St. Andrews Bay, Fife. Bird Study 20: 311-313.

Taverner, J. H. 1973. Great Black-backed Gull nesting in unusual habitat. Brit. Birds 66: 398.

Zobbe, B. 1973. Iagttagelser fra Vestgronland. Dan. Ornithol. Foren. Tidsskr. 67: 65-66.

1972

Andrle, R. F. 1972. Another probable hybrid of *Larus marinus* and *L. argentatus*. Auk 89: 669-671.

Dittberner, H. 1972. Die Grossmowen (*Larus marinus*, *L. fuscus* and *L. argentatus*) als Gastvogel markischer Gewasser. Beitr. Vogelkd. 18: 141-155.

Keskpaik, Y. and P. Khorma. 1972. [Body temperatures and heart rate of flying sea-gulls (*Larus m. marinus* L.).] Eesti NSV Tead. Akad. Toim. Biol. 21: 109-116. [In Russian with English summary.]

Nilsson, R. 1972. Fagelrapporter. Narke 1971. Var Fagelvarld 31: 199-201. [In Swedish.]

Ring, H. 1972. Trut attackerande fiskgjuse Pandion haliaeetus. [Gull attacking Osprey Pandion haliaeetus.] Var Fagelvarld 31: 129-130. [In Swedish with English summary.]

Stenman, O., R. Komu and A. Ermala. 1972. Kloraloosi harmaa- ja merilokki-myrkkyna. [Finnish experience of poisoning Herring and Great Black-backed Gulls with chloralose.] Suomen Riista 24: 107-116. [In Finnish with English summary.]

1971

Corkhill, P. 1971. Cannibalistic Great Black-backed Gull. Brit. Birds 64: 30-32.

Erwin, R. M. 1971. The breeding success of two sympatric gulls, the Herring Gull and the Great Black-backed Gull. Wilson Bull. 83: 152-158.

Harris, M. P. 1971. Ecological adaptations of moult in some British gulls. Bird Study 18: 113-118.

Schmidt, G. 1971. Mantelmowen, Larus marinus, als Kommensalen beim Kormoran, Phalacrocorax carbo. Vogelwelt 92: 24-25. [In German.]

Svensson, L. 1971. Om havstruten Larus marinus som predator. [The Great Black-backed Gull Larus marinus as a predator.] Var Fagelvarld 30: 125. [In Swedish with English summary.]

1970

Andersson, A. and K. E. Fridzen. 1970. Havstrut fangar vigg pa Stockholms strom. [Great Black-backed Gull (Larus marinus) catches scaup (Aythya marila) on the Stream of Stockholm.] Var Fagelvarld 29: 267-269. [In Swedish.]

Harris, M. P. 1970a. Rates and causes of increases of some British gull populations. Bird Study 17: 325-335.

Hatch, J. J. 1970. Predation and piracy by gulls at a ternery in Maine. Auk 87: 244-254.

Ingolfsson, A. 1970a. The moult of remiges and rectrices in Great Black-backed Gulls Larus marinus and Glaucous Gulls L. hyperboreus in Iceland. Ibis 112: 83-92.

Weaver, D. K. and J. A. Kadlec. 1970. A method for trapping breeding adult gulls. Bird-Banding 41: 28-31.

1969

Beer, J. V. 1969. Observations on the dispersal of gulls marked on Steep Holm and the Denny. Steep Holm Gull Res. Stn. Rep. 1968: 4-9.

Haugaard, N. 1969. Et ynglefund af Svartbag (*Larus marinus* L.). Dan. Fugle 20: 53.

Ingolfsson, A. 1969a. Behaviour of gulls robbing eiders. Bird Study 16: 45-52.

_____. 1969b. Sexual dimorphism of large gulls (*Larus* spp.). Auk 86: 732-737.

1968

Barth, E. K. 1968a. Egg dimensions and laying dates of *Larus marinus*, *L. argentatus*, *L. fuscus* and *L. canus*. Nytt Mag. Zool. 15: 5-34.

Karpovich, V. N. and I. P. Tatarinkova. 1968. [Population dynamics of Great Black-backed and Herring Gulls at the islands on the Murman coast and their influence on the efficiency of the reproduction of the Common Eider.] Pp. 85-104 *in* E. Kumari (ed.). [The Common Eider (*Somateria m. mollissima* L.) in the U.S.S.R.] Valgus Tallin. [In Russian with English summary.]

Muller, H. P. 1968. Mantelmowe (*Larus marinus*) verschluckt Rauchschwalbe (*Hirundo rustica*). Ornithol. Mitt. 20: 252. [In German.]

Presnall, C. C. 1968. Great Black-backed Gull attacks injured wigeon. Atl. Nat. 23: 107.

Stollman, A. 1968. [The seagull (*Larus marinus*)--a new member of the Slovak avifauna.] Biologia (Bratisl.) 23: 651-655. [In Czechoslovakian.]

Threlfall, W. 1968a. The food of three species of gulls in Newfoundland. Can. Field-Nat. 82: 176-180.

_____. 1968e. The helminth parasites of three species of gulls in Newfoundland. Can. J. Zool. 46: 827-830.

Wulf, J. 1968. Mantelmowe frisst Blesshuhu. Falke 15: 246.

1967

Barth, E. K. 1967. Standard body measurements in *Larus argentatus*, *L. fuscus*, *L. canus*, and *L. marinus*. Nytt Mag. Zool. 14: 7-83.

Harrison, J. G. and W. F. A. Buck. 1967. Peril in perspective. An account of the oil pollution in the Medway Estuary. Kent Bird Rep. 16, Spec. Suppl. 24 pp.

Ingolfsson, A. 1967. The feeding ecology of five species of large gulls (Larus) in Iceland. Ph.D. thesis, Univ. Michigan/Ann Arbor, MI. xii and 186 pp.

McLaughlin, F. L. 1967 ms. Behavior study of the interrelationships of gulls and eiders in mixed breeding colonies on Penobscot Bay, Maine. Unpubl. file rep., Maine Coop. Wildl. Res. Unit, Orono, ME.

Peakall, D. B. 1967. Recent changes in the status of the Great Black-backed Gull. Kingbird 17: 69-73.

Temme, M. 1967. "Begegnengszeremonien" bei unausgefarbten Mantelmowen (Larus marinus L.). ["Meeting ceremonies" of juvenile Great Black-backed Gulls (Larus marinus L.).] Ornithol. Mitt. 19: 155-160. [In German with English summary.]

1966

Buckley, P. A. 1966. Foot-paddling in four American gulls, with comments on its possible function and stimulation. Z. Tierpsychol. 23: 395-402.

Miller, J. C. 1966b. The Great Black-backed Gull nesting in New Jersey and additional notes on nesting Herring Gulls. Cassinia 49: 31.

Preuss, N. O. 1966. Svartbag. Feltornithologen 8: 12. [In Danish.]

Randazzo, G. R. 1966. Su di una cattura di Larus marinus Linn. in Sicilia. Riv. Ital. Ornitol. 36: 366-367. [In Italian.]

Temme, M. 1966. Uber das Verhaltens repertoire der Mantelmowe (Larus marinus L.), im Winterhalbjahr sowie einige Bemerkungen uber das Verhalten der Silbermowe (Larus argentatus Pontopp.) im gleichen Zeitraum. J. Ornithol. 107: 70-84. [In German.]

1965

Andersson, A. 1965. Havstruten (Larus marinus) som hackfagel i Skane. Medd. Skanes Ornitol. Foren. 5: 8-9.

Bergman, G. 1965. [Competition and feeding ecology of gulls in a south Finnish skerrygard.] Zool. Revy 27: 58-77. [In Swedish with German summary.]

Garrido, O. H. and F. G. Montana. 1965. Aves neuvas para Cuba. Poeyana Inst. Biol. Ser. A 10: 1-6. [In Spanish with English summary.]

Gerasimova, T. D. 1965. Ryboyadn. ptitsy i ikh znachenie v rybnom khoz. [Food of gulls of the Murman Coast.] Moscow (Nauka) 1965: 194-209. [In Russian.]

Harris, M. P. 1965. The food of some Larus gulls. Ibis 107: 43-53.

Parslow, J. L. F. 1965. Great Black-backed Gulls preying on storm petrels. Brit. Birds 58: 522-523.

Vass, S. E. 1965. Gull breeding records from Prince Edward Island. Can. Field-Nat. 79: 152-154.

Williams, I. C. and M. P. Harris. 1965. The infection of the gulls _Larus argentatus_ Pont., _L. fuscus_ L., and _L. marinus_ L. with cestoda on the coast of Wales. Parasitology 55: 237-256.

1964

Ammermann, D. 1964. Beringungsergenisse an Mantelmowen (_Larus marinus_) des deutschen uberwinterungsgebiets. Vogelwarte 22: 224-229. [In German.]

Harris, M. P. 1964a. Aspects of the breeding biology of the gulls _Larus argentatus_, _L. fuscus_ and _L. marinus_. Ibis 106: 432-456.

_____. 1964b. The incidence of some species of trematoda in three species of _Larus_ gulls in Wales. Ibis 106: 532-536.

_____. 1964d. Measurements and weights of Great Black-backed Gulls. Brit. Birds 57: 71-75.

1963

Baillie, J. L. 1963. The 13 most recent Ontario nesting birds. Ont. Field Biol. 17: 15-26.

Bruun, B. 1963. Svartbagen (_Larus marinus_ L.) i Danmark. [The Great Black-backed Gull (_Larus marinus_ L.) in Denmark.] Dan. Ornithol. Foren. Tidsskr. 57: 94-98. [In Danish with English summary.]

Goethe, F. 1963. Das "Wegsehen" (facing away) bei der Mantelmowe (_Larus marinus_ L.). J. Ornithol. 104: 437-438. [In German.]

Lemmetyinen, R. 1963. Lokkien esiintymisesta ja ravinnosta Gullkrona selan koillisosassa. [Occurrence and feeding habits of gulls in the northeastern part of the area of Gullkrona.] Suomen Riista 16: 69-82. [In Finnish with English summary.]

Saunders, D. R. 1963. The Great Black-backed Gull on Skomer. Nat. Wales 8: 99-104.

Williams, L. E., Jr. 1963. New specimen records for North Florida. Fla. Nat. 36: 127.

Zelenka, G. 1963. Notes on the depredation of the Brown Rat by the Great Black-backed Gull on the Calf of Man, 1960. Proc. Isle Man Nat. Hist. Antiq. Soc. 6: 431-433.

1962

Harris, M. P. 1962b. The Larus gulls breeding on Skomer, Skokholm and Grassholm islands. Nat. Wales 8: 56-58.

_____. 1962d. Recoveries of ringed Great Black-backed Gulls. Bird Study 9: 192-197.

Saunders, D. R. 1962. The Great Black-backed Gull on Skomer. Nat. Wales 8: 59-66.

1961

Isenmann, P. and B. Schmidt. 1961. Observations a propos d'un hybride Larus a. argentatus X Larus marinus. Oiseau Rev. Fr. Ornithol. 31: 341-344.

Mansueti, R. J. 1961. Waterfowl predation by and records of the Great Black-backed Gull in Chesapeake Bay during winter and spring. Chesapeake Sci. 2: 102-104.

Marshall, R. V. A. 1961a. Attack and counter-attack between a Great Black-backed Gull and Heron. Brit. Birds 54: 116.

_____. 1961b. Great Black-backed Gull attacking Coot. Brit. Birds 54: 243.

Rooke, K. B. 1961. A probable hybrid Great Black-backed Gull X Herring Gull in Devon. Brit. Birds 54: 161-163.

Tomkins, I. R. 1961. A second specimen of the Great Black-backed Gull from Georgia. Oriole 26: 10-11.

1960

Bergman, G. 1960. Uber neue Futtergewohnheiten der Mowen an den Kusten Finnlands. Ornis Fenn. 37: 11-28. [In German with Finnish summary.]

Jehl, J. R., Jr. 1960. A probable hybrid of Larus argentatus and L. marinus. Auk 77: 343-345.

Mylne, C. K. 1960. Predation of Manx Shearwaters by Great Black-backed Gulls on Skomer. Bird Notes 29: 73-76.

Snyder, D. E. 1960. Great Black-backed Gulls killing Dovekies. Auk 77: 476-477.

1959

Borg, K. 1959. Nabblangd och kroppsvikt hos gratrut (Larus argentatus), havstrut (L. marinus) och silltrut (L. fuscus). [Bill lengths and body weights for Herring Gulls (Larus argentatus), Great Black-backed Gulls (L. marinus), and Lesser Black-backed Gulls (L. fuscus).] Var Fagelvarld 18: 311-317. [In Swedish with English summary.]

Colston, P. R., B. Newport and M. J. Carter. 1959. Great Black-backed Gull attacking migrant Starling. Brit. Birds 52: 312-313.

Gamble, G. 1959. Great Black-backed Gull attacking migrant Blackbird. Brit. Birds 52: 164.

Iles, D. B., J. R. Govett and D. Rushforth. 1959. Inland breeding of Greater Black-backed Gull. Naturalist 870: 98.

King, B. 1959. Great Black-backed Gull diving from a height and submerging in an inland water. Brit. Birds 52: 198.

Lewis, H. F. 1959 ms. Predation of eider ducks by Great Black-backed Gulls in Nova Scotia. Unpubl. Rep. Nova Scotia Dep. Lands Forests, Halifax. 16 pp.

Slinn, D. J. 1959. Breeding population of the Great Black-backed Gull in Mann 1957. Peregrine 3: 2-7.

Stevenson, H. M. 1959. Great Black-backed Gull (Larus marinus). Fla. Nat. 32: 146.

1958

Davis, T. A. W. 1958. The breeding distribution of the Great Black-backed Gull in England and Wales in 1956. Bird Study 5: 191-215.

1957

Cobb, S. 1957. Great Black-backed Gull (Larus marinus). Auk 74: 498.

Lennerstedt, I. 1957. Albinistik havstrut Larus marinus i Bohuslan. [Albinistic Great Black-backed Gull Larus marinus in Bohuslan.] Var Fagelvarld 16: 52,58. [In Swedish with English summary.]

1956

Campbell, J. W. 1956. Status of Great Black-backed Gull in Scotland. Brit. Birds 49: 152.

Cormack, D. M., R. S. Cormack and R. H. Poulding. 1956. Breeding of Great Black-backed Gull in Gloucestershire. Brit. Birds 49: 153.

Krug, H. H. 1956. Great Black-backed Gulls nesting on Little Haystack Island, Lake Huron. Auk 73: 559.

1955

Andrew, D. G. 1955. Status of Great Black-backed Gull inland in Scotland. Brit. Birds 48: 455-456.

Cobb, F. K. 1955. Notes on the behaviour of Great Black-backed Gulls. Trans. Suffolk Nat. Soc. 9: 263-266.

Hamann, D. F. 1955. Great Black-backed Gull, *Larus marinus*, at Ormond Beach and Canaveral. Fla. Nat. 28: 59-60.

Larsen, A. and F. B. Jorgensen. 1955. Svartbag (*Larus marinus* L.) som yngle-fugl pa Saltholm. Dan. Ornithol. Foren. Tidsskr. 49: 136-138. [In Danish.]

1954

Gudmundsson, F. 1954. Islenzkir fuglar. X. Svartbakur (*Larus marinus* L.). [Icelandic birds. X. The Great Black-backed Gull (*Larus marinus* L.).] Natturufraedingurinn 24: 177-183. [In Icelandic with English summary.]

Nilsson, N. J. 1954. Havstrut (*Larus marinus*) hackande vid insjoar i Bohuslan. [Great Black-backed Gulls (*Larus marinus*) breeding on two lakes in Bohus-lan.] Var Fagelvarld 13: 38-40. [In Swedish with English summary.]

Schmidt, G. 1954. Zum Rauben der Schmarotzer-Raubmowe. Vogelwelt 75: 147-151. [In German.]

1953

Cross, A. 1953a. Greater Black-backed Gull diving for food. Scott. Nat. 65: 129.

Jonston, T. L. 1953. The Greater Black-backed Gull on the Cumberland Solway. Trans. Carlisle Nat. Hist. Soc. 8: 8-13.

1952

Dawn, W. 1952. Herring Gull regurgitates upon Black-backed Gull's demand. Linn. Newsl. 6(6/7): 2-3.

1951

Barnes, J. A. G. 1951. Inland breeding of Great B[l]ack-backed Gull. Brit. Birds 44: 36.

Stimson, L. A. 1951. Notes from South Florida. Fla. Nat. 24: 81.

Wilson, W. H. 1951. Hybrid Glaucous X Great Black-backed Gull at Limerick. Brit. Birds 44: 286-287.

1950

Adams, R. G. 1950a. Great Black-backed Gull dropping food from height. Brit. Birds 43: 382.

_____. 1950b. Skua-like tactics of Great Black-backed Gull. Brit. Birds 43: 382.

Butt, O. V., R. G. Pettitt and A. E. Vine. 1950. Great Black-backed Gulls roosting inland. Brit. Birds 43: 61.

Davis, T. A. W. 1950. Great Black-backed Gull with yellow legs. Brit. Birds 43: 164.

1949

Wilmahn, B. 1949. Ringmerkings-resultater for svartbak (Larus marinus L.). Stavenger Mus. Arbok 58: 123-128. [In Swedish.]

1948

Anon. 1948. Great Black-backed Gulls diving for food. Brit. Birds 41: 93-94.

Conder, P. J. 1948. Great Black-backed Gull dropping prey. Brit. Birds 41: 250.

1947

Barnes, A. M. 1947. The Black-backed Gull. Annu. Rep. Bowdoin Sci. Stn. 8: 18-21.

Harber, D. D. and M. Johns. 1947. Great Black-backed Gull dropping rat. Brit. Birds 40: 317.

1946

Hare, M. 1946. Avian leukosis and the Great Black-backed Gull. Auk 63: 245-246.

Mayfield, H. 1946. The status of Great Black-backed and Glaucous Gulls in Michigan. Jack-Pine Warbler 24: 19-22.

1945

Addy, C. E. 1945. Great Black-backed Gull kills adult Black Duck. Auk 62: 142-143.

Brooks, M. 1945. Great Black-backed Gull in Monongalia County, West Virginia. Auk 62: 634.

Gross, A. O. 1945. The present status of the Great Black-backed Gull on the coast of Maine. Auk 62: 241-256.

Svendsen, T. 1945. Svartbagens, Larus marinus, Yngleforekomst paa Sandrevet Syd for Laeso 1944. Dan. Ornithol. Foren. Tidsskr. 39: 54-55.

1944

Wilcox, L. 1944. Great Black-backed Gull breeding in New York. Auk 61: 653-654.

1943

Fitter, R. S. R. 1943. Status of the Black-backed Gulls in the London area. Brit. Birds 36: 163-164.

Gerber, R. 1943. Eine Mantelmowe, Larus marinus L., bei Penig in Sachsen. Ornithol. Monatsber. 51: 44.

Mayfield, H. 1943. Glaucous and Great Black-backed Gulls at the western end of Lake Erie. Wilson Bull. 55: 129-130.

Salomonsen, F. 1943. Svartbagen (Larus marinus L.) i Laeso omradet. Dan. Ornithol. Foren. Tidsskr. 37: 221-226. [In Danish.]

1942

Cleghorn, J. D. 1942. Great Black-backed Gull killing American Goldeneye. Auk 59: 584-585.

1941

Svendsen, L. and R. Horring. 1941. Svartbage, Larus marinus, ynglende ved Laeso. Dan. Ornithol. Foren. Tidsskr. 35: 224.

1938

Johnson, R. A. 1938. Predation of gulls in murre colonies. Wilson Bull. 50: 161-170.

Jourdain, F. C. R. 1938. On the occurrence of Larus marinus in Spitsbergen. Ibis (14th Ser.) 2: 539-540.

Marshall, A. J. 1938. On the occurrence of Larus marinus in Spitsbergen. Ibis (14th Ser.) 2: 341-342.

1937

Bodenstein, G. 1937. Von der Wanderungen der Seemowen (Larus hyperboreus, L. marinus, L. argentatus, L. fuscus, und L. canus) in Ostlichen Ostsee nach den Beringungsergebnissen. Schr. Phys.-Okon. Ges. Konigsberg 69: 223-234.

Broekhuysen, G. J., Jr. 1937. Gedragingen van geslachtsrijpe en nog niet geslachtsrijpe Zilver- en Grote Mantelmeeuwen (Larus argentatus Pont. et Larus marinus L.) buiten de broedtijd. Ardea 26: 159-172. [In Dutch with English summary.]

Kuerzi. R. G. 1937. The Black-backed Gull as a predator. Proc. Linn. Soc. N.Y. 48: 97-98.

Lockley, R. M. 1937. Black-backed and Herring-Gulls and Ravens feeding on ants. Brit. Birds 30: 325-326.

Loppenthin, B. 1937. Et Besog paa knotten. Noter om Svartbag, Larus marinus, som dansk ynglefugl. Dan. Ornithol. Foren. Tidsskr. 31: 142-146.

1936

Cottam, C. 1936a. Early migration of the Great Black-backed Gull. Auk 53: 79.

_____. 1936b. Status of the Black-backed Gull. Auk 53: 332-333.

Timmermann, G. and F. Gudmundsson. 1936. Ein Besuch der Mantelmowenkolonie Auf der Insel Sandey im Thingvallavatn (Sudwest-Island). Beitr. Fortpfl. Vogel 12: 14-21.

1935

Broekhuysen, G. J., Jr. 1935. Gedragingen van nog niet geslachtsrijpe doch reeds zelfstandige Zilver- en Grote Mantelmeeuwen (Larus argentatus Pont. et Larus marinus L.). Ardea 24: 239-250. [In Dutch with German summary.]

Gross, W. A. O. 1935. The life history cycle of Leach's Petrel (Oceanodroma leucorhoa leucorhoa) on the outer sea islands of the Bay of Fundy. Auk 52: 382-399.

Sprunt, A., Jr. 1935. The Black-backed Gull on the South Carolina coast. Auk 52: 447-448.

1934

Barth, E. K. 1934. Hegrer of svartbak ostenfor Lindesnes. Naturen 58: 28-30. [In Danish.]

Cottam, C. 1934. Possible extension of regular winter range of the Great Black-backed Gull. Auk 51: 376.

Roberts, R. 1934. Notes on the birds of central and south east Iceland with special reference to food-habits. Ibis (13th Ser.) 4: 239-264.

Shelley, L. O. 1934b. Gull notes from the New Hampshire and Maine coasts. Auk 51: 83.

1933

Harllee, H. L. 1933. Great Black-backed Gull on the South Carolina coast. Auk 50: 217.

Harrisson, T. H and H. G. Hurrell. 1933. Numerical fluctuations of the Great Black-backed Gull (Larus marinus Linn.) in England and Wales. Proc. Zool. Soc. Lond. 103: 191-209.

Holt, E. G. 1933. Great Black-backed Gull in Maryland. Auk 50: 216-217.

Oldham, C. 1933. Great and Lesser Black-backed Gulls in North Wales. Brit. Birds 27: 38-41.

Taylor, W. R. 1933. Early breeding of Guillemot, Razorbill, Shag and Great Black-backed Gull in Cornwall. Brit. Birds 27: 52.

1932

Haworth, A. G. 1932. Colour of iris in Great Black-backed Gull. Brit. Birds 26: 100.

Jackson, C. F. and P. F. Allan. 1932. Additional note on the breeding in Maine of the Great Black-backed Gull (Larus marinus). Auk 49: 349-350.

Lockley, R. M. 1932. Incubation-periods of Lesser and Great Black-backed and Herring-Gulls. Brit. Birds 25: 310-313.

Robinson, H. W. 1932. Colour of iris in Great Black-backed Gull. Brit. Birds Birds 26: 140.

1931

Eaton, R. J. 1931. Great Black-backed Gull (Larus marinus) breeding in Essex County, Massachusetts. Auk 48: 588-589.

Harrisson, T. H. and H. G. Hurrell. 1931. Numerical status of the Great Black-backed Gull in Devon. Brit. Birds 25: 136-138.

Lonnberg, E. 1931. Fargen in nabben av havstruten, Larus marinus. Fauna Flora 26: 183-184.

Means, W. G. and R. J. Eaton. 1931. Great Black-backed Gull (Larus marinus L.) breeding in Essex County, Mass. Bull. Essex Co. Ornithol. Club 13: 4-6.

Norton, A. H. and R. P. Allen. 1931. Breeding of the Great Black-backed Gull and Double-crested Cormorant in Maine. Auk 48: 589-592.

Rasmussen, S. 1931. Svartbag, Larus marinus L., som Dansk Ynglefugle. Dan. Ornithol. Forens. Tidsskr. 25: 125-127.

Seton, G. 1931. Great Black-backed Gull preying on Storm-Petrels. Brit. Birds 25: 60.

1925

Robinson, H. W. 1925. Colour of the eyes in the Hawfinch, Pochard and Greater Black-backed Gull. Ibis (12th Ser.) 1: 949-951.

1924

Blathwayt, F. L. 1924. Breeding of the Great Black-backed Gull in Dorset. Brit. Birds 18: 61.

1923

Ingram, G. C. S. and H. M. Salmon. 1923. Great Black-backed Gull breeding in Somerset. Brit. Birds 16: 214-215.

Lewis, S. 1923. Great Black-backed Gull breeding in Somerset. Brit. Birds 17: 67.

Robinson, H. W. 1923. Great Black-backed Gull killing Razorbill. Brit. Birds 17: 67-68.

1922

Robinson, H. W. 1922. Great Black-backed Gull nesting in Westmoreland. Brit. Birds 16: 139.

1920

Lewis, H. F. 1920. Among the Coffin Carriers (Larus marinus). Kansas Field Nat. 34: 101-106.

1919

Lonnberg, E. 1919. Hybrid gulls. Ark. Zool. 12: 1-22.

1918

Palmgren, R. 1918. Larus argentatus Brunn [male] X marinus (L.) [female]. Helsingfors Medd. Soc. Fauna Flora Fenn. 44: 125-127.

1917

Kihlen, G. 1917. Till frargan om alfagelns ruggningar och hafstrutens hackning vid sotvatten. Fauna Flora 12: 229-230.

1913

Deffay, M. 1913. Le Goeland marin. Havre Soc. Linn. 1: 17-19.

1911

Robinson, H. W. 1911a. Slaughter of Manx Shearwaters by Black-backed Gulls. Brit. Birds 5: 55.

_____. 1911b. Rats and Manx Shearwaters. Brit. Birds 5: 88.

1910

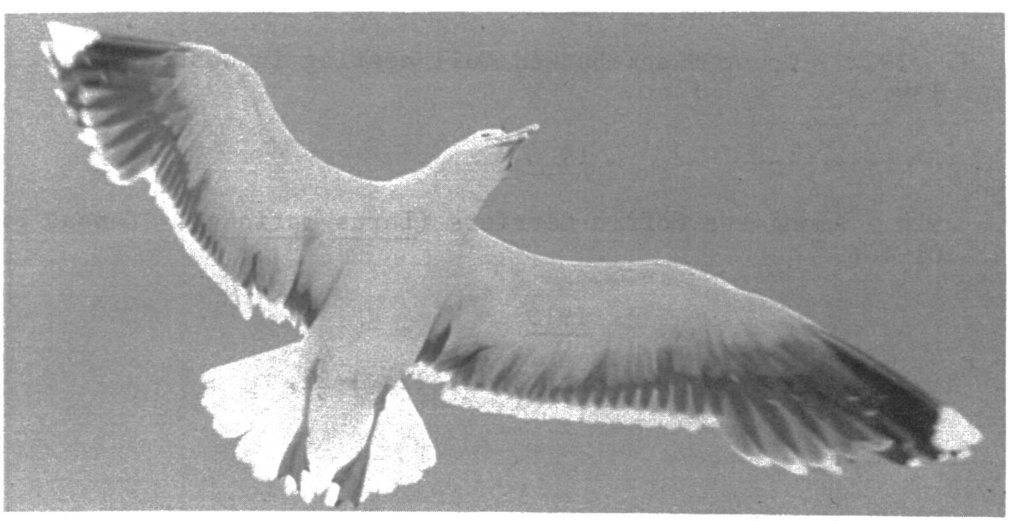
Stubbs, F. J. 1910. Breeding of the Greater Black-backed Gull in Lakeland. Lancashire Nat. 3: 266.

1908

Warren, R. 1908. Unusual site for a Great Black-backed Gull's nest. Zoologist (Lond.) 12: 396.

1882

Ridgway, R. 1882. The Great Black-backed Gull from a new locality. Bull. Nuttall Ornithol. Club 7: 60.



Adult Great Black-backed Gull in breeding plumage. Photograph by Pat Lynch.

GULL-BILLED TERN

(Sterna nilotica)

[DA: Sandterne, DU: Lachstern, FI: Hietatiira, FR: Sterne hansel, GE: Lachseeschwalbe, IC: Hlaturperna, IT: Rondine di mare zampenere, NW: Sandterne, PO: Rybitwy krotkodziobej, SP: Pico de gaviota, Pagaza piconegra; SW: Engelsk tarna, Sandtarna]

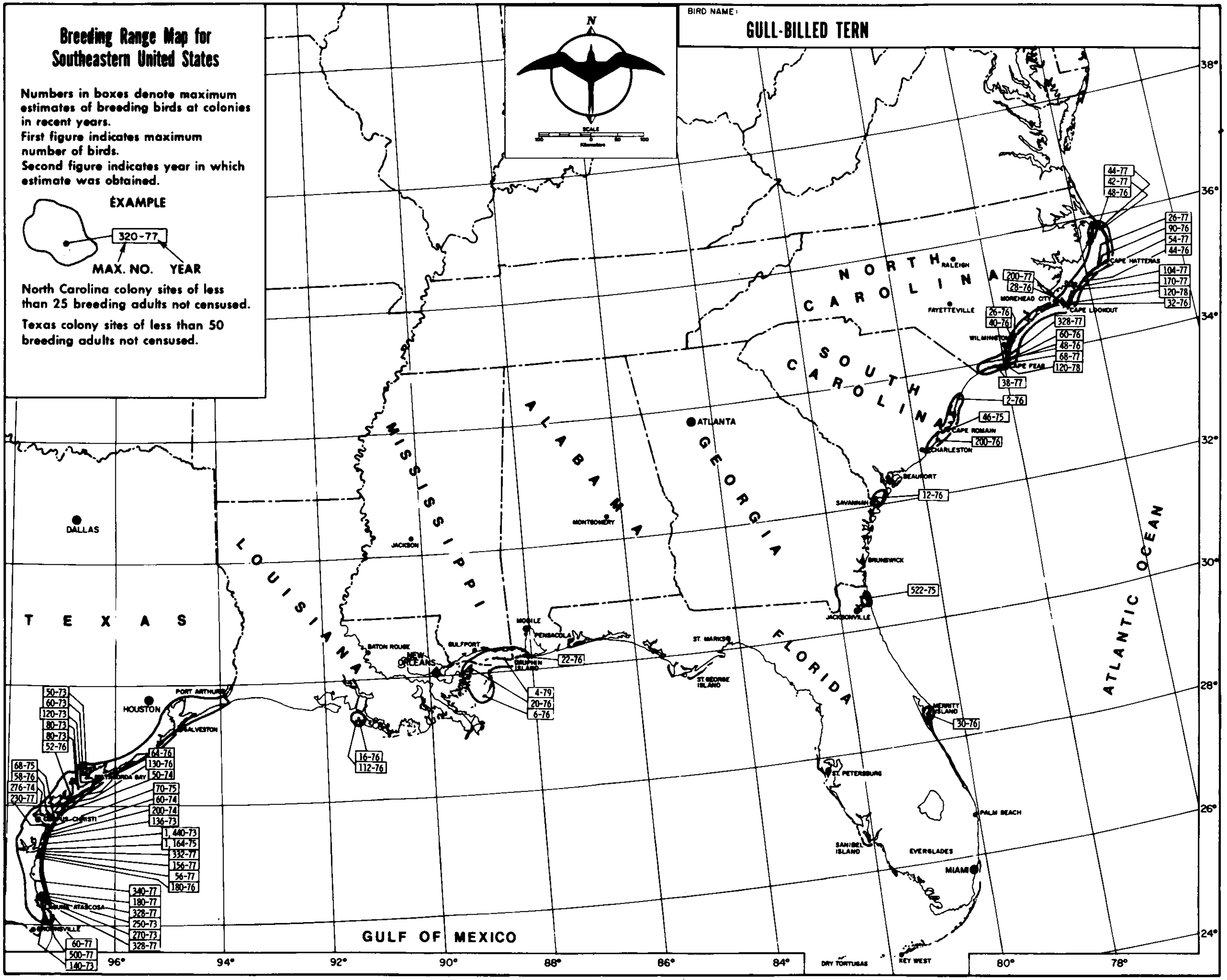
GENERAL DISTRIBUTION

North America Along the Atlantic coast, Gull-billed Terns nest irregularly in New York and New Jersey (Buckley et al. 1975) and regularly from Maryland south to Florida, with occasional inland breeding on fresh water in the latter state. They also breed along the Gulf coast from Florida to Texas where they are most abundant (Map 9). An isolated colony is present on the Salton Sea in California, and others breed on the west coast of Mexico. Eastern birds winter locally along the Atlantic and Gulf coasts (Map 10), primarily in the western portion of the Gulf. Most birds, however, winter farther south along the coasts of Central America and along the northern coast of South America. Birds from the western population winter in Central America and coastal South America (AOU 1957, Blake 1977).

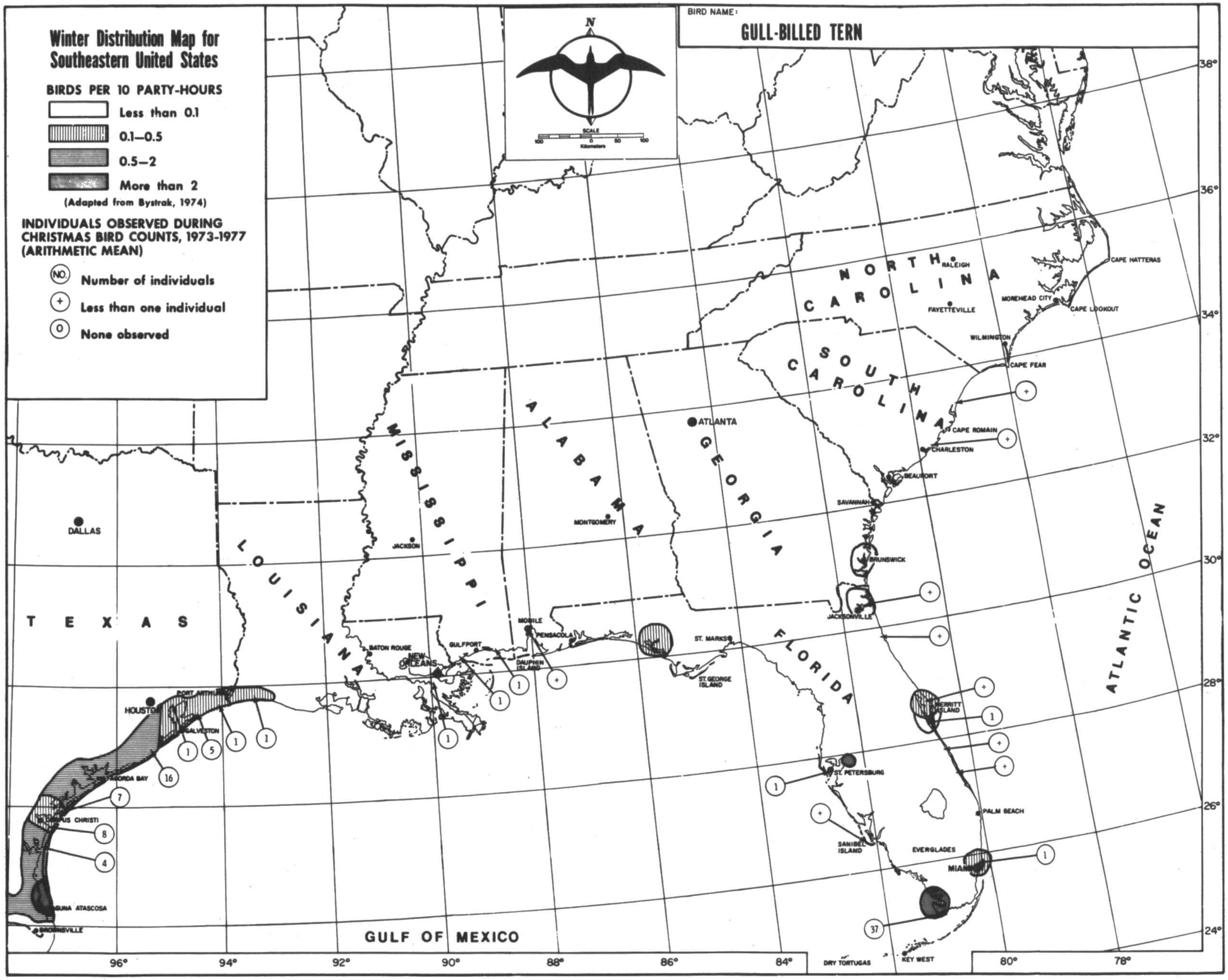
World Distribution Gull-billed Terns are nearly cosmopolitan in their breeding distribution. They breed in the Caribbean in the Bahamas and Virgin Islands (AOU 1957), in South America on the coasts of Brazil, Uruguay, and northern Argentina (Blake 1977), and in southwestern Ecuador (Marchant 1958). In 1972 they bred locally in Europe in Denmark, West Germany, France (in the Camargue), Spain, Italy, Romania, Greece, Turkey, and the south European U.S. S.R. (Moller 1975d). They formerly bred in Poland (AOU 1957), England, the Netherlands, Portugal, Austria, Hungary, and Bulgaria (Moller 1975d). In Africa, Gull-billed Terns bred in 1972 along the northwestern coast in Senegal, in the Banc d'Arguin off Mauritania and along the Mediterranean coast in Tunisia. Earlier breeding records also exist for Morocco and Algeria (Moller 1975d). Breeding populations are found in Asia from the Persian Gulf to India and the Malay Archipelago. Gull-billed Terns also breed on mainland Australia, and (rarely) on Tasmania (Dement'ev and Gladkov 1951, Vaurie 1965, Serventy et al. 1971).

Populations in eastern Europe primarily winter in northwestern Africa from Senegal to Nigeria while populations in western Europe winter in eastern Africa from the Somali Republic to Mozambique and Botswana (Moller 1975b). Populations from more southern breeding localities in Asia, Australia, and Ecuador apparently winter largely in coastal areas near the breeding range.

Taxonomic note: This species is frequently placed in the monotypic genus Gelochelidon.


Breeding Range Map for Southeastern United States
Numbers in boxes denote maximum estimates of breeding birds at colonies in recent years.
First figure indicates maximum number of birds.
Second figure indicates year in which estimate was obtained.
EXAMPLE
320-77
MAX. NO.
YEAR
North Carolina colony sites of less than 25 breeding adults not censused.
Texas colony sites of less than 50 breeding adults not censused.
BIRD NAME:
GULL-BILLED TERN
N
SCALE
Kilometers
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI
LOUISIANA
TEXAS
FLORIDA
ATLANTIC OCEAN
GULF OF MEXICO
RALEIGH
FAYETTEVILLE
MOREHEAD CITY
CAPE HATTERAS
CAPE LOOKOUT
WILMINGTON
CAPE FEAR
CAPE ROMAIN
CHARLESTON
BEAUFORT
SAVANNAH
BRUNSWICK
JACKSONVILLE
ATLANTA
MONTGOMERY
JACKSON
MOBILE
PENSACOLA
GULFPORT
DAUPHIN ISLAND
BATON ROUGE
NEW ORLEANS
ST. MARKS
ST. GEORGE ISLAND
MERRITT ISLAND
ST. PETERSBURG
SANIBEL ISLAND
EVERGLADES
PALM BEACH
MIAMI
KEY WEST
DRY TORTUGAS
DALLAS
HOUSTON
PORT ARTHUR
GALVESTON
MATAGORDA BAY
CORPUS CHRISTI
LAGUNA ATASCOSA
BROWNSVILLE
44-77
42-77
48-76
26-77
90-76
54-77
44-76
104-77
170-77
120-78
32-76
200-77
28-76
26-76
40-76
328-77
60-76
48-76
68-77
120-78
38-77
2-76
46-75
200-76
12-76
522-75
30-76
22-76
4-79
20-76
6-76
16-76
112-76
50-73
60-73
120-73
80-73
80-73
52-76
68-75
58-76
276-74
230-77
64-76
130-76
50-74
70-75
60-74
200-74
136-73
1,440-73
1,164-75
332-77
156-77
56-77
180-76
340-77
180-77
328-77
250-73
270-73
328-77
60-77
500-77
140-73
38°
36°
34°
32°
30°
28°
26°
24°
96°
94°
92°
90°
88°
86°
84°
80°
78°

Map 9


Winter Distribution Map for Southeastern United States
BIRDS PER 10 PARTY-HOURS
Less than 0.1
0.1–0.5
0.5–2
More than 2
(Adapted from Bystrak, 1974)
INDIVIDUALS OBSERVED DURING CHRISTMAS BIRD COUNTS, 1973-1977 (ARITHMETIC MEAN)
Number of individuals
Less than one individual
None observed
BIRD NAME:
GULL-BILLED TERN
N
SCALE
Kilometers
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
FLORIDA
ALABAMA
MISSISSIPPI
LOUISIANA
TEXAS
ATLANTIC OCEAN
GULF OF MEXICO
RALEIGH
FAYETTEVILLE
MOREHEAD CITY
CAPE HATTERAS
CAPE LOOKOUT
WILMINGTON
CAPE FEAR
CAPE ROMAIN
CHARLESTON
BEAUFORT
SAVANNAH
BRUNSWICK
JACKSONVILLE
ATLANTA
MONTGOMERY
JACKSON
MOBILE
PENSACOLA
DAUPHIN ISLAND
GULFPORT
BATON ROUGE
NEW ORLEANS
ST. MARKS
ST. GEORGE ISLAND
MERRITT ISLAND
ST. PETERSBURG
SANIBEL ISLAND
EVERGLADES
PALM BEACH
MIAMI
KEY WEST
DRY TORTUGAS
DALLAS
HOUSTON
PORT ARTHUR
GALVESTON
MATAGORDA BAY
CORPUS CHRISTI
LAGUNA ATASCOSA
BROWNSVILLE
38°
36°
34°
32°
30°
28°
26°
24°
96°
94°
92°
90°
88°
86°
84°
80°
78°

Map 10

DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

Gull-billed Terns were once common along the central and the southeastern Atlantic coast of the United States, although early range and status trends of populations are not well documented. In the 19th century, they bred commonly in New Jersey (Stone 1909), Virginia (Bailey 1913), and Georgia (Burleigh 1958), and probably in other coastal states as well. The population decline in the late 1800's was apparently the result of plume hunting and perhaps the loss of marsh habitat (Bent 1921, Burleigh 1958). Considered an uncommon species in the southeast early in this century, the Gull-billed Tern has recently reoccupied much of its former range, a trend that is still continuing (Savell 1972, Buckley et al. 1975). Although the species is now common locally along the Atlantic coast, populations are not yet stable (Therres et al. 1978).

North Carolina Gull-billed Terns are seen locally along the coast of North Carolina and are occasionally seen inland (Teulings 1975d). Nesting has been reported at many places along the coast (Map 9). The species is present primarily in summer, but a few birds may be present in fall and winter (Pearson et al. 1942). These terns usually return to their colonies in North Carolina from mid-April to early May. Eggs are laid from about mid-May to as late as mid-July, and dependent young may be present into early August (Parnell and Soots 1979 ms).

Gull-billed Terns are now considerably more abundant as nesting birds (Table 38) in North Carolina than they were at the beginning of this century, but they still breed only in small numbers and are regarded as a species of special concern in North Carolina. They nest from Roanoke Sound south to the Cape Fear River (Parnell and Soots 1979 ms). A majority of the breeding population nests on man-made or altered sites (65.8% of ca. 1,690 breeding birds in 1973 [Soots and Parnell 1975a], 83.6% of 900 breeding birds in 1976 [Portnoy et al. 1981], and 84.3% of ca. 1,240 breeding birds in 1977 [Parnell and Soots 1979 ms]).

Colonies tend to be small (1), but a large proportion of the state population is concentrated at a few sites. Thirty-one colonies censused in 1976 averaged 29.0 breeding birds (median 20) (Portnoy et al. 1981); 21 colonies censused in 1977 (Parnell and Soots 1979 ms) averaged 31 breeding birds (median 30). In 1976 the four largest colonies held 36% of the breeding population. Two of these large colonies with 130 and 60 breeding birds, respectively, were on dredge-spoil islands in the Cape Fear River; one colony was on a dredge-

(1) Old World colonies are also small but increase in size in the southern portions of the range. Colonies on the Chernomorskii Reserve in the southern U.S.S.R. usually contain 20 to 40 breeding birds, and only rarely as many as 100 (Borodulina 1960). Colonies in Denmark average 72 breeding birds with a maximum of 400 and colonies in Germany average 10 breeding birds with a maximum of 110) (Moller 1981a). Colonies in southern breeding areas rarely may hold as many as 2,000 breeding birds (Moller 1982).

spoil island at Hatteras Inlet (90 breeding birds); and one was on a barrier beach at Portsmouth Island on the Outer Banks (62 breeding birds) (Portnoy et. al 1981). In 1977 the four largest colonies contained almost 65% of all nests found. The largest colony, located on a dredged island in the Cape Fear River, held about 330 breeding birds. The other three large colonies were: one found on Brant Island (a dredged island in the Morehead Channel, Carteret County), with about 200 breeding birds; one on a dredged island at Drum Inlet, Carteret County, that held 170 birds; and one colony on the barrier beach on the north shore of Drum Inlet, with 104 breeding birds (Parnell and Soots 1979 ms).

South Carolina Sprunt and Chamberlain (1949) considered the Gull-billed Tern a common summer resident and irregular breeding bird in this state. This species has been seen as early as March (Teulings 1973c) and as late as November (Teulings 1975a) and December (Chamberlain 1968), but most are present from April to September (Sprunt and Chamberlain 1949). These terns nest regularly near Charleston and at Cape Romain NWR (Map 9), successfully in some years and not so successfully in others (Teulings 1971d, 1972d). Egg laying begins in the first week of May and young hatch from June through July; young fledge as early as 3 July (Blus and Stafford 1980).

Recent nesting populations in the low hundreds have been found on coastal estuarine islands (Blus and Stafford 1980). The largest nesting colonies in recent years are one on Raccoon Key that held about 310 and 320 breeding birds in 1972 and 1973, respectively (Blus and Stafford 1980), and one to the south on Bird Island in Bulls Bay that contained 220 breeding birds in 1976 (Portnoy et al. 1981).

Georgia Gull-billed Terns are now uncommon and irregular summer residents along the Georgia coast, although occasional nesting has been reported in Chatham and McIntosh Counties (Burleigh 1958, Denton et al. 1977). They also occasionally occur inland (LeGrand 1978).

Florida Few Gull-billed Terns were recorded in Florida in the early part of this century (Howell 1932). The first nesting was noted in 1932 (Weston 1933), but since that time the Gull-billed Tern has become a regular breeding bird, most common on the Atlantic coast. Kale (1979 ms a) reported a colony of about 25 pairs at the Mayport Naval Station in the St. Johns River Inlet in addition to the colonies at the Bird Islands in Nassau Sound and those on spoil islands in the Banana River on Merritt Island NWR indicated on Map 9. The colony at Merritt Island NWR contained over 150 pairs in 1977 (Map 9).

Gull-billed Terns breed much less abundantly on the Florida Gulf coast; Kale (1979 ms b) considered them rare there, noting that a few pairs nest on spoil islands in Tampa and Boca Ciega Bays along the central west coast, as well as on St. Joe Island along the northern Gulf coast. Most egg laying occurs in mid- to late May or early June (Schreiber and Schreiber 1978); dependent young are probably present into August.

Alabama Gull-billed Terns are uncommon summer residents in Alabama. Breeding occurs in southern Mobile County where eggs have been reported from 22 May through 16 June. These terns are common migrants on the Alabama coast, with a maximum of 75+ birds recorded at Fort Morgan on 6 August, but few are present in winter (Imhof 1976b). Twenty-three breeding birds were reported on Dauphin Island in 1976 (Portnoy 1977), the largest number of Gull-billed Terns found nesting in Alabama in recent years.

Mississippi These terns are uncommon in Mississippi, but breed in small numbers on coastal islands and at the mouth of the Pascagoula River (Burleigh 1944, Jackson et al. 1980). Eggs have been found in late May and early June (Jackson et al. 1980), and dependent young are present at least through July. Records of occurrence are from late March to early September (Gandy and Turcotte 1970, Jackson et al. 1979 ms b).

Louisiana Lowery (1974) considered Gull-billed Terns to be fairly common permanent residents in Louisiana, least abundant in summer. Small numbers nest on islands off the coast and near the Rigolets Pass. Portnoy (1977) found only four colonies in Louisiana in 1976, but he may have overlooked some nesting areas. The largest breeding colony (112 birds) contained nearly three-quarters of the Gull-billed Terns found nesting in 1976. Found on spoil in Atchafalaya Bay (Portnoy 1977), this colony was still active in 1978. That year, a fifth colony was found on Grassy Island in Grand Island Pass (Portnoy 1978 ms), but none bred at two colonies (another in Atchafalaya Bay and one at Curlew Island) where Gull-billed Terns had bred in 1976. All Gull-billed Terns breeding in Louisiana, Alabama, and Mississippi in 1976 were found nesting in Black Skimmer colonies (Portnoy 1977).

Texas Gull-billed Terns breed commonly but locally along the Texas coast (Map 9). They are present throughout the year but are less numerous in winter. Eggs have been recorded from 14 April through 17 July (Oberholser 1974), but the nesting season is usually shorter; in 1977, most young had fledged by 28 June (Chaney et al. 1978).

Texas probably holds more than half the entire number of Gull-billed Terns nesting in the United States. Populations there are evidently stable (Blacklock et al. 1978 ms). Censuses from 1973 through 1978 revealed populations containing from 1,370 breeding birds in 1974 to approximately 5,320 in 1973 (mean = 2,975) (Blacklock et al. 1978, Blacklock et al. 1978 ms.). These nesting populations were most abundant along the central coast. From 1973 to 1976, the largest colonies contained 400 or more breeding birds. One colony found on spoil in Kleberg County held about 1,440 and 400 birds in 1973 and 1975, respectively; another colony on islands in Baffin Bay in Kleberg County averaged about 1,020 breeding birds in 1975 and 1976; and a third colony on spoil in Cameron County held about 450 birds in 1973. However, most colonies are considerably smaller, and only a few contain more than 100 breeding birds. Of 78 colonies censused 1973-1976 (Blacklock et al. 1978), almost 54% contained 50 or less breeding birds; the median size of these colonies was 50 birds.

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

Breeding The Gull-billed Tern is nearly cosmopolitan in its distribution and breeds on all continents except Antarctica (AOU 1957). In all areas, however, they seem to be uncommon and local. In North America this species breeds regularly but locally along the Atlantic coast from New Jersey south to Florida and along the Gulf coast. An isolated group nests at the Salton Sea in California. Gull-billed Terns also nest in the West Indies and on the coast of Mexico (Bond 1961, AOU 1957). American colonies now are usually small, but the species probably was more abundant a century ago than it is at present.

Judging from recent censuses, most of the North American population breeds along the coast of the southeastern United States. Figures listed in Table 38 probably underestimate the numbers breeding in some areas (e.g., Florida) because this species is easily overlooked on censuses and because the few recent surveys of coastal waterbirds in the southeast have been incomplete.

Only a few Gull-billed Terns were found nesting along the northeastern Atlantic coast in 1977 (Erwin 1979a). Four colonies with 38 breeding birds were found in New Jersey, and two colonies containing 310 birds were reported in Virginia. The population breeding in Maryland contained about 70 birds in 1951 (Erwin 1979a), but only one pair was found there from 1974 to 1976; none was found in 1977 (Therres et al. 1978). Two pairs were found breeding on Long Island, New York, in 1975 (Buckley et al. 1975), but the species has not been known to nest there since (Erwin 1979a).

We found few recent data on recent populations of the Gull-billed Tern in the Old World. In 1972 about 90 bred in Denmark, 6 bred in West Germany, about 1,800 bred in Spain, 400 bred in Senegal, about 50 bred in Italy, about 800 bred in Greece, 6 bred in Romania, about 800 bred in Turkey, and about 230 bred in the Camargue of France (Moller 1975d); the breeding population in the latter area had increased to about 400 by 1979 (Hafner et al. 1980). About 13,000 bred on the Banc d'Arguin off Mauretania in 1959 (Moller 1975d). In 1972 another 1,000 bred in Afghanistan; about 2,000 bred in Iraq, Iran, Pakistan and India; and no more than 4,000 bred in the Soviet Union (Moller 1975d). Moller estimated that the total number breeding in 1972 in Europe, Africa and western Asia was about 24,000.

From our limited data, the southeastern United States appears to contain a significant proportion of the global world population. As a result, this area is critical to the well-being of the entire species.

Winter and Migration Gull-billed Tern populations may be either sedentary or migratory with the populations in northern North America and the northern Palearctic moving south for the winter. Birds breeding in the United States are believed to migrate primarily along the coasts (Bent 1921) to wintering grounds in central and northern South America, but no studies of dispersal and migration based on marked breeding birds are available to indicate the location of particularly important migratory or wintering areas for populations nesting in the southeastern United States. Small numbers winter along the coasts of

Table 38. Recent estimates of Gull-billed Tern populations nesting in the southeastern United States.

State	Number found breeding in 1976 (a)	Percent of southeastern breeding population	Maximum number found breeding in recent years and year
North Carolina	900	25.9	1,690 (1973)
South Carolina	230	6.6	680 (1972)(b)
Georgia	none		none
Florida-Atlantic Coast (c)	210	6.0	1,070 (1975)
Florida-Gulf Coast	??		??
Alabama	20	0.6	20 (1976)
Mississippi	2	0.06	4 (1979)
Louisiana	150	4.3	150 (1976)
Texas	1,960	56.5	5,320 (1973)
	3,472		

(a) Figures above 10 are rounded to the nearest 10.
(b) Total is low because one area was not counted during peak nesting (Blus and Stafford 1980).
(c) The figures listed for the Florida Atlantic coast for 1976 are derived from Portnoy et al. (1981) (in which these data were listed as from Georgia) and from Map 9. The total number breeding in this state is poorly known.

the southeastern United States (Map 10), but large wintering populations are found only along the Texas coast.

Birds from the eastern Palearctic winter primarily in southern Africa (Moller 1975b) with others wintering along the Mediterranean (BOU 1971). Gull-billed Terns banded in the Old World have straggled at least three times about 7,500 km (4,700 mi) from Denmark to Barbados in the West Indies (Lincoln 1936) and have wandered once to Madeira (Moller 1975b). Other Palearctic populations winter in Arabia, the Persian Gulf, India, Ceylon, and the Greater Sundas (Dement'ev and Gladkov 1951, Vaurie 1965, BOU 1971).

Most migrants from Danish populations follow the German west coast south and migrate over Spain and along the northwest coast of Africa; a smaller proportion migrate over Italy and across the northern African continent (Moller 1975b). Migrants from populations along the eastern Mediterranean are thought to migrate south along the Red Sea (Moller 1975b). Serventy et al. (1971) regarded Australian Gull-billed Terns as nomadic, suggesting that they disperse to coastal areas during the nonbreeding season and return inland to breed. Marchant's (1958) observations in southwest Ecuador suggest that this may also be true of South American populations.

HABITAT

Nesting In North America Gull-billed Terns are primarily colonial nesters in coastal areas where they typically nest with other marine birds. In the Old World, they often nest with other species of gulls and terns (de Waard 1950, Lind 1963a). In the southeastern United States, Gull-billed Terns frequently nest with Black Skimmers and/or Least Terns (Ericksen 1926, Weston 1933, Nicholson 1948a, Hallman 1960, Portnoy 1977, Sears 1978).

Gull-billed Terns breeding inland at the Salton Sea in California nested in caked, wind-blown dunes (Pemberton 1927), while those at Lake Okeechobee, Florida, placed their nests on the sandy shores of small islands (Nicholson 1948a). Gull-billed Terns breeding along the northern Atlantic coast usually nest in marshes or on sandy barrier beaches. Those on Long Island, New York in 1975 nested on exposed fill near marshland (Buckley et al. 1975). Birds at three saltmarsh colonies in New Jersey in 1977 placed their nests on drift material (Buckley and McCaffrey 1978).

Nesting habitats used in the southeastern United States include windrows of dead marsh grass ("drift" or "wrack") (Ericksen 1926, Parnell and Soots 1979 ms), grassy islands in freshwater lakes (Sprunt 1940, Nicholson 1948a), dredged-material islands (Chaney et al. 1978; Kale 1979 ms a, 1979 ms b; Parnell and Soots 1979 ms; Jackson et al. 1980), natural estuarine islands (Parnell and Soots 1979 ms, Blus and Stafford 1980), barrier beaches (Parnell and Soots 1979 ms), and sites on the coastal mainland (Oberholser 1974).

In the eastern United States, Gull-billed Terns often nest on dredge-spoil islands consisting of sand mixed with shells or silt (Chaney et al. 1978, Sears 1978). The extent to which man-made or man-altered sites are used for nesting varies considerably. Only 28% of the populations in New Jersey studied by Buckley and McCaffrey (1978) nested on dredge-spoil, but about two-thirds to four-fifths of the Gull-billed Terns nesting in North Carolina were found on dredged-material islands (Soots and Parnell 1975a, Parnell and Soots 1979 ms, Portnoy et al. 1981). In areas studied along the Texas coast in 1976 and 1977, Chaney et al. (1978) discovered that 70% and 84%, respectively, of the breeding Gull-billed Terns were nesting on dredged-material islands. The degree to which this species uses such habitats may be a reflection of the extent of man-made modification of coastal environments and the amount of remaining natural nesting habitat.

On beaches in North Carolina Gull-billed Terns usually nest in low-lying areas subject to flooding (e.g., flats near inlets); on spoil islands they choose elevated slopes or domes. Nesting areas are sparsely vegetated; in the early 1970's the average cover of vegetation was 14.7% (Soots and Parnell 1975a) and the average plant height was about 12 cm (4.7 in) (Parnell and Soots 1979 ms). Plants frequently associated with nesting sites are seabeach evening-primrose (*Oenothera humifusa*), horseweed (*Conyza canadensis*), seaside goldenrod (*Solidago sempervirens*), camphorweed (*Heterotheca subaxillaris*), sea rocket (*Cakile edentula harperi*), and sand grass (*Triplasis purpurea*) (Soots and Parnell 1975a).

In Texas Gull-billed Terns nest primarily on sparsely vegetated sandy islands with coarse sand, shell, or serpulid reef material. Plants usually associated with nesting areas in Texas are rush grasses (Sporobolus spp.), sandspurs (Cenchrus spp.), finger grass (Eustachys petraea), forbs such as bluet (Houstonia nigricans), seaside evening-primrose (Oenothera drummondii), and marsh elder (Iva angustifolia) (Chaney et al. 1978).

Gull-billed Terns nest in marshes more often in the Old World than they do in North America. Birds in Denmark nest primarily on salt-marsh islets covered with low grass (Moller 1981a); nesting areas in Germany are apparently similar (Gloe 1974 in Moller 1981a). Most populations in the southern U.S.S.R. nest in "salt marshes, floodplains, swamps, lakes, and reeded estuaries..." (Borodulina 1960). Gull-billed Terns in the U.S.S.R. nest mostly on plains, but some also nest at elevations as great as 2 km (1.2 mi) on mountain lakes in Armenia (Dement'ev and Gladkov 1951). At the Banc d'Arguin in Mauritania they nest in sandy habitats (de Naurois 1959) similar to those used in the southeastern United States. Nest sites in Australia are all inland on the mainland (Serventy et al. 1971) and include old nests of Black Swans (Cygnus atratus), exposed dry mud in cane-grass swamps (Hobbs 1975), and bare, earthy, or sandy banks along inland lakes and on the islands within them (Bourke et al. 1973).

Feeding Gull-billed Terns generally feed over land or inland marshes. Cain (1933) characterized one feeding area as "scrub." They have been seen feeding over a brushy field in Florida (Rohwer and Woolfenden 1968) and over a small freshwater pond in South Carolina (Chamberlain 1960b). Gull-billed Terns in the southern U.S.S.R. feed over water and at arid inland localities including hillocks and sandhills (Borodulina 1960). In Australia they feed in both freshwater and in coastal habitats such as seashores, mudflats, lagoons, and estuaries (Serventy et al. 1971).

Feeding areas may be several miles away from nesting sites (Chamberlain 1960b, Rohwer and Woolfenden 1968). In Europe the size of the feeding range decreases from small, northern colonies to large southern ones (Moller 1982). In Denmark, where colonies are small, most birds feed within 20 km (12 mi) of the colony, but some feed as far away as 45 km (28 mi). In a Spanish colony of about a thousand birds, most birds feed within 5 km (3 mi) of the colony, although some feed up to about 10 km (6 mi) away (Moller 1982).

Nonbreeding and Offshore There is virtually no information on the habitat, distribution and feeding ecology of Gull-billed Terns wintering in the southeastern United States. Gull-billed Terns wintering in South America apparently remain along the coast. Wetmore (1965) found birds in Panama on a sandspit on the bay shore. In Colombia birds have been seen resting on a sandbar and feeding over salt marsh (Donahue 1974). Gull-billed Terns in Australia are seldom seen far from shore (Serventy et al. 1971). Those wintering in North Africa prefer lagoons and deltas sheltered from the sea, but they may also be seen on inland lakes and rivers (Bannerman 1962).

FOOD AND FEEDING BEHAVIOR

Cain (1933) compared the hunting behavior of the Gull-billed Tern over land to that of a harrier (Circus), describing it as "skimming over the scrub." Gull-billed Terns hunting mice in Australia drift back with the wind, then dive and seize mice with the bill (Jensen 1946). A tern flying around the edge of a marshy pond in South Carolina occasionally cut across the pond or made a figure "8"; the bird then set its wings and swooped to the surface of the pond to pluck an insect from the surface (Chamberlain 1960b). Reynolds (1977) saw Gull-billed Terns in Kenya dip into the water for small fish from a height of about 4 m (13 ft). Similar behavior has been witnessed in Australia (Serventy et al. 1971) and elsewhere (Lind 1963a). This particular feeding behavior is sometimes termed "aerial-dipping" (Clapp et al. 1982b) and usually refers to birds obtaining food over water. Gull-billed Terns use this method over both land and water and, judging from the literature, obtain a large proportion of their food this way. They may also pick up food from the ground while walking around their colonies (Lind 1963a).

Rohwer and Woolfenden (1968) pointed out that a number of authors (e.g., Bent 1921, Ford 1961) believed that Gull-billed Terns never dive, but also cited Wetmore (1926) and Meinertzhagen (1954) to indicate that these birds do enter the water. Wetmore's remarks are equivocal as he only stated that Gull-billed Terns were "frequently diving for small fishes in the tidal channels" in Buenos Aires. Meinertzhagen stated that the species "dives for food, often completely submerged, and in Arabia only on salt water but never far from land." In any case, observations available to us suggest that this species seldom plunges into the water and obtains most of its food on the wing.

In Denmark most Gull-billed Terns feed solitarily or in groups of two or three; flocks of 4-10 birds make up 15-25% of the observations of Gull-billed Terns seen feeding in the breeding season (Moller 1982). In southern France flocks of 6-8 birds are common (authors cited in Moller 1982), and even larger flocks may be encountered in southern Spain (authors cited in Moller 1982). Gull-billed Terns in Virginia usually feed solitarily and are not seen in groups of more than 2-3 birds. Fourteen of 16 observations of feeding birds in Virginia were of either 1 or 2 birds (Erwin 1978b).

Gull-billed Terns kleptoparasitize their own and other species of birds. Reynolds (1977) observed three terns pursue a Greenshank (Tringa nebularia) and try to force it to drop a fish (Reynolds 1977). Hobbs (1976) observed one Gull-billed Tern force another to drop a house mouse (Mus musculus), which the first tern then caught in flight.

The Gull-billed Tern differs from other coastal terns in that it feeds inshore and inland and prefers to eat insects and small mammals. Diet varies by region and according to the relative abundance of prey. Fish make up a small proportion of the food of this species (Dement'ev and Gladkov 1951, Moller 1977).

Little information is available on the diet of Gull-billed Terns in the southeastern United States. Young terns are known to eat Cnemidophorus lizards (Sprunt and Chamberlain 1949) and an adult was seen seizing grasshoppers and dragonflies from the edge of a small freshwater pond in South Carolina (Chamberlain 1960b). The stomachs of five birds taken in Alabama contained mole crabs (Emerita talpoida), dragonflies (Odonata), and a grasshopper (Orthoptera) (Howell 1932). Gull-billed Terns collected near Gulfport, Florida, had fed on green anoles (Anolis carolinensis) apparently picked from shrubs (Rohwer and Woolfenden 1968). Other foods documented are grasshoppers and fiddler crabs (Uca sp.). Wintering Gull-billed Terns at Lake Charles, Louisiana, have been seen feeding on crayfish (Clement 1946).

In the southern U.S.S.R. Gull-billed Terns feed primarily on insects, lizards, amphibians, crustaceans, and small rodents (Muridae). The primary food in one area was lizards and shrimp, in another frogs, and insects were most important in other areas (Borodulina 1960 and authors cited therein). Insects are the food most frequently eaten in other areas of the Old World such as North Jutland, Denmark, and the Camargue, France (Moller 1977), but vertebrates may form more of the diet by weight. Small mammals are particularly important in North Jutland, Germany (Moller 1977) and Australia (Hobbs 1976). Frogs are the most significant item of diet in the Camargue and lizards predominate in one part of Australia (Hobbs 1976) and are also important in Denmark (Andersen 1945, Moller 1977).

Insects frequently eaten in the Old World include beetles (Coleoptera), grasshoppers and crickets (Orthoptera), and dragonflies (Odonata) (Leveque 1956, Borodulina 1960, Moller 1977). Mammalian prey items from the Old World include short-tailed voles (Microtus agrestis) (Moller 1977), house mice (Mus musculus) (Hobbs 1976, Moller 1977), wood mice (Apodemus [= Sylvaemus] sylvaticus), harvest mice (Micromys minutus), common shrews (Sorex araneus), pygmy shrews (S. minutus), and water shrews (Neomys fodiens) (Moller 1977). Amphibians identified in the diet include frogs (Rana ridibundus), a toad (Bufo calamita), and a newt (Triturus sp.) (Moller 1977). Lizards eaten include Lacerta agilis (Borodulina 1960, Moller 1977), L. vivipara (Moller 1977), Eremias spp. (Borodulina 1960), E. arguta (Schevchenko in Dement'ev and Gladkov 1951) and Phrynocephalus spp. (Spangenberg and Feigin in Borodulina 1960).

Young birds made up 14.5% of the diet in a study at North Jutland and included species as diverse as Lapwings (Vanellus vanellus), Redshanks (Tringa totanus), Avocets (Recurvirostra avosetta), Common and Arctic Terns, Skylarks (Alauda arvensis), Meadow Pipits (Anthus pratensis), and Yellow Wagtails (Motacilla flava). Other species of birds eaten in the Old World include the young of White-winged Larks (Melanocorypha leucoptera) (Zarudnyi in Dement'ev and Gladkov 1951) and Winter Wrens (Troglodytes troglodytes) (Jensen 1946). Eggs of the Redshank and those of either the skylark or pipit were also eaten (Moller 1977).

Other food items reported from the Old World include crustaceans, earthworms, spiders, and maggots (Cain 1933, Andersen 1945, Jensen 1946, de Waard 1950, Borodulina 1960, Rohwer and Woolfenden 1968, Moller 1977).

Papers cited in the terminal biblography for this species, especially Moller's (1977) comprehensive review of food habits in the Palearctic, provide more information on specific foods eaten.

IMPORTANT BIOLOGICAL PARAMETERS

Egg Laying In the eastern United States egg laying occurs from May to early July; peak laying occurs from mid-May through early June. In more southern colonies (e.g., in Texas), laying may begin as early as late April. Nests observed on the Salton Sea in California were well advanced in incubation on 20 May (Pemberton 1927), suggesting that laying is initiated in late April. Nests initiated later than early July on the Atlantic coast are probably the result of loss of a first clutch (Sears 1978).

Laying periods in northern portions of the Old World are similar to those in North America. Gull-billed Terns in Denmark, the northern end of the European breeding range, lay eggs from early May through early July; peak laying occurs from mid-May to early June. Birds in the southern U.S.S.R. lay from mid-May through early July (Borodulina 1960). Birds in the Persian Gulf begin laying as early as the first week of April (Meinertzhagen 1954).

Gull-billed Terns nesting in Australia usually nest in spring and summer (Serventy et al. 1971). In western Australia, eggs were present in September at one colony, but birds at another colony were just beginning to nest in May (Serventy and Whittell 1976). At Ivanhoe, New South Wales, most egg laying had been completed by late December (Bourke et al. 1973).

Moller (1981a) found that breeding birds in Denmark arrived at colonies 5-32 days before egg laying begins; he reported a signficant negative correlation between arrival date and the length of the prelaying period (i.e., the earlier the birds arrived, the longer before they began to lay eggs).

The length of the laying period at a number of colonies in Denmark varies from 25 to 51 days (mean 38.7). Larger colonies lay for significantly longer periods (mean 43.1 days, n = 12) than do smaller ones (mean 28.3 days, n = 16) (Moller 1981a). Moller (1981a) found that egg laying in small colonies begins later than in large ones, but he found no difference in the initiation of egg laying between successful and unsuccessful colonies.

Mean Clutch Size Gull-billed Terns lay 1-4 eggs, but clutches usually contain only 2-3 (Nicholson 1948a; Leveque 1956; Borodulina 1960; Serventy et al. 1971; Moller 1975a, 1981a). In most areas, three eggs is the mean, but elsewhere (e.g., the Persian Gulf [Meinertzhagen 1954], New South Wales [Bourke et al. 1973]) a full clutch contains only two eggs. As many as six (Glegg 1925a, Leveque 1956, Borodulina 1960) or seven eggs (Dement'ev and Gladkov 1951) have been found in one nest, but these clutches were believed to be the result of laying by more than one female.

In North Carolina, Gull-billed Terns that began nesting before 15 May produced larger clutches (mean = 2.5, n = 16) than those birds that laid eggs later (mean = 1.7, n = 25) (Sears 1978). In Denmark, however, clutches laid during the middle third of the laying period were significantly larger (mean = 2.53, n = 183) than those laid during the first (mean = 2.15, n = 107) and latter (mean = 2.17, n = 47) thirds, respectively (Moller 1975a, 1981a).

Clutch size appears to decrease from north to south (Table 39).

Incubation Period The incubation period for Old World Gull-billed Terns has been reported as 22-23 days (Dircksen in Witherby et al. 1941, Taning 1944, Geroudet in Leveque 1956). These data are based on little information.

Hatching Success There are few figures available on the proportion of Gull-billed Tern eggs that hatch. Chaney et al. (1978) reported a 27.9% hatching success for 20 nests in Texas. Clutches from large colonies in Denmark that hatched at least one young had a 96.6% hatching success; if unsuccessful clutches are included, the figure is 90.3% (Moller 1981a).

Age at Fledging According to Taning (1941), young Gull-billed Terns fledge 30 days after hatching. Other authors (e.g., Dement'ev and Gladkov 1951) recorded a fledging period of 28-35 days, but this may trace back to an indefinite statement that "Young can fly a little after 4 weeks and well after 5" (Heinroth in Witherby et al. 1941).

Fledging Success Few data are available on fledging success of Gull-billed Terns. Moller (1981a) reported that the overall reproductive success (average number fledged divided by average clutch size) in Denmark was 69.1% for large colonies. Moller (1981b) also reported a higher recovery rate for young banded in Danish colonies with 51-100 pairs than for smaller or larger colonies and equated the higher recovery rate with greater production of young. Colonies examined by Blus and Stafford (1980) in South Carolina were believed to produce few young; out of 28 colonies for which these authors estimated the number of young produced per nest, only 4 produced 0.51-1.00 chicks. Most colonies (13) produced 0.5 young per nest or less, and many (11) produced no young at all.

Mortality of Eggs and Young Laughing Gulls and Herring Gulls prey on eggs and chicks of Gull-billed Terns (de Waard 1950; Sears 1978, 1979). Sears (1978) thought that humans and dogs are predators or sources of disturbance, and noted that straying young may be attacked by adults of their own or other species of terns. Sears (1979) emphasized the role of colonial nesting in the deterrence of predators.

Predation by gulls, disturbance by man, and loss of nests to inclement weather are the primary sources of nesting mortality in the southeastern United States. High tides, heavy rain, and storms have caused total (or nearly total) failure at colonies in New Jersey (Savell 1972), North Carolina (Teulings 1974d), and Florida (Ogden 1976, 1977). Flooding caused by heavy rains and high tides

Table 39. Mean clutch sizes reported for the Gull-billed Tern (a).

Mean clutch size	Number of clutches	Locality	Latitude of area	Source
2.39	152	Denmark, Northern Jutland	57°	Moller 1975a
2.29	186	Denmark, Western Jutland	57°	Moller 1975a
2.00 (b)	--	Denmark	57°	Moller 1981a
2.36 (b)	--	Denmark	57°	Moller 1981a
2.99 (c)	303	Camargue, France	43°	Leveque 1956
2.06	610	Andalusia, Spain	38°	Studier-Thiersch and Studier-Thiersch 1968
2.0	41	North Carolina	35°	Sears 1978
2.3 (d)	46	South Carolina	33°	Blus and Stafford 1980
1.77	30	Texas, Laguna Madre	27°	Chaney et al. 1978

a) Mean clutch sizes given here are sometimes calculated from data given in the sources cited. Some of these figures are evidently counts of contents of nests that do not take into account whether the eggs were all laid by one bird or whether laying had been completed; as a result these figures may not adequately represent clutch size.

b) The first set of figures is for 16 small colonies (2-15 pairs); the second set is for 12 large colonies.

c) If nests containing five or six eggs (probably representing multiple clutches) are excluded, the mean is 2.89 (n = 290).

d) This figure is imprecise because it is based on a count of nests containing both eggs and young.

caused considerable loss of eggs in South Carolina colonies (Blus and Stafford 1980). Parnell and Soots (1979 ms) suggested that the principal causes of nesting failure in North Carolina were the flooding of low-lying colonies and disturbance by people and vehicles. Predators were a significant source of nest failure in South Carolina, where eggs were taken both by Laughing Gulls and by rats (Rattus sp.) (Blus and Stafford 1980); Blus and Stafford believed that no young were produced at Devaux Bank from 1972 to 1975 because of predation by Laughing Gulls. Rats are also predators in North Carolina (Sears 1978).

Mortality from flooding is common in Old World colonies and is thought to be the cause of a decline in populations nesting on the Chernomorskii Reserve in the southern U.S.S.R (Borodulina 1960). Moller (1978b) stated that desertion of Danish colonies was caused most commonly by disturbance by humans, rats (Rattus norvegicus) and foxes (Vulpes vulpes).

Renesting Several papers (e.g., Spangenberg in Dement'ev and Gladkov 1951, Parnell and Soots 1979 ms) indicated that Gull-billed Terns may renest after the loss of a first nest. However, the degree and extent to which this occurs is not well known. Lind (1963a) reported that one repeat clutch was initiated 8-10 days after the first clutch was disturbed. Colonies that suffer heavy losses from tides or storms sometimes relocate and renest (Sears 1978).

Age at First Breeding Gull-billed Terns in Denmark first breed at an age of four or five years (Moller 1975a).

Maximum Natural Longevity Rydzewski (1978) reported that a bird banded as a chick was recovered at the age of 15 years and 10 months. A bird banded as a chick in South Carolina and recovered in Guyana was at least 6 years and 4 months old (Clapp et al. 1982a).

Weight We found little information on the weights of Gull-billed Terns (Table 40). The average weight of adults in North America is about 170 g (6 oz) (Table 40); Old World birds weigh about 210 g (7.4 oz) (Borodulina 1960).

SUSCEPTIBILITY TO OIL POLLUTION

We found little information to suggest that Gull-billed Terns are frequently affected by oiling. One bird seen at Lake Charles, Louisiana, in mid-January had oil-soaked plumage (Clement 1946). Because of their aerial feeding habits and tendency to feed inland, Gull-billed Terns probably will not suffer much from the direct effects of oil in the southeastern United States.

The majority of North American Gull-billed Terns breed in the southeastern United States. Because the species nests in areas highly susceptible to environmental perturbations and because it may be easily affected by human disturbance, development of coastal areas may seriously affect the well-being of this little-studied species.

BIBLIOGRAPHY

1982

Gloe, P. 1982. Zur Jugendentwicklung, Ethologie und Okologie der Lachseeschwalber (*Gelochelidon nilotica*). Ornithol. Mitt. 34: 29-40. [In German.]

Moller, A. P. 1982. Coloniality and colony structure in Gull-billed Terns *Gelochelidon nilotica*. J. Ornithol. 123: 41-53. [In German.]

1981

Gloe, P. 1981a. Lachseeschwalben (*Gelochelidon nilotica*) im Flug. Ornithol. Mitt. 33: 109. [In German.]

Table 40. Weight (in grams) of Gull-billed Terns (a).

Mean weight	Range	Number weighed	Sample and season	Area	Source
176	166-187	3	males, Mar.-May	Mexico	LSU coll.
166	---	1	male, Mar.	British Honduras	Russell 1964
183	---	1	male, Oct. (b)	Honduras	LSU coll.
150	---	1	male	Florida	Hartman 1955
205	130-261	29	males	southern U.S.S.R.	Borodulina 1960
210	---	1	males	U.S.S.R.	Dement'ev and Gladkov 1951
187	168-205	2	females, Mar.-Apr.	Mexico	LSU coll.
169	161-177	4	females, Mar.	British Honduras	Russell 1964
213	172-260	--	females	southern U.S.S.R.	Borodulina 1960
166	150-190	11	adult males and females, Jun.-Aug.	Texas	Zusi 1962; Zusi, pers. comm.
213	195-233	8	fledglings (Aug.)	southern U.S.S.R.	Borodulina 1960
24	---	--	recently hatched young	southern U.S.S.R.	Borodulina 1960
29.3	27.5-32.3	21	fresh or slightly incubated eggs	U.S.S.R.	Dement'ev and Gladkov 1951

(a) Weights above 100 g are rounded to the nearest gram. Weights of birds from the Old World are those of the nominate race, *Sterna n. nilotica*. Those birds from the New World are probably largely the eastern *S. n. aranea*, but those from Mexico might be the western *S. n. vanrossemi*. Birds from British Honduras were identified as *aranea* by Russell and were considered rather fat.

(b) This is probably the bird identified by Monroe (1968) as *G. n. aranea*.

Gloe, P. 1981b. Zur feldornithologischen Unterscheidung von Lachseeschwalbe (Gelochelidon nilotica) und Brandseeschwalbe (Sterna sandvicensis). Ornithol. Mitt. 33: 322-324. [In German.]

Moller, A. P. 1981a. Breeding cycle of the Gull-billed Tern Gelochelidon nilotica Gmel., especially in relation to colony size. Ardea 69: 193-198.

_____. 1981b. En analyse af ringmaerknings- og genmeldingsoplysinger for Sandterne Gelochelidon nilotica (Gmel.). [An analysis of ringing and recovery information for the Gull-billed Tern Gelochelidon nilotica (Gmel.).] Dan. Ornithol. Foren. Tidsskr. 75: 127-130. [In Danish with English summary.]

Sears, H. B. 1981. The display behavior of the Gull-billed Tern. J. Field Ornithol. 52: 191-209.

1980

Blus, L. J. and C. J. Stafford. 1980. Breeding biology and relation of pollutants to Black Skimmers and Gull-billed Terns in South Carolina. U.S. Fish Wildl. Serv. Spec. Sci. Rep. Wildl. 230. 18 pp.

Gloe, P. 1980. Zur Variabilitat des Dunenkleides der Lachseeschwalbe (Gelochelidon nilotica). Ornithol. Mitt. 32: 227-228. [In German.]

Moller, A. P. 1980. Flokstorrelse hos Sandternen Gelochelidon nilotica. [Flock size in the Gull-billed Tern Gelochelidon nilotica.] Dan. Ornithol. Foren. Tidsskr. 74: 152-153. [In Danish with English summary.]

1979

Gloe, P. 1979. Vegetabile Nahrungsreste bei Lachseeschwalben (Gelochelidon nilotica Gmel.). Vogelwelt 100: 107-111.

Sears, H. F. 1979. Colonial nesting as an anti-predator adaptation in the Gull-billed Tern. Auk 96: 202-203.

1978

Davis, A. H. and K. E. Vinicombe. 1978. Field identification of Gull-billed Terns. Brit. Birds 71: 466-468.

Erwin, R. M. 1978b. Coloniality in terns: the role of social feeding. Condor 80: 211-215.

Gloe, P. 1978a. Uber das Nest der Lachseeschwalbe (Gelochelidon n. nilotica). [Regarding the nest of the Gull-billed Tern (Gelochelidon n. nilotica).] Ornithol. Mitt. 30: 91-95. [In German.]

Gloe, P. 1978b. Aggressionen auslosende Situationen an Brutplatzen der Lachseeschwalbe (Gelochelidon n. nilotica). Ornithol. Mitt. 30: 107-115. [In German.]

_____. 1978c. Beschadigte Grossbeute von Lachseeschwalben-Familien (Gelochelidon nilotica Gmel.). Corax 6: 44-46.

Gloe, P. and A. P. Moller. 1978. Der Zug nordeuropaischer Lachseeschwalben (Gelochelidon n. nilotica) in Nord-, Nordwest- und Mitteleuropa. [The migration of north European Gull-billed Terns (Gelochelidon n. nilotica) in North, Northwest and Middle Europe.] Ornithol. Mitt. 30: 185-202. [In German with English summary.]

Grant, G. S. 1978. Foot-wetting and belly-soaking by incubating Gull-billed Terns and Black Skimmers. J. Bombay Nat. Hist. Soc. 75: 148-152.

Grant, P. J. 1978. Upperwing pattern of adult Gull-billed and Sandwich Terns. Brit. Birds 71: 468-469.

King, K. A., E. L. Flickinger and H. H. Hildebrand. 1978. Shell-thinning and pesticide residues in Texas aquatic bird eggs, 1970. Pestic. Monit. J. 12: 16-21.

Moller, A. P. 1978a. Sandternens Gelochelidon nilotica adfaerd over for Rovfugle. [Aggressive behaviour of Gull-billed Terns Gelochelidon nilotica towards Kestrels Falco tinnunculus.] Dan. Ornithol. Foren. Tidsskr. 72: 60. [In Danish with English summary.]

_____. 1978b. Skiftende koloniplaceringer hos danske Sandterner Gelochelidon n. nilotica Gmel. [Deserting flights in the Gull-billed Tern Gelochelidon n. nilotica Gmel., with special reference to the Danish population.] Dan. Ornithol. Foren. Tidsskr. 72: 119-126. [In Danish with English summary.]

_____. 1978c. Sandternens Gelochelidon n. nilotica Gmel. fourageringsomrader i yngletiden. [Feeding areas of the Gull-billed Tern Gelochelidon n. nilotica Gmel. during the breeding season.] Dan. Ornithol. Foren. Tidsskr. 72: 145-147. [In Danish with English summary.]

Sears, H. F. 1978. Nesting behavior of the Gull-billed Tern. Bird-Banding 49: 1-16.

Spaans, A. L. 1978. Status of terns along the Surinam coast. Bird-Banding 49: 66-76.

Therres, G. D., J. S. Weske and M. A. Byrd. 1978. Breeding status of Royal Tern, Gull-billed Tern, and Black Skimmer in Maryland. Md. Birdlife 34: 75-77.

Vargas, J. M., A. Antunez and M. Blasco. 1978. Comportamiento reproductive y alimentario de la Pagaza piconegra (Gelochelidon nilotica L.) en la Laguna de Fuente Piedra de Malaga. Ardeola 24: 227-231.

1977

Gloe, P. 1977a. Schlafplatz der Lachseeschwalbe, Gelochelidon nilotica nilotica (Gmel.) an der Westkuste Schleswig-Holsteins. Ornithol. Mitt. 29: 107-112. [In German.]

_____. 1977b. Vom Brutplatz abwandernde Lachseeschalben-Familien (Gelochelidon nilotica) vor Einsetzen des Wegzuges. Ornithol. Mitt. 29: 231-237. [In German.]

Johnstone, R. E. 1977. An Asian Gull-billed Tern in Western Australia. West. Austr. Nat. 14: 26.

Moller, A. P. 1977. Sandternens Gelochelidon n. nilotica Gmel. fode i yngletiden i Nordjylland og Camargue, Frankrig, med en oversigt over fodeeminer i andre dele af artens udbredelsesomrade. [Food composition of the Gull-billed Tern Gelochelidon n. nilotica Gmel. during breeding in North Jutland, Denmark, and Camargue, France, with a review of food items in other areas.] Dan. Ornithol. Foren. Tidsskr 71: 103-111. [In Danish with English summary.]

Reynolds, J. F. 1977. Attempted food-piracy by Gull-billed Terns. Brit. Birds 70: 392-393.

Schlenker, R. 1977. Zug der Lachseeschwalbe (Gelochelidon nilotica) in der Deutschen Bucht. Ornithol. Mitt. 29: 51.

1976

Gloe, P. 1976. Nahrung und Zug der Lachseeschwalbe (Gelochelidon n. nilotica) im Wattenmeer. Ornithol. Mitt. 28: 117-123. [In German.]

Hobbs, J. N. 1976. Birds feeding on house mice. Emu 76: 219-220.

Sears, H. F. 1976. Breeding behavior of the Gull-billed Tern. Ph.D. thesis, Univ. North Carolina/Chapel Hill, NC.

1975

Beretzk, P. and A. Keve. 1975. Die Lachseeschwalbe, Gelochelidon nilotica (Gm. 1789), in Ungarn. Beitr. Vogelkd. 21: 245-250.

Buckley, P. A., F. G. Buckley and M. Gochfeld. 1975. Gull-billed Tern: New York State's newest breeding species. Kingbird 25: 178-183.

Hobbs, J. N. 1975. Nests of the Gull-billed Tern. Austr. Bird Watcher 6: 117.

Moller, A. P. 1975a. Sandternens Gelochelidon n. nilotica Gm. ynglebiologi i Danmark. [The breeding biology of the Gull-billed Tern Gelochelidon n. nilotica Gm. in Denmark.] Dan. Ornithol. Foren. Tidsskr. 69: 9-18. [In Danish with English summary.]

_____. 1975b. Europaeiske Sandternens (Gelochelidon nilotica nilotica) traek belyst ved hjaelp af ringmaerking. [Migration of European Gull-billed Terns (Gelochelidon nilotica nilotica) according to recoveries.] Dan. Fugle 27: 61-77. [In Danish with English summary.]

_____. 1975c. Sandternens Gelochelidon n. nilotica Gmel. bestandsaendringer i Danmark og analyse af nogle bestandsregulerende faktorer. [Population changes of the Gull-billed Tern Gelochelidon n. nilotica Gmel. in Denmark, including an analysis of some population regulating factors.] Dan. Ornithol. Foren. Tidsskr. 69: 81-88. [In Danish with English summary.]

_____. 1975d. Ynglebstanden af Sandterne Gelochelidon nilotica nilotica Gmel. i 1972 i Europa, Afrika og det vestlige Asien med en oversigt over bestandsaendringer i dette arhundrede. [The breeding population of Gull-billed Terns Gelochelidon nilotica nilotica Gmel. in 1972 in Europe, Africa and Western Asia, with a review of fluctuations during the present century.] Dan. Ornithol. Foren. Tidsskr. 69: 1-8. [In Danish with English summary.]

_____. 1975e. Sandternen (Gelochelidon nilotica nilotica) som ynglefugl i Danmark. En oversight over de enkelte kolonier. [The Gull-billed Tern (Gelochelidon nilotica nilotica) as a breeding bird in Denmark. A survey of the colonies.] Dan. Fugle 27: 33-43. [In Danish with English summary.]

1974

Donahue, P. K. 1974. Gull-billed Tern in Caribbean South America. Auk 91: 845.

Filonov, K. P., V. I. Lysenko and V. D. Siokhin. 1974. [Peculiarities of Limicolae and Lari nesting on islands of Molochny Estuary (the Sea of Azov).] Vestn. Zool. 1974: 52-58. [In Russian with English summary.]

Gloe, P. 1974. Die Lachseeschwalbe (Gelochelidon nilotica) im Dithmarschen. Ornithol. Mitt. 26: 47-51. [In German.]

Lindner, H. 1974. Gelochelidon nilotica (Gm.) and Larus melanocephalus Temm. bei der Insel Libitz/Rugen (NSG). Beitr. Vogelkd. 20: 347.

1973

Bourke, P. A., V. T. Lowe and T. G. Lowe. 1973. Notes on the Gull-billed Tern. Austr. Bird Watcher 5: 69.

Fien, I. 1973. Feeding behavior of Gull-billed Terns. Sunbird 4: 57.

Latour, M. 1973. Nidification de cinq especes de larids au voisinage de l'embouchure du fleuve Senegal. Oiseau Rev. Fr. Ornithol. 43: 89-96. [In French.]

Petrovic, C. A. and J. King, Jr. 1973. Bird records from the Dry Tortugas. Fla. Field Nat. 1: 5-8.

1972

Anon. 1972. The Gull-billed Tern--a new species (In ACT). Canberra Bird Notes 2: 10.

Panin, V. Ya. and D. Zhartkanbaeva. 1972. [Dicrocoelium bykhowskajae sp. n.--a new species of dicrocoelid from Gelochelidon nilotica.] Izv. Akad. Nauk Kaz. SSR Ser. Biol. 1972: 46-47. [In Russian with Kazakh summary.]

Savell, W. E. 1972. Gull-billed Terns in New Jersey. Cassinia 53: 47-48.

1971

Rettig, K. 1971. Lachseeschwalben (Gelochelidon nilotica) bei Emben durchziehend. Vogelkd. Ber. Neiders. 3: 26. [In German.]

Schulter, G. C. M. 1971. Gull-billed Tern, Gelochelidon nilotica. Ostrich 42: 138.

1970

Tait, C. S. 1970. Gull-billed Terns in Stirlingshire. Scott. Birds 6: 45-46.

Wiatr, B. 1970. Obserwacje rybitwy krotkodziobej, Gelochelidon nilotica (Gm.) nad jez Bukowo. [New records of the Gull-billed Tern, Gelochelidon nilotica (Gm.) in Poland.] Acta Ornithol. 12: 46-47. [In Polish with English summary.]

1969

Axelsson, H. 1969. Sandtarna Gelochelidon nilotica och tall-sparv Emberiza leucocephala i Varmland 1967. Var Fagelvarld 28: 46. [In Swedish.]

Bates, A. K. and M. L. Bierly. 1969. White-rumped Sandpipers, Northern Phalaropes, Ruddy Turnstones, Gull-billed Terns, and Stilt Sandpipers at Marion Fish Hatchery. Ala. Birdlife 17: 52-54.

Campbell, N. A. 1969. Gull-billed Tern (?) at Lake MacIlwaine. Honeyguide 59: 30.

MacDonald, A. 1969. Gull-billed Tern in East Lothian. Scott. Birds 5: 284-285.

Manfeldt, E. 1969. Lachseeschwalben-Beobachtungen im ostlichen Schleswig-Holstein. Corax 3: 40-41. [In German.]

Manson, A. J. and C. Manson. 1969. Gull-billed Tern--a further sighting. Honeyguide 59: 31.

1968

Armistead, H. T. 1968. Gull-billed Terns at Blackwater. Md. Birdlife 24: 94-95.

Rohwer, S. A. and G. E. Woolfenden. 1968. The varied diet of the Gull-billed Tern includes a shrub-inhabiting lizard. Wilson Bull. 80: 330-331.

Schoennagel, E. 1968. Schmarotzerraubmowen (Stercorarius parasiticus) belastigen Lachseeschwalben (Gelochelidon nilotica). Ornithol. Mitt. 20: 44-45. [In German.]

Studer-Tiersch, A. and P. Studer-Tiersch. 1968. Sobres aves aquaticus en una laguna del interior de Andalucia (observaciones de marzo a junio de 1967). Ardeola 14: 166-174.

van Vegten, J. A. 1968. Gull-billed Tern on Sao Miguel, Azores. Ardea 56: 196.

1967

Smout, T. C. 1967. Gull-billed Tern in West Lothian. Scott. Birds 4: 448.

1966

Nebelsiek, U. 1966. Das Schicksal der Flussseeschwalbe (Sterna hirundo) und der Lachseeschwalbe (Gelochelidon nilotica) als Brutvogel Bayerns. Anz. Ornithol. Ges. Bayern 7: 823-846. [In German with English summary.]

Schlenker, R. 1966. Uber das Vorkommen der Lachseeschwalbe (Gelochelidon nilotica Gmel.) an der Westkuste Schleswig-Holsteins. Corax 1: 209-216. [In German.]

1965

Allen, C. R. K. 1965. A sight record of Gull-billed Terns in Nova Scotia. Can. Field-Nat. 79: 211-212.

1963

Ahmad, N.-u.-D. 1963. Addition to the recorded avifauna of Lahore. Pak. J. Sci. 15: 143-144.

Lind, H. 1963a. The reproductive behaviour of the Gull-billed Tern, Sterna nilotica Gmelin. Vidensk. Medd. Dan. Naturhist. Foren. 125: 407-448.

_____. 1963b. Nogle sociale reaktioner has terner. [Notes on social behaviour in terns.] Dan. Ornithol. Foren. Tidsskr. 57: 155-175. [In Danish with English summary.]

Witkowski, J. 1963. Wystempowanie rybitwy krotkodziobej, Gelochelidon nilotica (Gm.) w Polsce. [Occurrence of Gull-billed Tern, Gelochelidon nilotica (Gm.) in Poland.] Notatki Ornitol. 4: 5. [In Polish with English summary.]

1962

Bannerman, D. A. 1962. The birds of the British Isles. Vol. XI. Oliver and Boyd, London. 368 pp.

Forssell, S. G. 1962. Sandtarnor (Gelochelidon nilotica) iakttagna nara Goteborg. [Gull-billed Terns (Gelochelidon nilotica) observed near Gothenburg.] Var Fagelvarld 21: 307-308. [In Swedish with English summary.]

Temme, M. 1962. Beitrag zur Irnahrung der Lachseeschwalbe (Gelochelidon nilotica). Vogelwelt 83: 154-155. [In German.]

1961

Ford, J. 1961. Additional records of the Gull-billed Tern in Western Australia. West. Austr. Nat. 7: 208.

Konig, D. 1961. Lachseeschwalbe (Gelochelidon nilotica) 1960 Brutvogel in Schleswig-Holstein. Vogelwelt 82: 1-6. [In German.]

Zimmerman, H. 1961. Lachseeschwalben und Sabelschnabler auf der "Grunen Insel"/Schleswig-Holstein. Ornithol. Mitt. 13: 21-25. [In German.]

1960

Chamberlain, B. R. 1960b. Gull-billed Tern telefeeding. Chat 24: 98-99.

Hallman, R. C. 1960. Gull-billed Tern (Gelochelidon nilotica) nesting in Gulf County, Florida. Fla. Nat. 33: 224.

Smout, T. C. 1960. Gull-billed Tern in East Lothian. Scott. Birds 1: 335-336.

1959

de Naurois, R. 1959. Premieres recherches sur l'avifaune des iles du Banc d'Arguin (Mauritanie). Alauda 27: 241-308. [In French.]

1958

Abdulali, H. 1958. The identity of the Gullbilled Terns [Gelochelidon nilotica (Gmelin)] in India. J. Bombay Nat. Hist. Soc. 55: 169-170.

Marchant, S. 1958. The birds of the Santa Elena Peninsula, S.W. Ecuador. Ibis 100: 349-387.

1957

Jakab, A. 1957. A kacagoeser feszkelese es a locser eloforduIasa Fonyodon. [Appearance of the Gull-billed Tern and Caspian Tern at Fonyod (Lake Balaton).] Aquila 63/64: 284, 342. [In Hungarian and English.]

1956

Edfelt, A. 1956. Sandtarna (Gelochelidon nilotica) observad vid Skalderviken. [Gull-billed Tern (Gelochelidon nilotica) observed in Skalderviken.] Var Fagelvarld 15: 284, 287.

Konig, D. 1956. Beobachtungen an der Lachseeschwalbe, Gelochelidon nilotica (Gmel.), nach der Brutzeit. Ornithol. Mitt. 8: 143-147. [In German.]

Kumerloeve, H. 1956. Zum Vorkommen der Lachseeschwalbe in Deutschland und am Neusiedlersee. Falke 3: 49-51.

Leveque, R. 1956. Une colonie de Sternes hansel en Camargue. Nos Oiseaux 23: 233-246. [In French.]

Markgren, M. 1956. Iakttagelser av tarnor, bl. a. sandtarnan (Gelochelidon nilotica), vid Sjolunda utanfor Malmo. Var Fagelvarld 15: 126-127.

1955

Axell, H. E. 1955. Gull-billed Tern in Kent. Brit. Birds 48: 511-512.

Ferguson-Lees, I. J. 1955. Gull-billed Tern in Sussex. Brit. Birds 48: 512.

Harber, D. D. 1955. Gull-billed Terns in Sussex. Brit. Birds 48: 511.

McKenzie, H. R. 1955. A new bird for New Zealand. Gull-billed Tern (Gelochelidon nilotica) near Invercargill. Notornis 6: 163-164.

1954

Meinertzhagen, R. 1954. The birds of Arabia. Oliver and Boyd, London. xiii and 624 pp.

1952

Brown, C. F., J. Sheppard, D. D. Harber and A. R. Mead-Briggs. 1952. Gull-billed Terns in Sussex. Brit. Birds 45: 262-263.

de Waard, S. 1952. On the Gull-billed Terns at "De Beer" near Hook-of-Holland in 1949. Brit. Birds 45: 339-341.

Ferguson-Lees, I. J. 1952. Studies of some species rarely photographed. XLIV. The Gull-billed Tern. Brit. Birds 45: 357-358.

Harber, D. D. 1952. Gull-billed Terns in Sussex. Brit. Birds 45: 371-372.

Pyman, G. A. and C. B. Wainwright. 1952. The breeding of the Gull-billed Tern in Essex. Brit. Birds 45: 337-339.

1950

de Waard, S. 1950. Drie broedparen van de Lachstern, *Gelochelidon nilotica* (Gm.), op "De Beer", Rozenburg, in 1949. Ardea 37: 161-167. [In Dutch with English summary.]

Remmert, H. 1950. Lachseeschwalbe - *Gelochelidon n. nilotica* (Gm)- bei Bredstedt (Schleswig-Holstein). Ornithol. Mitt. 2: 151.

1949

Kooijmans, F. P. J. 1949. Niewe broedgevallen van de Lachstern, *Gelochelidon nilotica* (Gm.) in Nederland. [New breeding cases of *Gelochelidon nilotica* (Gm.) in the Netherlands.] Limosa 22: 342-346. [In Dutch with English summary.]

1948

Nicholson, D. J. 1948a. Fresh-water nesting of the Gull-billed Tern in Florida. Auk 65: 139-140.

Sprunt, A., Jr. 1948c. A correction of first fresh-water nesting of Gull-billed Tern in Florida. Auk 65: 311-312.

1946

Clement, R. C. 1946. Some Louisiana observations. Auk 63: 97-99.

Jensen, P. V. 1946. Nogle Iagttagelser over Sandternens (*Gelochelidon nilotica* (Gm.)) biologi. [Observations on the biology of the Gull-billed Tern, *Gelochelidon nilotica* (Gm.).] Dan. Ornithol. Foren. Tidsskr. 40: 80-96. [In Danish with English summary.]

1945

Andersen, J. 1945. Sandternens (Gelochelidon nilotica (Gm.)) fode. [Food of the Gull-billed Tern (Gelochelidon nilotica (Gm.)).] Dan. Ornithol. Foren. Tidsskr. 39: 198-205. [In Danish with English summary.]

Haverschmidt, F. 1945. Een nieuw broedgeval van de Lachstern, Gelochelidon n. nilotica (Gm.) in Nederland. Ardea 33: 117-125. [In Dutch.]

1944

Taning, A. V. 1944. Ynglefuglenes traek til og fra Tipperne. Dan. Ornithol. Foren. Tidsskr. 38: 168-217.

1941

Longstreet, R. J. 1941. Gull-billed Tern nesting in Florida. Auk 58: 96.

1940

Sprunt, A., Jr. 1940. Gull-billed Tern breeding in Florida. Auk 57: 251-252.

1939

Griscom, L. 1939. Gull-billed Tern in Massachusetts. Auk 56: 186.

1938

Craighill, F. H. 1938. Gull-billed Terns breeding on Pea Island. Chat 2: 43-46.

1937

Emeis, W. 1937. Die Lachseeschwalbe (Gelochelidon nilotica (Gm.)) Brutvogel auf der Nordseeinsel Amrum. Ornithol. Monatsber. 45: 170. [In German.]

Schumann, H. 1937. Beobachtungen am letzten deutschen Brutpaar der Lachseeschwalbe. Ornithol. Monatsschr. 62: 184-186. [In German.]

1936

Lincoln, F. C. 1936. Trans-Atlantic flight of Gull-billed Tern. Auk 53: 331.

1934

van der Meer, G. 1934. Nogmaals Sterna Gelochelidon Kl. Waarnemingen van de lachstern in Nederland, III. Org. Club Ned. Vogelkd. 6: 103-106.

1933

Cain, W. 1933. Nesting of the Gull-billed Tern (Gelochelidon nilotica). S. Austr. Ornithol. 12: 28-30.

Weston, F. M. 1933. Gull-billed Tern nesting at Pensacola, Florida. Auk 50: 215-216.

Wust, W. 1933. Ein Brutversuch der Lachseeschwalbe bei Munchen. Ornithol. Monatsber. 41: 147-150.

1932

Dircksen, R. 1932. Die Lachseeschwalbe, 1931 Brutvogel auf Norderoog. Ornithol. Monatsber. 40: 133-136. [In German.]

Emeis, W. 1932. Herbstdurchzug der Lachseeschwalbe (Gelochelidon nilotica (Gm.)) im westlichen Schleswig. Vogelzug 3: 92-94. [In German.]

1931

Strijbos, J. P. 1931. De lachstern, Sterna Gelochelidon Kl., broedvogel in Nederland. Org. Club Ned. Vogelkd. 4: 26-27.

Thijsse, J. P. 1931a. Alweer een nieuwe broedvogel (Gelochelidon n. nilotica). Levende Nat. 36: 97-98.

_____. 1931b. Onze nieuwe gasten [Sterna (Lachstern)]. Levende Nat. 36: 209-211.

van der Meer, G. 1931. Waarnemingen van de Lachstern Sterna Gelochelidon Kl., II. Org. Club Ned. Vogelkd. 3: 136-144.

1930

van der Meer, G. 1930. Waarnemingen van de Lachstern, Sterna Gelochelidon Kl., in Nederland, I. Org. Club Ned. Vogelkd. 3: 70-82.

1929

Bancroft, G. 1929. A new Pacific race of Gull-billed Tern. Trans. San Diego Soc. Nat. Hist. 5: 283-286.

1928

Ball, W. H. 1928. The Gull-billed Tern (Gelochelidon nilotica) in Washington, D.C. Auk 45: 367.

1927

Pemberton, J. R. 1927. The American Gull-billed Tern breeding in California. Condor 29: 253-258.

Ten Kate, C. G. B. 1927. *Gelochelidon nilotica nilotica* (Gm.) bij Kampen. Ardea 16: 138-139.

1926

de Vries, T. G. 1926. *Gelochelidon nilotica* (Gm.) bij Amsterdam. Ardea 15: 1. [In Dutch.]

Ericksen, W. J. 1926. Gull-billed Terns breeding on the coast of Georgia. Auk 43: 533-534.

Wetmore, A. 1926. Observations on the birds of Argentina, Paraguay, Uruguay, and Chile. U.S. Natl. Mus. Bull. 133. iv and 448 pp.

1925

Blanchet, A. 1925. Sur le regime alimentaire du *Gelochelidon n. nilotica* (Gm.). [On the food of *Gelochelidon n. nilotica* Gm.] Rev. Fr. Ornithol. 17: 298-299.

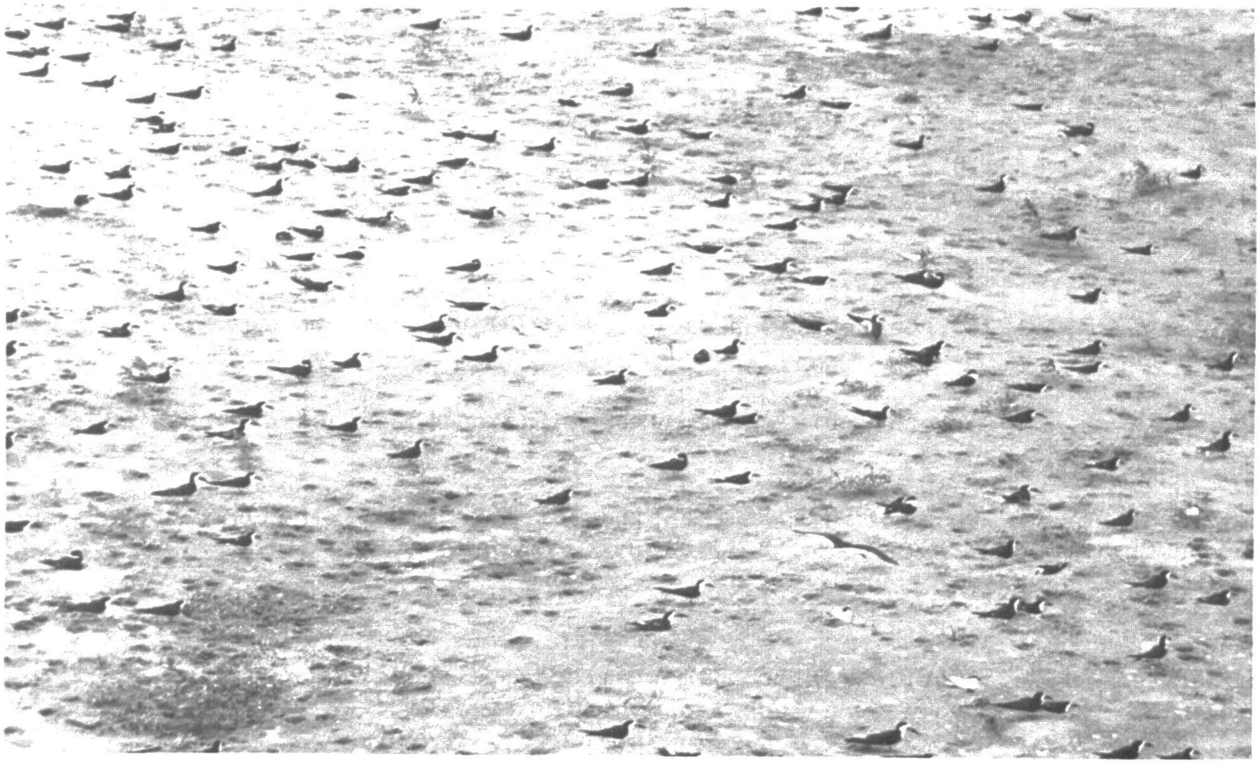
Glegg, W. E. 1925a. On the nesting of the Gull-billed Tern in the Camargue. Brit. Birds 18: 202-209.

_____. 1925b. Further notes on the nesting of the Flamingo and Gull-billed Tern in the Camargue. Brit. Birds 19: 145-148.

1917

Waite, H. W. 1917. The breeding of the Gull-billed Tern (*Sterna anglica*). J. Bombay Soc. Nat. Hist. 25: 300-301.

Adult Gull-billed Tern in breeding plumage. Photograph by Clayton Taylor.



Gull-billed Terns nesting in a Black Skimmer colony. Photograph by J. A. Spendelow.

Adult Caspian Tern in breeding plumage. Photograph by Clayton Taylor.

CASPIAN TERN

(*Sterna caspia*)

[DA: Rovterne, DU: Reuzenstern, FI: Rayska, FR: Sterne caspienne, GE: Raubseeschwalbe, IC: Randerna, IT: Rondine di mare maggiore, NW: Rovterne, PO: Rybitwa wielkodzioba, SP: Charran caspica, Pagaza piquirroja; SW: Skrantarna]

GENERAL DISTRIBUTION

North America In Canada Caspian Terns breed mainly in 4 areas in the interior. One area is in the vicinity of Great Slave Lake in southern Mackenzie and Lake Athabasca in northeastern Alberta; a second extends from Dore Lake in central Saskatchewan to Lake Winnipeg and Lake Winnipegosis in southern Manitoba; the third is around the Great Lakes and upper St. Lawrence River in southern Ontario; and the fourth is in southeastern Quebec. These terns may breed locally in Newfoundland (Godfrey 1966).

In the western United States this species breeds locally, mostly in the interior. These birds breed in Washington, Oregon, Nevada, Utah, and Wyoming, and south to the Salton Sea and coastal California (AOU 1957).

In the eastern United States Caspian Terns mainly breed in three disjunct areas. One area is on the Great Lakes in northeastern Wisconsin, Michigan, and northwestern Pennsylvania (AOU 1957); the second extends in patches along the southeastern Atlantic coast from Virginia (AOU 1957, Weske et al. 1977) to northern Brevard County, Florida (Schreiber 1978); and the third is along the Gulf coast, primarily in southeastern Louisiana and coastal Texas (AOU 1957). During the last two decades, scattered nesting has occurred occasionally on the central Gulf coast of Florida (Schreiber 1978), and isolated instances of nesting have also been recorded at lakes in north-central Minnesota (Warner and Beimborn 1969) and central North Dakota (Herman et al. 1978). The only other known nesting areas in the New World are in Baja California (AOU 1957) and along the northwest coast of Mexico (Voous 1960).

North American populations winter primarily along the Pacific coast from central California to Baja California and to the southern coast of Chiapas in western Mexico (AOU 1957, Wetmore 1965, Gill and Mewaldt 1979), and along the Atlantic coast from South Carolina to Florida (Sprunt and Chamberlain 1949, Sprunt 1954, Burleigh 1958), along the northern Gulf coast, and to some extent in the Bahamas and Greater Antilles (AOU 1957, Bond 1971, Schreiber 1978). They winter commonly on the lower Magdelena River and Caribbean coast of Colombia (Blake 1977), but apparently not in large numbers on the coasts of Central America.

Taxonomic note: Also appears frequently in the literature as *Hydroprogne caspia* or *Hydroprogne tschegrava*.

Although some migration occurs through the interior, evidently most takes place along the coasts. The scarcity of records for these terns along the coasts of Central America suggests a direct overwater flight to wintering areas off northern Colombia.

World Distribution The distribution of Old World breeding populations is also fragmented. In eastern Eurasia, Caspian Terns breed along the shores of the Baltic in Sweden, Finland, and Estonia (Vaurie 1965); on the north coasts of the Black Sea and Sea of Azov; and on the Caspian and Aral Seas (Borodulina 1960). In western Eurasia, they breed in northwestern Mongolia, northern Sri Lanka, on the coast of China north to Manchuria, and in Ussuriland (Vaurie 1965).

In Africa, Caspian Terns nest at a number of scattered localities, most of them coastal, including the Gulf of Suez; Tunisia; the Banc d'Arguin off northern Mauretania; islets off Senegal, Gambia, and Portuguese Guinea; and Nigeria (Etchecopar and Hue 1964, Vaurie 1965, Mackworth-Praed and Grant 1970). They also breed in South Africa from the Cape of Good Hope to the mouth of the Zambezi River, and in the interior of the continent at Lake Rudolph in Kenya (AOU 1957, Vaurie 1965).

In the southwest Pacific, Caspian Terns breed on islands around the coast of Australia (except for New South Wales), on the North and South Islands of New Zealand, and in Tasmania (Serventy et al. 1971, Condon 1975).

Old World populations winter in a variety of areas depending on their nesting areas. Some may be sedentary, others nomadic, yet others truly migratory, but adequate information is still lacking for many populations. Western Eurasian birds winter along the coast of the Mediterranean but to a greater extent off the coast of Africa. Others, probably those from more eastern populations, winter along the Red Sea to northern India, in Africa, and in Indonesia and southeastern China (Dement'ev and Gladkov 1951, Borodulina 1960). Those from the coast of China may move south to Indonesia. Populations in Australia apparently are sedentary and exhibit only local movements (Serventy et al. 1971).

DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

North Carolina Caspian Terns are primarily uncommon migrants in North Carolina. Most records have occurred along the coast from April through November (Pearson et al. 1942) with a range of dates from 28 April to 4 January (Pearson et al. 1942, LeGrand 1978). Inland, where Caspian Terns are regarded as the most regularly seen tern in spring (LeGrand 1979d), this species has been recorded as early as 28 March (Teulings 1976c).

Caspian Terns breed irregularly in small numbers along the North Carolina coast. They were first recorded breeding in the state on 25 June 1972, when two nests were found at Oregon Inlet (Parnell and Soots 1976). In the following three years, 1, 4, and 4 nests were found at this locality, and another was found at Hatteras Inlet. All the observations made from 1973 to 1975 were made between 1 and 13 June and nests contained either eggs or chicks (Parnell and

Soots 1976). Breeding populations during the ensuing two years consisted of 18 birds breeding on a spoil island inshore from Oregon Inlet in 1976 (Portnoy et al. 1981, Map 11), and 16 at two localities on barrier islands in 1977 (Map 11).

South Carolina Caspian Terns occur commonly in small numbers throughout the year along the South Carolina coast (Sprunt and Chamberlain 1949). Their status as a breeder in South Carolina is poorly known. Sprunt and Chamberlain (1949) indicated that this species bred in small numbers among Royal Terns in the Cape Romain area, but Burton (1970) stated that this tern is "a permanent resident that does not breed", adding that he had seen at least 100,000 Royal Tern nests in South Carolina but had never found a Caspian Tern nest among them. The first documented nesting in the state occurred on 5 June 1970 when a nest with two eggs was found at Cape Romain NWR (McDaniel and Beckett 1971). The eggs were still present on 2 July and a chick about 3-weeks old was caught, banded, and photographed on 25 July. None were found breeding in South Carolina in 1976 (Portnoy et al. 1981).

Georgia Caspian Terns are common throughout the year on the Georgia coast and are occasionally seen in the interior in late summer and fall (Denton et al. 1977). They are not known to breed in the state. The population is small, and usually no more than one or two birds are seen at a time (Burleigh 1958).

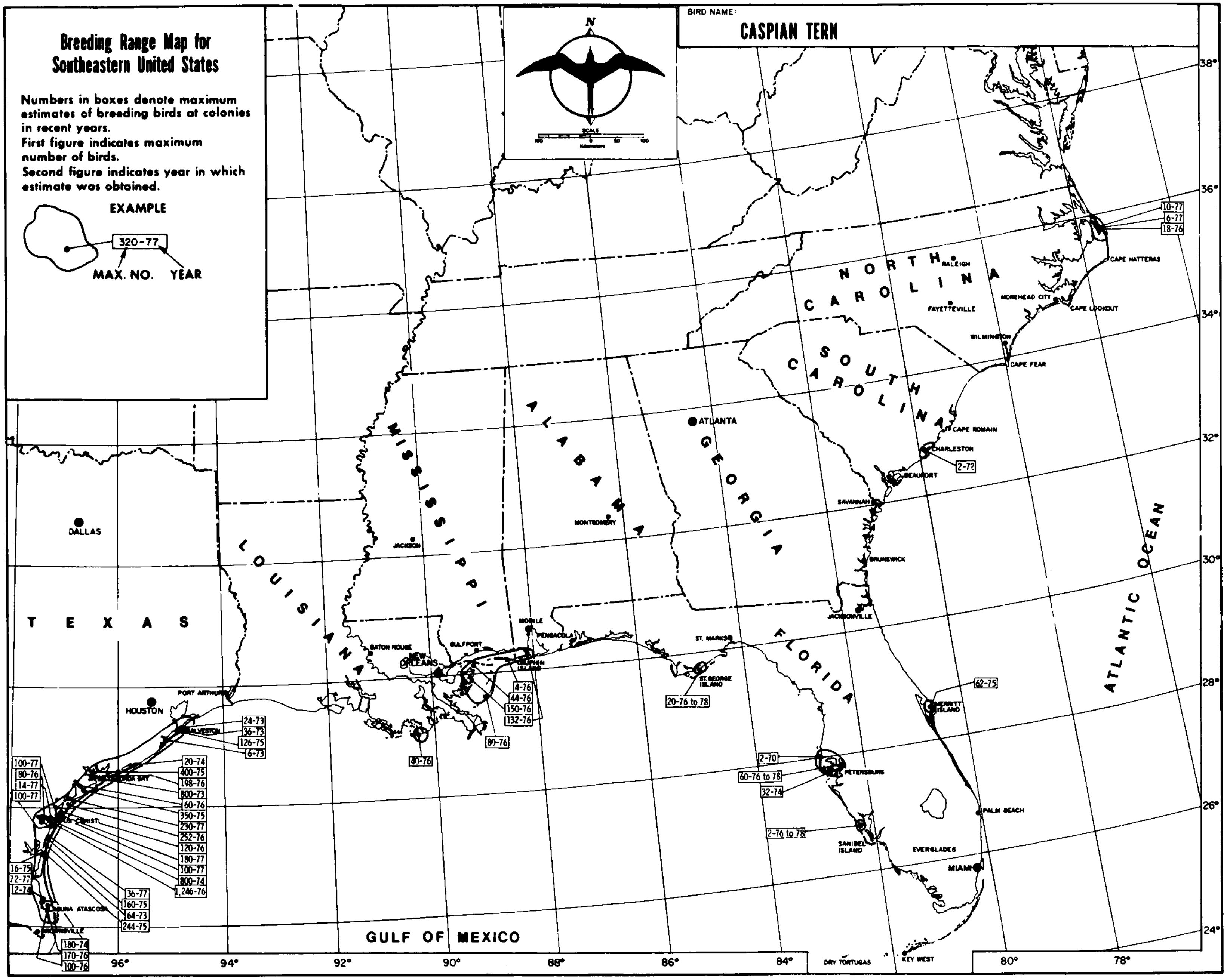
Florida - Atlantic Coast Caspian Terns are present in small numbers on the Florida Atlantic coast throughout the year, but few breed in this area. Kale (1979 ms a) reported a maximum of 31 pairs nesting on dredge-spoil islands at Merritt Island NWR (Map 11), the only breeding site on this coast. Surveys of the Florida Atlantic coast in 1976 found no nesting Caspian Terns (Portnoy et al. 1981).

Caspian Terns seemingly have been nesting in Florida more frequently in recent years. Schreiber (1978) suggested this is the result of the increased nesting habitat made available by man-made spoil islands.

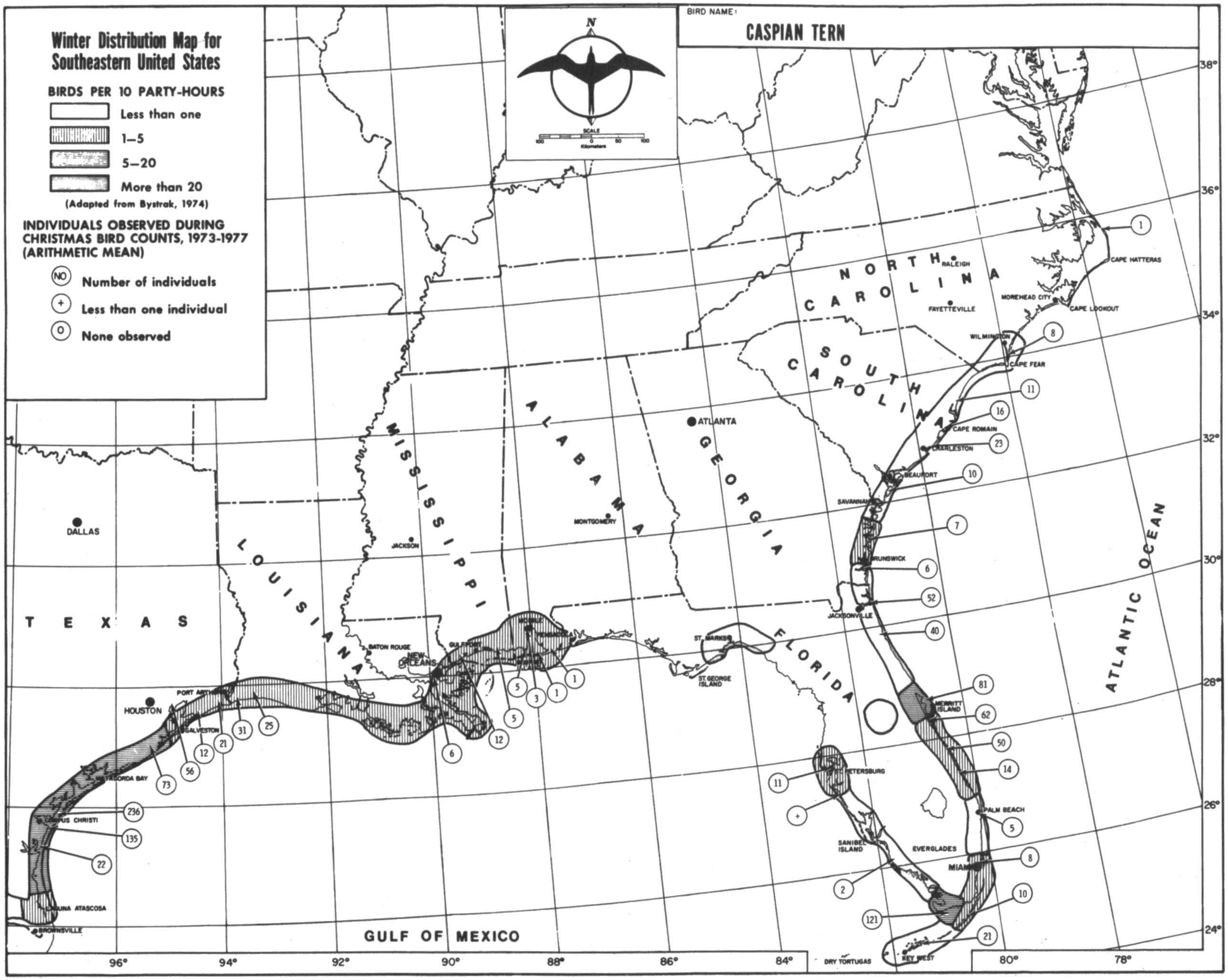
Florida - Keys Caspian Terns are primarily winter visitors (Map 12) in the Florida Keys. They are seen from early fall through mid-spring (Hundley and Hames 1960-62).

Florida - Gulf Coast Kale (1979 ms b) briefly summarized Caspian Tern nesting along the Florida Gulf coast. The first nesting pair was found in 1961 on a dredge-spoil island in Boca Ciega Bay. By 1978, birds were nesting on dredge-spoil islands at three different localities: Hillsborough Bay (30 pairs); Eastport, Franklin County (30 pairs); and Gasparilla Sound (1 pair). Along the Gulf coast, eggs have been recorded from as early as 5 May (Dunstan et al. 1975) to 11 July (Stevenson 1979b), and young have been recorded from 27 May (Dunstan et al. 1975) to 15 July (Woolfenden and Meyerriecks 1963).

Alabama Along the Alabama coast Caspian Terns are common in winter and uncommon to rare in summer (Imhof 1976b). According to Imhof (1976b), they are more common in brackish or freshwater habitats and thus reach peak abundance in areas such as Mississippi Sound and the head of Mobile Bay. We know


Breeding Range Map for Southeastern United States
Numbers in boxes denote maximum estimates of breeding birds at colonies in recent years.
First figure indicates maximum number of birds.
Second figure indicates year in which estimate was obtained.
EXAMPLE
320-77
MAX. NO.
YEAR
N
BIRD NAME:
CASPIAN TERN
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI
LOUISIANA
TEXAS
FLORIDA
ATLANTIC OCEAN
GULF OF MEXICO
RALEIGH
FAYETTEVILLE
MOREHEAD CITY
CAPE HATTERAS
CAPE LOOKOUT
WILMINGTON
CAPE FEAR
CAPE ROMAIN
CHARLESTON
BEAUFORT
SAVANNAH
BRUNSWICK
JACKSONVILLE
ATLANTA
MONTGOMERY
JACKSON
MOBILE
PENSACOLA
GULFPORT
BATON ROUGE
NEW ORLEANS
DAUPHIN ISLAND
ST. MARKS
ST. GEORGE ISLAND
MERRITT ISLAND
PETERSBURG
SANIBEL ISLAND
EVERGLADES
PALM BEACH
MIAMI
KEY WEST
DRY TORTUGAS
DALLAS
HOUSTON
PORT ARTHUR
GALVESTON
BROWNSVILLE
10-77
6-77
18-76
2-7?
62-75
20-76 to 78
2-70
60-76 to 78
32-74
2-76 to 78
4-76
44-76
150-76
132-76
80-76
40-76
24-73
36-73
126-75
6-73
20-74
400-75
198-76
800-73
60-76
350-75
230-77
252-76
120-76
180-77
100-77
800-74
1,246-76
100-77
80-76
14-77
100-77
16-75
72-77
12-74
36-77
160-75
64-73
244-75
180-74
170-76
100-76
38°
36°
34°
32°
30°
28°
26°
24°
96°
94°
92°
90°
88°
86°
84°
80°
78°

Map 11


Winter Distribution Map for Southeastern United States
BIRDS PER 10 PARTY-HOURS
Less than one
1–5
5–20
More than 20
(Adapted from Bystrak, 1974)
INDIVIDUALS OBSERVED DURING CHRISTMAS BIRD COUNTS, 1973-1977 (ARITHMETIC MEAN)
NO Number of individuals
+ Less than one individual
O None observed
BIRD NAME:
CASPIAN TERN
N
SCALE
Kilometers
TEXAS
LOUISIANA
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
SOUTH CAROLINA
NORTH CAROLINA
ATLANTIC OCEAN
GULF OF MEXICO
DALLAS
HOUSTON
JACKSON
MONTGOMERY
ATLANTA
RALEIGH
FAYETTEVILLE
BATON ROUGE
NEW ORLEANS
PORT ARTHUR
GALVESTON
MATAGORDA BAY
CORPUS CHRISTI
LAGUNA ATASCOSA
BROWNSVILLE
ST. MARKS
ST. GEORGE ISLAND
JACKSONVILLE
BRUNSWICK
SAVANNAH
BEAUFORT
CHARLESTON
CAPE ROMAIN
CAPE FEAR
WILMINGTON
MOREHEAD CITY
CAPE LOOKOUT
CAPE HATTERAS
MERRITT ISLAND
PALM BEACH
MIAMI
EVERGLADES
SANIBEL ISLAND
ST. PETERSBURG
KEY WEST
DRY TORTUGAS
96° 94° 92° 90° 88° 86° 84° 80° 78°
24° 26° 28° 30° 32° 34° 36° 38°

Map 12

of one nesting record for the state. While conducting an aerial survey of waterbirds along the northern Gulf Coast during the summer of 1976, Portnoy (1977) found a colony of 132 birds nesting on a spoil island just north of Dauphin Island. Portnoy (pers. comm.) saw these birds from a low altitude and his observations of the nest spacing and the bright red bills of the adults convinced him that the identification was correct.

Mississippi Burleigh (1958) regarded this species as fairly common along the coast, where small flocks can be seen almost daily. Numbers are greatest in fall and winter when local populations are augmented by migrants from the north.

In Mississippi, as in a number of other coastal southeastern states, nesting Caspian Terns have been found only recently. We know of four records of nesting, few of which were documented in any detail. The first record occurred in 1966 when 5 nests were found on Horn Island (Portnoy 1977). Fifteen nests were found there in each of two subsequent years (Portnoy 1977). In June 1976 they nested on a spoil island in Horn Island Pass (Jackson et al. 1979 ms a).

Louisiana Caspian Terns are common in Louisiana both inland and along the coast. As in Alabama, this species tends to prefer fresh or brackish water and is more common in marshy areas than along beaches (Lowery 1974). Lowery (1974) indicated that sizable breeding colonies were found along the coast, but recent surveys (Map 11) suggest that only small numbers breed within the state.

Texas These terns occur along the Texas coast throughout the year and a substantial majority of the Caspian Terns breeding in the southeastern United States nest in this area (Map 11, Table 41). Indeed, recent data suggest that several of the Texas colonies contain more breeding Caspian Terns than all of the rest of the southeastern states combined. The breeding season in Texas extends from mid-March to mid-July. Eggs have been recorded from 25 March through 18 June (Oberholser 1974).

Breeding populations along the Texas coast in 1977 and 1978 contained 1,088 and 1,004 pairs, respectively (Blacklock et al. 1978 ms). This represents no change from the preceding four years. Counts from 1973 to 1976 revealed that most of the nesting population occurs along the north and central coasts (Map 11). During these four years the north, central, and south coasts contained 17.3-59.7%, 40.3-78.6%, and 0.0-9.9%, respectively, of the population breeding in Texas.

SYNOPSIS OF PRESENT DISTRIBUTION AND BREEDING

Breeding Caspian Terns are birds of extremely widespread but patchy distribution that are largely associated with temperate and subtropical continental land masses. They are absent as breeding birds only from oceanic and polar areas and from South America. They breed from about 65° N in Europe to about 45° S in New Zealand, but most of the breeding populations are concentrated in

Table 41. Recent estimates of Caspian Tern populations nesting in the southeastern United States.

State	Number found breeding in 1976	Percent of southeastern breeding population	Maximum number found breeding in recent years and year
North Carolina	18	0.6	18 (1976)
South Carolina	none	---	2 (1972)
Georgia	none	---	none
Florida-Atlantic Coast	none	---	62 (1975)
Florida-Keys	none	---	none
Florida-Gulf Coast	none (a)	---	62 (1978)
Alabama	132	4.3	132 (1976)
Mississippi	4	0.1	30 (1968)
Louisiana	282	9.2	ca. 1,000 (1967)
Texas	2,640	85.8	2,640 (1976)
	3,076		

(a) Precise data for 1976 are lacking but we suspect that at least some nesting occurred along the Florida coast. This species tends to nest in isolated pairs or in small colonies among other colonial larids, and often nests at widely scattered localities. In consequence, nests may be overlooked on surveys and the species may breed more widely in some areas (e.g., Florida) than present data indicate.

the Holarctic between 20° and 55° N.

The Caspian Tern breeds in the southeastern United States, but throughout much of the area it is a rare and irregular breeder. Breeding populations of a thousand or more formerly could be found in Louisiana (Portnoy 1977), but at the present time substantial nesting populations are found only in Texas. Recent estimates for the southeastern United States are given in Table 41.

In North America, most Caspian Terns (about 7,500 birds) nest in the Great Lakes area of Canada and the United States. An estimated 1,620 breeding pairs were present in 1964 (Ludwig 1965a). In 1978, about 3,740 pairs nested there, about 1,650 of them on islands in Lake Michigan within U.S. waters (Shugart et al. 1979). The largest U.S. colonies in the Great Lakes were those at Gravelly Island and Shoe Island with 580 and 350 pairs, respectively. Some of the other large colonies of Caspian Terns recently recorded elsewhere in North America were ones with about 1,240 pairs at Whitcomb Island, Grays Harbor in 1976; 1,000 pairs at Goose Island in 1973; 600 pairs at Sand Island, Grays Harbor and 400 pairs in Wallapa Bay in 1976 (all in Washington) (Penland 1976a), and one with 500-600 pairs on Bair Island in San Francisco Bay, California, in 1975

(Gill 1977). For comparison, the largest colony in recent years in the southeastern United States was one in Neuces Bay, Texas, that contained about 623 pairs in 1976 (Blacklock et al. 1978). This Texas colony held more breeding Caspian Terns than were found in all the other southeastern states combined and was the largest breeding colony in the eastern United States.

The Caspian Tern is almost unknown as a breeder on the U.S. Atlantic coast north of North Carolina. Only a single nesting pair in Virginia was found in this area in 1977 (Erwin 1979a).

In northern Europe Caspian Terns nest only along the Baltic Sea with a breeding population estimated at about 2,300 pairs. Nearly 1,000 of these breed in Sweden (Staav 1979), and about 1,000 pairs breed along the Baltic coast of Finland (Vaisanen 1973). Recent data for colonies from most of the rest of the Old World are scant or lacking. Dement'ev and Gladkov (1951) remarked that Caspian Terns are common on the Caspian Sea and locally common on the Aral Sea and in eastern Kazakhstan. They are apparently uncommon in the southern U.S.S.R. (Borodulina 1960).

Winter Wintering Caspian Terns in the northern portion of the Old World are found mostly off the coast of Africa, from the Red Sea to northern India, and in Indonesia and southeastern China. Those in Australia evidently winter near the breeding areas. Those that breed in North America winter predominantly along the Pacific coast of Mexico, on the Atlantic coast of Florida, along the Gulf coast from Florida to Central America, and in the Caribbean to northwestern South America.

Caspian Terns fledging in the Great Lakes winter predominantly in the southeastern United States, the eastern Caribbean, and Colombia (Ludwig 1965a). Those fledging from colonies in San Francisco Bay, California, winter along the west coast of Mexico (Gill and Mewaldt 1979).

The status of wintering populations is poorly known. Judging from recent Christmas Bird Counts (Map 12), the largest wintering populations in the southeastern United States are found on the north and central Atlantic coast of Florida, on Florida Bay in southern Florida, and on the Texas coast.

Migration Information on the migration of Caspian Terns in the Old World is limited and is most complete for populations wintering in northwest Europe.

Details of migration are well known for only a few North American populations. Ludwig (1965a) believed that adult and juvenile Caspian Terns migrating from the Great Lakes primarily reach their wintering areas to the east and southeast by following the Mississippi Flyway to the Gulf coast; some birds move along Lakes Erie and Ontario to Pennsylvania and New York, and then move south along the Atlantic coast.

Most young fledge from the colonies in the Great Lakes in July and August and rapidly proceed south. Ludwig (1965a) reported that the average recovery dates in Virginia, North Carolina, and Louisiana were, respectively, 17 August, 11 September, and 12 September. Most of the recoveries from Mississippi, Georgia, and Florida were obtained in November and December. Almost a third (32.6%) of the 132 recoveries obtained in the southeastern United States came from Florida. Louisiana had 18.9%, Alabama and North Carolina had 15.2% each, Mississippi had 7.6%, Georgia and South Carolina had about 4.9%, and one bird was recovered in Texas.

HABITAT

Nesting Caspian Terns typically nest on sparsely vegetated islets. Ludwig (1965a) found Caspian Tern colonies in the Great Lakes "only on islands with sand-gravel substrates which had sparse or no vegetation." Preferred nesting habitat in the Baltic area was described by Bergman (1980) as "small, low, flat, rocky or gravel islets without trees or bushes, in most cases less than 2 ha in area and situated in a physiognomically marine landscape." In Australia most nesting occurs on sandy beaches, but other nests are found on shingle or headlands (Serventy et al. 1971). After reviewing the literature, Penland (1976a) concluded that the only common factor in all nesting areas was a limited amount of vegetation.

Caspian Terns nest solitarily, or in small to large colonies. In the Baltic, about 75% of the breeding sites are occupied by single pairs, but about 92% of the breeding population is found in colonies containing from 9 to 164 pairs (Bergman 1980). Nests in colonies are often closely packed together. Distances between 50 nests in one colony in the U.S.S.R. ranged from 80 cm to 4 m (ca. 32-157 in) (Borodulina 1960). Nesting densities for a variety of nesting habitats at Whitcomb Island, Washington, ranged from 0.39 to 1.27 nests/sq m (3.62-11.80 nests/100 sq ft) (Penland 1976a).

Most of the Caspian Tern colonies found along the coast of Louisiana and Mississippi are found on barrier or spoil islands, but the largest colony (150 birds), representing over a third of the birds breeding in that area, was found on a shell berm in a salt marsh in St. Bernard Parish, Louisiana (Portnoy 1977). Colonies in Florida are found mostly on dredge-spoil islands (Schreiber 1978). Oberholser (1974) stated that Caspian Terns nesting in Texas usually were found in "less developed and polluted segments of the coast, nesting principally on barren spoil islands or shell beaches free of vegetation."

Feeding Feeding areas used by breeding Caspian Terns may vary during the course of the nesting season. In Finland, Bergman (1953 in Soikelli 1973b) noted that these terns fed in the inner archipelago at the beginning of the breeding season, but also fed in the outer archipelago later in the season.

Caspian Terns at Elkhorn Slough, Monterey, California, prefer to forage over the main channel, and fish to a lesser extent over shallower waters near the shore (Baltz et al. 1979). Caspian Terns in Australia also use both deep and shallow waters for fishing (Serventy et al. 1971). Dement'ev and Gladkov (1951) remarked that fish were captured in shallow clear waters.

Nonbreeding and Offshore Wintering Caspian Terns usually are found along beaches, spits, and on isolated islets. They often roost with other larids, particularly the similar-appearing Royal Tern. Migrant Caspian Terns are one of the North American terns most likely to be seen inland along watercourses or in large marshes.

The distance that Caspian Terns forage offshore in the southeast is not well known. Lee and Booth (1979) indicated that this species was "regularly observed 20 or more miles offshore" during pelagic observations conducted off North Carolina. On the other hand, transient Caspian Terns seen in the northern Chesapeake Bight rarely ranged offshore beyond the sight of land (Rowlett 1980). Oberholser (1974) suggested that this species usually feeds well offshore in Texas.

FOOD AND FEEDING BEHAVIOR

When searching for food, Caspian Terns usually fly slowly over the water, sometimes briefly hovering, and then plunge to the surface to seize prey with their bill. They may submerge entirely, but only for brief periods (Penland 1976a). Foraging flights are usually low (Dement'ev and Gladkov 1951), but Caspian Terns may hover up to 40 ft (12 m) above the water before diving (Serventy et al. 1971). Penland (1976a) noted that Caspian Terns foraging in Washington usually dive from heights of 5 to 20 m (16-66 ft). Dement'ev and Gladkov (1951) stated that this species "frequently feeds on the water, swimming like a gull."

Dement'ev and Gladkov (1951) indicated that breeding birds usually foraged only short distances from the nesting areas. Borodulina (1960) reported that birds in Kazakhstan foraged 10-12 km (6.2-7.5 mi) from the breeding grounds. Bergman (1953 in Soikelli 1973b) indicated, however, that Caspian Terns in Finland may fly over 30 km (19 mi) from their nests to obtain food. Tags from smolts of salmon and sea-trout found at two nests in Finland had been placed on these fish at localities 70 and 85 km (43 to 53 mi) distant (Soikelli 1973b). Similar data are available from North American colonies. Gill (1976) found a number of tags from rainbow trout (Salmo gairdneri) among food items recovered at a colony in San Francisco Bay, California. Eleven of these had been released in a reservoir 18 mi (29 km) away, and another in a reservoir 37 mi (60 km) away. Gill suggested that the location of the tags (seven at one nest, five at an adjacent nest) was the result of one pair learning about a foraging site from another pair.

Caspian Terns are almost entirely piscivorous. The kind of fish eaten depends largely on what species of the proper size is most readily available. The diet may change during the year as one species or another becomes more abundant. For example, in Finland, roach (Rutilus rutilus) predominated in the diet early in the breeding season while Clupeids were favored at the end of May (Koli and Soikkeli 1974). Perch (Perca fluviatilis) became more significant in June and July, although roach remained very important in the diet. Koli and Soikkeli concluded that Caspian Terns are opportunistic feeders that feed primarily on available fish in a size range between 8 and 26 cm (3-10 in) long. Most prey taken were between 14 and 20 cm (5-8 in) long. Borodulina (1960) indicated that fish taken in the U.S.S.R. are usually 15-20 cm (6-8 in) long, but occasionally some as long as 30 cm (11.8 in) are taken.

The diet of the Caspian Tern is relatively well known for several areas of North America and Europe. Koli and Soikkeli (1974) provide detailed information on the species of fish eaten in Finland and Sweden, and other items of diet consumed in the Old World are given in papers listed in the terminal species bibliography. Little specific information is available on the diet of Caspian Terns in the southeastern United States. We summarize by area below some of the foods eaten elsewhere in North America because this may reflect this tern's diet in the southeast.

Washington Smith and Mudd (1978) examined dead fish in a colony at Gray's Harbor, Washington. These fish had total lengths ranging from 9.8 cm (3.9 in) to 29.6 cm (11.7 in). Because these fish had not been eaten, these figures may not be the best estimate of the sizes of fish normally eaten. The species found most frequently were shiner perch (*Cymatogaster aggregata*), chum salmon (*Oncorhynchus keta*), and Pacific staghorn sculpin (*Leptocottus armatus*).

California Gill (1976) conducted a study of food habits at a colony in San Francisco Bay and found that the major food items were estuarine fish that could be caught close to the ternery. Although a total of 21 species of fish were identified, three predominated: jacksmelt (*Atherinopsis californiensis*), shiner perch, and Pacific staghorn sculpin. These made up 33%, 19%, and 19%, respectively, of the 605 fish examined.

Baltz et al. (1979) reported on the food habits of the Caspian Terns nesting at Elkhorn Slough, Monterey County, basing their report on the contents of 10 stomachs collected in July. These birds had fed primarily on adult shiner perch (80% of 25 fish identified), but had also eaten adult Northern anchovy (*Engraulis mordax*). Martini (1964 in Koli and Soikkeli 1974) found the diet at San Diego Bay to be similar. There, 88% of the diet was made up of shiner perch and topsmelt (*Atherinops affinis*).

Alberta At a colony on Little George Island in Lake Winnipeg, 784 regurgitated pellets all contained fish remains, 6.0% contained insects, 3.2% contained tern eggshells, and 0.3% contained bird bones (Vermeer 1973a).

U.S. Great Lakes Ludwig (1965a) reported that terns nesting on Lakes Huron and Michigan in 1963 and 1964 fed exclusively on fish. Of 169 food items identified, 73.7% were alewives (*Alosa psuedoharengus*) and 15.1% were rainbow smelt (*Osmerus mordax*); the same species still made up the majority of the diet in 1977 and 1978 (Shugart et al. 1979). Alewifes made up 57.2% (of 1,219 food items) and smelt made up 34.0%. Most fish captured were 5-15 cm (2-6 in) in length.

Occasionally (but rarely) crayfish (Cambarus sp.) (Shugart et al. 1979) and insects (Borodulina 1960) are also eaten. Dement'ev and Gladkov (1951) stated that this tern also occasionally feeds on nestlings and eggs of other birds. Rarely, this tern may feed on carrion. Cunningham (1966) found a Caspian Tern feeding on a dead snake (Eastern Cottonmouth, Agkistrodon p. piscivorus) on a road near Nine-Mile Pond, Everglades National Park.

IMPORTANT BIOLOGICAL PARAMETERS

Egg Laying In Atlantic coast colonies most eggs are laid in May and early June. Along the Gulf coast, most laying apparently occurs during April and May.

Laying regimes elsewhere in the world vary with locality. Caspian Terns in the Great Lakes region laid eggs from early May up to the beginning of July (Ludwig 1965a). During one year at Gray's Harbor, Washington, egg laying began in the third week of April and continued for three to four more weeks (Penland 1976a). In northern Aland, Finland, laying occurs from early May to late June or early July, with young beginning to hatch by late May or early June (Koli and Soikelli 1974). In central Asia most lay early in May but at more southern localities may lay earlier (e.g., in early April in Mesopotamia)(Dement'ev and Gladkov 1951). Egg laying in southern Australia occurs from September to December, but in northern Australia active nests have been recorded year round (Serventy et al. 1971).

Mean Clutch Size Caspian Terns usually lay from one to three eggs, but as many as four or five eggs have been found in one nest (Soikkeli 1973a, Penland 1976a). Penland (1976a) presented some data indicating that such clutches may be the result of eggs being transferred or stolen from other nests.

Shugart et al. (1979) noted that clutch size was typically 1-2 eggs in Manitoba, California, Texas, and Florida, and typically 2-3 eggs in the Great Lakes, Washington, and northern Europe. Serventy et al. (1971) reported that Caspian Terns nesting in Australia usually lay 1-2 eggs.

First clutches in the Great Lakes averaged 2.81 eggs (n = 225) in 1963-1964 (Ludwig 1965a), and 2.4 eggs (n = 2,170) in 1975-1978 (Shugart et al. 1979). Chaney et al. (1978) found an average of 1.6 eggs in 10 nests at one colony in Texas. Penland (1976a) noted mean clutch sizes of 2.05 to 2.50 at colonies in Washington.

Clutch size may decrease as the breeding season progresses. Soikkeli 1973a) noted a steady decrease in clutch size through the season in Finland during 1970-73. The mean clutch size from the beginning of the season to 20 May was 2.70. It was 2.04 for 21-31 May, 1.79 for 1-10 June, and 1.61 for clutches laid thereafter.

Incubation Period Tarr (1960) reported that the incubation period at a single nest of Caspian Terns in Australia was 21 days. Ludwig (1965a) reported that the incubation period was about 26 days in Caspian Terns nesting on the

Great Lakes of the United States and Canada. Three eggs at Whitcomb Island, Washington were incubated 27 days each. Data for eleven other eggs suggested a range of incubation periods of 26-28 days, with most (9) hatching at 27 days (Penland 1976a).

Hatching Success Hatching success was 81% at 200 nests in the Great Lakes (Ludwig 1965a); 81.8% hatched at one colony in the Toronto Outer Harbor, Ontario (Haymes and Blokpoel 1978a); and 12 of 16 (75%) hatched at one colony in Texas (Chaney et al. 1978). Soikkeli (1973a) did not report precise figures for hatching success, but reported that 1.78-1.86 chicks hatched per pair over a 3-year period (1970-72) in the Aland Archipelago, Finland.

Age at Fledging Bergman (1953 in Borodulina 1960) indicated that Caspian Terns begin to fly at about 46-48 days, and Ludwig (1965a) reported that young fledge at 6-8 weeks (42-56 days). Soikkeli (1973a) reported that young terns in the Aland Archipelago could fly at 36 days or less, as did Martin (in Penland 1976a) for young terns from the Potholes Reservoir area in Washington.

Fledging Success Ludwig (1965a) estimated a production of 1.61 chicks per pair at colonies in the Great Lakes in 1963-64. This figure, divided by mean clutch size (given above), provides a fledging success of 57.3%. Production in this area from 1975 to 1978 was calculated at 1.0 chicks per pair, an estimated success from 39% of the eggs laid (Shugart et al. 1979). Shugart et al. indicated that survival of young and nests during this period was suboptimal due to perturbations (i.e., nests abandoned or washed out by flooding). Rates of production similar to those observed by Ludwig (1.49-1.64 chicks per pair) were found at two colonies in Finland in 1970-1972 (Soikkeli 1973a).

Mortality of Eggs and Young Loss of eggs and young by storm winds and high tides is perhaps the most frequent source of nest failure. Some localities at which such losses have been noted include South Carolina (Sprunt and Chamberlain 1949), San Francisco Bay (DeGroot 1931), the Great Lakes (Shugart et al. 1979), and the southwest Pacific (Jones 1980). During 1975-78 in the Great Lakes, gale force winds (75+ kph) resulted in the loss of 12% of all initial nesting attempts. The largest single source of nest failure, however, was the abandonment of 445 out of 685 nests at Hat Island in 1977 as the result of cannon-netting in the colony (Shugart et al. 1979). Human disturbance of colonies has been considered a source of egg loss elsewhere. Penland (1976a) concluded that egg mortality in the Whitcomb Island, Gray's Harbor, Washington, colony was very low in 1976-76, "certainly less than 5%, and probably near 2%", but believed that most of the loss could be ascribed to the effects of human disturbance. Such disturbance caused mortality by exposing eggs and young to cold temperatures, by allowing nests to be covered by drifting sand, and by allowing predatory gulls to take eggs.

Gulls sometimes prey on eggs. Penland (1976a) believed that the larger the number of gulls, the worse the effects of predation. When few gulls were present at a colony that Penland studied in Washington, their predation on eggs usually had no signficant effect on nesting success. The greatest danger to chicks at this colony was adult Caspian Terns that attacked and killed the chicks when they wandered into neighboring territories. Kleptoparasitism by Common Black-headed Gulls on adult Caspian Terns carrying food caused starvation and increased mortality in young Caspian Terns off Stockholm (Forssgren 1980 in Bergman 1980).

Renesting Some Caspian Terns that lose their first nests attempt to renest, but figures on rates of renesting are not available. Shugart et al. (1979) estimated that 66% of 465 pairs that failed in their initial nesting attempts in 1977 at Hat Island, Lake Michigan, tried to nest again, but thought that this estimate may have been too high. The rate of survival of chicks from renesting attempts tended to be similar to that from first nesting attempts, but production of chicks was lower because second clutches were smaller.

Age at First Breeding Ludwig (1965a) believed that most Caspian Terns do not breed until their third year. This aspect of their breeding biology has not been studied adequately.

Maximum Natural Longevity The oldest Caspian Tern recorded in North America was a juvenile banded in Michigan that reached a minimum age of 26 years 2 months (Clapp et al. 1982a). Similar longevities have been recorded elsewhere. Two birds in Finland wore bands for 19 and 20 years, respectively (Soikkeli 1970).

Estimations have been made of mortality rates and expected survival rates of Caspian Terns. Hickey (1952 in Soikelli 1970) calculated mortality rates of 44% for birds in the first year after fledging, 26% for the second year, and 18% for older birds. Ludwig (1965a) based his calulations on the same populations in the Great Lakes that were studied by Hickey, and estimated that the average adult life span for Caspian Terns there is 8.8 years, with an average annual loss of 11.3% for birds older than three years. Soikelli (1970) calculated that Caspian Terns in Finland that had survived to an age of 1.5 years had a mean annual mortality rate of 12%, leading to a further life expectancy of 7.8 years.

Weights Borodulina (1960) reported that three females (presumably collected in the U.S.S.R.) ranged from 585 to 673 g (1.29-1.48 lb), and averaged 640 g (1.41 lb). Dement'ev and Gladkov (1951) gave the weight of one female as 640 g. Six chicks about 10-15 days old at Whitcomb Island, Washington, weighed 180-257 g (6.3-9.1 oz) and averaged 233 g (8.2 oz) (Penland 1976a). Dement'ev and Gladkov (1951) reported that slightly incubated eggs weighed 57-68 g (2.0-2.4 oz) and averaged 64 g (2.3 oz).

SUSCEPTIBILITY TO OIL POLLUTION

Caspian Terns have seldom been reported as victims of oiling. Three banded birds have been recovered as a result of oil--two in California and one in Louisiana (files of the Bird Banding Laboratory, Laurel, MD). Several Caspian Terns that were oiled on the breast have been seen flying in the Corpus Christi area in Texas (F. Buckley, pers. comm.). Because Caspian Terns are widely distributed in small numbers in much of the southeast and feed well offshore, direct effects of oiling are likely to be slight. The species may be at risk from development of onshore facilities and other forms of land development because it is susceptible to human disturbance. It also nests on barrier islets and spoil islands that are easily affected by dredging and erosion control. The status of this species along the Texas coast, where a significant proportion of the U.S. population nests, should be carefully monitored.

BIBLIOGRAPHY

1982

Koonz, W. H. 1982. Vandalism in a Manitoba Caspian Tern colony. Blue Jay 40: 48-49.

1981

Bergman, G. 1981. Single-breeding versus colonial breeding in the Caspian Tern, Hydroprogne caspia. (Abstract only.) Mem. Soc. Fauna Flora Fenn. 57: 1.

Blokpoel, H. 1981. An attempt to evaluate the impact of cannon netting in Caspian Tern colonies. Colonial Waterbirds 4: 61-67.

Forssgren, K. 1981. The kleptoparasitic behaviour of the Arctic Skua Stercorarius parasiticus and the Lesser Black-backed Gull Larus fuscus with the Caspian Tern Hydroprogne caspia. (Abstract only.) Mem. Soc. Fauna Flora Fenn. 57: 5.

Harvey, T. E. 1981. The breeding ecology of Caspian and Forster's Terns in Elkhorn Slough Saltponds, California. (Abstract only.) Pac. Seabird Group Bull. 8: 93.

King, B. 1981a. Caspian Terns sun-bathing with Ring-billed Gulls. Brit. Birds 74: 181.

_____. 1981b. Caspian Tern dropping and retrieving objects. Brit. Birds 74: 228.

Ludwig, J. P. 1981. Band wear and band loss in the Great Lakes Caspian Tern population and a generalized model of band loss. Colonial Waterbirds 4: 174-186.

Raffaele, H. 1981. New records of bird species for Puerto Rico and one for the West Indies. Am. Birds 35: 142-143.

1980

Bergman, G. 1980. Single-breeding versus colonial breeding in the Caspian Tern Hydroprogne caspia, the Common Tern Sterna hirundo and the Arctic Tern Sterna paradisaea. Ornis Fenn. 57: 141-152. [In English with Finnish summary.]

Hockey, P. A. R. and C. T. Hockey. 1980. Notes on Caspian Terns Sterna caspia breeding near the Berg River, Southwestern Cape. Cormorant 8: 7-10.

Jones, A. 1980. The effects of weather on a Caspian Tern colony. Notornis 27: 405-406.

Pulliainen, E. and A. Marjakangas. 1980. Eggshell thickness in eleven sea and shore bird species of the Bothnian Bay. Ornis Fenn. 57: 65-70.

Quinn, J. 1980. Chick feeding in Caspian Terns. (Abstract only.) Proc. 1979 Conf. Colonial Waterbird Group 3: 259.

Staav, R. 1980. Skrantarnans Sterna caspia upptradande i Sverige under hog- och eftersommar. [Occurrence of the Caspian Tern Sterna caspia in Sweden during high and late summer.] Var Fagelvarld 39: 139-148. [In Swedish with English summary.]

1979

Baltz, D. M., G. V. Morejohn and B. S. Antrim. 1979. Size selective predation and food habits of two California terns. West. Birds 10: 17-24.

Byard, M. E. 1979. Caspian Tern in Cimarron County, Oklahoma. Bull. Okla. Ornithol. Soc. 12: 21.

Caldwell, J. R. and C. Jorgenson. 1979. Caspian Tern nests at Last Mountain Lake, Saskatchewan. Blue Jay 37: 111.

Gill, R., Jr. and L. R. Mewaldt. 1979. Dispersal and migratory patterns of San Francisco Bay produced herons, egrets, and terns. N. Am. Bird Bander 4: 4-13.

Martin, M. 1979. Status report on Caspian Tern (Sterna caspia) in Canada. Can. Wildl. Serv., Ottawa, Ontario, Canada. 43 pp.

Martinez, A. and J. Muntaner. 1979. Migration de la Sterne caspienne Hydroprogne caspia par le Delta de l'Ebre. Alauda 47: 29-33.

Shugart, G. W., W. C. Sharf and F. J. Cuthbert. 1979. Status and reproductive success of the Caspian Tern (Sterna caspia) in the U.S. Great Lakes. Proc. 1978 Conf. Colonial Waterbird Group 2: 146-156.

Staav, R. 1979. Dispersal of Caspian Terns (Sterna caspia) in the Baltic. Ornis Fenn. 56: 13-17.

Stevenson, H. M. 1979b. First nesting of the Caspian Tern in the Florida Panhandle. Fla. Field Nat. 7: 8.

Tombal, C. and J. C. Tombal. 1979. Donnees complementaires sur la migration de la Sterne caspienne *Hydroprogne caspia* par le Delta de L'Ebre (Catalogne). [On the migration of *Hydroprogne caspia* in the Ebra Delta (Catalonia).] Alauda 47: 303-304.

Weseloh, D. V. and L. Cocks. 1979. Recent nesting of the Caspian Tern at Egg Island, Lake Athabasca, Alberta. Blue Jay 37: 212-215.

1978

Blokpoel, H. and P. M. Fetterolf. 1978. Colonization by gulls and terns of the Eastern Headland, Toronto Outer Harbour. Bird-Banding 49: 59-65.

Brichetti, P. 1978. Sulla nidificazione in Italia di: Gabbiano corallino *Larus melanocephalus* Temminck, Gabbiano roseo *Larus genei* Breme, Rondine di mare maggiore *Hydroprogne tschegrava* (Lepechin). Riv. Ital. Ornitol. 48: 215-233.

Clinning, C. F. 1978. Breeding of the Caspian Tern in South West Africa. Cormorant 5: 15-16.

Haymes, G. T. and H. Blokpoel. 1978a. Reproductive success of larids nesting on the Eastern Headland of the Toronto Outer Harbor in 1977. Ont. Field Biol. 32: 1-17.

Herman, J. F., R. A. Schmidt and K. J. Wilson. 1978. First nesting record of the Caspian Tern in North Dakota. Prairie Nat. 10: 23-24.

Hosea, F. 1978. Techniques for tern and gull banding. N. Am. Bird Bander 3: 111.

Loftin, R. W. 1978. Caspian Terns in the Georgia mountains. Oriole 43: 66-67.

Schreiber, R. W. 1978. Species of special concern. Caspian Tern. P. 94 *in* H.W. Kale, II (ed.) Rare and endangered biota of Florida. Vol. 2. Birds. Univ. Presses of Florida, Gainesville, FL. xix and 121 pp.

Shugart, G. W. 1978. The development of chick recognition by adult Caspian Terns. Proc. 1977 Conf. Colonial Waterbird Group 1: 110-117.

Smith, J. L. and D. R. Mudd. 1978. Food of the Caspian Tern in Grays Harbor, Washington. Murrelet 59: 105-106.

Staav, R. 1978. [A study of Caspian Terns (*Sterna caspia*) in Blekinge 1977.] Faglar Blekinge 14: xviii-xx. [In Swedish.]

Whitfield, A. K. and S. J. M. Blaber. 1978. Feeding ecology of piscivorous birds at Lake St. Lucia. Part I: diving birds. Ostrich 49: 185-198.

1977

Allen, L. J. 1977. The comparative feeding ecology relative to population dynamics of the Herring and Ring-billed Gulls (Larus argentatus and L. delawarensis) and some comparisons with the Caspian Tern. M.S. thesis. Queens Univ./Kingston, Ontario. 196 pp.

Baglieri, S. and F. Fagotto. 1977. La rondine di Mare Maggiore--(Hydroprogne tschegrava (Lepechin)--nella Sicilia orientale. [The Caspian Tern (Hydroprogne tschegrava) in eastern Sicily.] Riv. Ital. Ornitol. 47: 229-234. [In Italian with English summary.]

Blokpoel, H. 1977. Gulls and terns nesting in northern Lake Ontario and the upper St. Lawrence River. Can. Wildl. Serv. Prog. Notes 75. 12 pp.

Fetterolf, P. M. and H. Blokpoel. 1977. Terns and gulls nesting on Toronto's Eastern Headland. Ont. Field Biol. 31: 51-52.

Shugart, G. W. 1977c. Nest, nest-site, egg, and chick recognition by adult Caspian Terns. M.S. thesis, N. Illinois Univ./DeKalb, IL.

Staav, R. 1977. Etude de passage de la Sterne caspienne Hydroprogne caspia en Mediterranee a partir des reprises d'oiseaux bagues en Suede. [Study of the migration of Caspian Terns in the Mediterranean by captures of tagged birds in Sweden.] Alauda 45: 265-270. [In French with English summary.]

Weske, J. S., R. B. Clapp and J. M. Sheppard. 1977. Breeding records of Sandwich and Caspian Terns in Virginia and Maryland. Raven 48: 59-66.

1976

Becker, P. 1976. Raubseeschwalbe (Hydroprogne caspia) als Brutvogel an der Sudwestafrikanischen Kuste. Namib & Meer 7: 21-23. [In German with English summary.]

Gill, R. E., Jr. 1976. Notes on the foraging of nesting Caspian Terns Hydroprogne caspia (Pallas). Calif. Fish Game 62: 155.

Isenmann, P. 1976. Beweis eines langeren Aufenhaltes einer Gruppe Raubseeschwalben (Hydroprogne caspia) wahrend des Wegzuges in der Camargue (Sud-Frankreich). Vogelwarte 28: 312-313. [In German.]

Parnell, J. F. and R. F. Soots. 1976. Caspian Tern nesting in North Carolina. Chat 40: 14-15.

Penland, S. 1976a. The natural history and current status of the Caspian Tern (Hydroprogne caspia) in Washington State. M.S. thesis, Univ. Puget Sound/Tacoma, WA. 101 pp.

_____. 1976b. The Caspian Tern: a natural history. Wash. Wildl. 28: 17-19.

1975

Dunstan, F. M., R. W. Schreiber and J. J. Dinsmore. 1975. Caspian Tern nesting in Florida, 1973 and 1974. Fla. Field Nat. 3: 16-17.

Wolinski, R. A. 1975. First reported Caspian Tern sighting for Isabella County [Mich.]. Jack-Pine Warbler 53: 75.

1974

Alcorn, G. D. 1974. Caspian Tern, sea wanderer of the world. Pac. Search 8: 4-5.

Britton, P. L. and L. H. Brown. 1974. The status and breeding behaviour of East African Lari. Ostrich 45: 63-82.

Cronert, H. and M. Ny. 1974. Skrantarnans forekomst i nordostra Skane. Anser 13: 254-256.

Koli, L. and M. Soikkeli. 1974. Fish prey of breeding Caspian Terns in Finland. Ann. Zool. Fenn. 11: 304-308.

Rudebeck, G. 1974. Rapport fran Silvakratornet vid krankesjon. 1. Ovantat riklig forekomst av skrantarna _Hydroprogne tschegrava_. Anser 13: 149-153. [In Swedish with English summary.]

1973

Horton, W. 1973. Caspian Terns at Mount Isa, Q. Austr. Bird Bander 11: 51-55.

Isenmann, P. 1973. Le passage de la Sterne Caspienne _Hydroprogne caspia_ en 1971 et 1972 en Camargue. [The 1971 and 1972 passages of the Caspian Tern _Hydroprogne caspia_ in the Camargue.] Alauda 41: 365-370. [In French with English summary.]

Soikkeli, M. 1973a. Breeding success of the Caspian Tern in Finland. Bird-Banding 44: 196-204.

_____. 1973b. Long-distance fishing flights of the breeding Caspian Tern _Hydroprogne caspia_. Ornis Fenn. 50: 47-48.

Vaisanen, R. A. 1973. Establishment of colonies of Caspian Tern _Hydroprogne caspia_ by deserting flights in the northern Gulf of Bothnia. Ornis Scand. 4: 47-53.

Vermeer, K. 1973a. Comparison of food habits and mercury residues of Caspian and Common Terns. Can. Field-Nat. 87: 305.

1972

Gill, R. E., Jr. 1972. San Francisco Bay breeding bird survey, 1971. Calif. Dep. Fish Game Wildl. Manage. Branch Adm. Rep. 72-6.

Schreiber, R. W. and J. J. Dinsmore. 1972. Caspian Tern nesting records in Florida. Fla. Nat. 45: 161.

Staav, R., B. Almkvist and S. Hedgren. 1972. Skrantarnan Hydroprogne tschegrava i Sverige 1971. [The Caspian Tern Hydroprogne tschegrava in Sweden 1971.] Var Fagelvarld 31: 241-246. [In Swedish with English summary.]

Vermeer, K. 1972. Comparison of the clutch initiation of Caspian and Common Terns at Lake Winnipeg. Blue Jay 30: 218-220.

1971

Beretzk, P. and A. Keve. 1971. Die Raubseeschwalbe Hydroprogne caspia (Pallas) in Ungarn (1953-1969). Zool. Abh. (Dres.) 30: 227- 242. [In German.]

Campbell, R. W. 1971. Status of the Caspian Tern in British Columbia. Syesis 4: 185-189.

Diamond, A. W. 1971. The ecology of the sea-birds of Aldabra. Philos. Trans. R. Soc. Lond. B. Biol. Sci. 260: 561-571.

McDaniel, T. H. and T. A. Beckett, III. 1971. Caspian Tern nesting in South Carolina. Chat 35: 39-41.

1970

Chaniot, G. E., Jr. 1970. Notes on color variation in downy Caspian Terns. Condor 72: 460-465.

Dobrowolski, K. A. 1970. Wystepowanie rybitwy wielkodziobej, Hydroprogne caspia (Pall.) w Polsce w okresie ubieglych 150 lat. [The occurrence of Caspian Tern, Hydroprogne caspia (Pall.) in Poland during the past 150 years.] Acta Ornithol. 12: 209-228. [In Polish with English summary.]

Evans, R. M., D. B. Krindle and M. E. Mattson. 1970. Caspian Terns nesting near Spruce Island, Lake Winnipegosis, Manitoba. Blue Jay 28: 68-71.

Schick, W. J. 1970. First British Columbia record of Caspian Tern. Syesis 3: 187.

Soikkeli, M. 1970. Mortality rate of Finnish Caspian Terns Hydroprogne caspia. Ornis Fenn. 47: 177-179.

Vermeer, K. 1970. Large colonies of Caspian Terns on Lakes Winnipeg and Winnipegosis, 1970. Blue Jay 28: 117-118.

1969

Daneel, A. B. 1969. Breeding of the Caspian Tern at Vaaldam. Ostrich 40: 16.

Dunstan, T. C. 1969. Tern mortality due to entanglement in nylon monofilament fishline. Loon 41: 50-51.

Jozefik, M. 1969. [Caspian Tern, Hydroprogne caspia Pall. in Poland--the biology of migration period.] Acta Ornithol. 11: 381-443. [English translation from the Polish.]

Warner, D. W. and D. A. Beimborn. 1969. First Caspian Tern nesting in Minnesota. Loon 41: 83-84.

1968

Ludwig, J. P. 1968. Dynamics of Ring-billed Gull and Caspian Tern populations of the Great Lakes. Ph.D. thesis, Univ. Michigan/Ann Arbor, MI.

Rohwer, S. A. 1968. Second breeding record of the Caspian Tern in Florida. Fla. Nat. 41: 35.

Schwarz, R. and P. Kragenow. 1968. Zum Durchzug der Raubseeschwalbe im Naturschutzgebiet "Grasser Schwerin" im Kreis Robel/Muritz. Falke 15: 264-267. [In German.]

1967

Diem, K. L. and D. de L. Condon. 1967. Banding studies of waterbirds on the Molly Islands, Yellowstone Lake, Wyoming. Yellowstone Library and Mus. Assoc. 41 pp.

Tomialoje, L. 1967. Materialy do awifauny Polski. IV. Hydroprogne caspia (Pall.)--rybitwa wielkodzioba. [Contributions to the avifauna of Poland. IV. Hydroprogne caspia (Pall.)--Caspian Tern.] Acta Ornithol. 10: 25-82. [In Polish with English translation.]

1966

Amadon, D. 1966. The scientific name of the Caspian Tern. Ibis 108: 424-425.

Cunningham, R. L. 1966. Caspian Tern feeding on carrion. Wilson Bull. 78: 319.

Maluquer, S. and J. A. Albert. 1966. La Pagaza Piquirroja Hydroprogne caspia en el Delta del Ebro. Ardeola 11: 155.

Vaurie, C. 1966. Comments on the scientific names of the Caspian Tern and Pied Wheatear. Ibis 108: 633-634.

1965

Bezzel, E. and J. Reichholf. 1965. Vom Zug der Binnenseeschwalben *Chlidonias* und der Raubseeschwalbe *Hydroprogne caspia* in Sudbayern. Vogelwarte 23: 121-128. [In German.]

Hader, R. J. 1965. More Caspian Terns at Raleigh, North Carolina. Chat 29: 87.

Ludwig, J. P. 1965a. Biology and structure of the Caspian Tern (*Hydroprogne caspia*) population of the Great Lakes from 1896-1964. Bird-Banding 36: 217-233.

_____. 1965b. Ring-billed Gull nesting within Caspian Tern colony. Jack-Pine Warbler 43: 61.

Taro, R. 1965. Rayskia (*Hydroprogne caspia*) syyskesalla 1963 ja-64 Hauhonsel-alla. [Observations of the Caspian Tern at Hauho.] Ornis Fenn. 42: 63-67. [In Finnish with English summary.]

1964

Martini, E. 1964. Otolithen in Gewollen der Raubseeschwalbe (*Hydroprogne caspia*). [Otoliths in pellets of the Caspian Tern (*Hydroprogne caspia*).] Bonn. Zool. Beitr. 15: 59-71. [In German with English summary.]

1963

Bergman, G. 1963. Rovternen. Pp. 79-88 *in* N. Bladel (ed.). Nordens fugle i farver, Vol. 4. Munksgard, Copenhagen. [In Danish.]

Hader, R. J. 1963. Caspian Tern at Raleigh, North Carolina. Chat 27: 79-80.

Tomkins, I. R. 1963b. Skimmer-like behavior in the Royal and Caspian Terns. Auk 80: 549.

Woolfenden, G. E. and A. J. Meyerriecks. 1963. Caspian Tern breeds in Florida. Auk 80: 365-366.

1962

Ludwig, J. P. 1962b. A survey of the gull and tern populations of Lakes Huron, Michigan, and Superior. Jack-Pine Warbler 40: 104-119.

Schevareva, J. P. 1962. Neue daten uber Wiederfunde beringter Tschegraven (*Hydroprogne tschegrava* Lepechin). Migrationen der Tiere, Moskva: 92-105. [In German.]

1961

Doncev, S., A. Prostov and Z. Georgiev. 1961. Die Raubseeschwalbe, Hydroprogne tschegrava tschegrava (Lepechin, 1770), eine neue Art in der bulgarischen Ornithofauna. Izv. Zool. Inst. Bulg. Akad. N. 10: 389-391.

Dragesco, J. 1961b. Observations ethologiques des oiseaux de Banc d'Arguin. Alauda 29: 81-98. [In French.]

Lewis, C. B. 1961. Caspian Terns in Jamaica. Auk 78: 264-265.

Ludwig, C. C. and F. E. Ludwig. 1961. Herring Gulls and Caspian Terns--1960 recoveries. Inl. Bird Banding News 33: 28-29.

Ziedler, K. 1961. Raubseeschwalbe am Galbenbacher See. Falke 8: 75-78.

1960

Moltoni, E. 1960. Altre notizie riguardanti la Rondine di mare maggiore Hydroprogne caspia (Pall.) in Italia. Riv. Ital. Ornitol. 30: 197-200. [In Italian.]

Suchantke, A. 1960. Comportement de peche de la Sterne caspienne (Hydroprogne caspia) d'apres des observations en Camargue. Alauda 28: 38-44. [In French.]

Tarr, H. E. 1960. Nesting of the Caspian Tern. Austr. Bird Watcher 1: 78-81.

1959

Briche, L. 1959. Observation de Sternes caspiennes Hydroprogne caspia (Pallas) a Arras. Alauda 27: 321. [In French.]

Davidson, A. R. 1959. The Caspian Tern. Victorian Nat. 16: 21.

de Naurois, R. 1959. Premieres recherches sur l'avifaune des iles du Banc d'Arguin (Mauritanie). Alauda 27: 241-308. [In French.]

Mayaud, N. 1959. Hydroprogne caspia (Pallas) a Bayonne. Alauda 27: 234. [In French.]

Tordoff, H. B. and W. E. Southern. 1959. Caspian Tern and Black Skimmer in Newfoundland. Wilson Bull. 71: 385-386.

1958

Alcorn, E. D. 1958. Nesting of the Caspian Tern in Grays Harbor, Washington. Murrelet 39: 19-20.

Geroudet, P. 1958. Curieuse methode de peche chez la Sterne caspienne. Alauda 26: 67. [In French.]

Mayaud, N. 1958. Migration et hivernage en Afrique d'Hydroprogne caspia. Alauda 26: 151. [In French.]

Moltoni, E. 1958. La Rondine di mare maggiore Hydroprogne caspia (Pall.) in Italia. Riv. Ital. Ornitol. 28: 218-223. [In Italian.]

Pettingill, O. S., Jr. 1958b. Nesting of the Caspian Tern within a Ring-billed Gull colony. Jack-Pine Warbler 36: 183-184.

Suchantke, A. 1958. Hydroprogne caspia en Camargue. Alauda 26: 306. [In French.]

1957

Bergman, G. 1957. Analyse der "aggressiven Beugungen" und des "Herabstarrens" der Raubseeschwalbe Hydroprogne tschegrava. Ornis Fenn. 34: 113-117. [In German.]

Jakab, A. 1957. A kacagoeser feszkelese es a locser elofordulasa Fonyodon. [Appearance of the Gull-billed Tern and Caspian Tern at Fonyod (Lake Balaton).] Aquila 63/64: 284, 342. [In Hungarian and English.]

Stein-Spiess, S. 1957. A locser elso izben Erdelyben. [First occurrence of the Caspian Tern in Transylvania.] Aquila 63/64: 285, 343. [In Hungarian and English.]

Tenovuo, R. 1957. Rayskan, Hydroprogne tschegrava (Lep.), pesimisesta Peramerella. [On the breeding of the Caspian Tern in the northern Gulf of Bothnia.] Ornis Fenn. 34: 140-141. [In Finnish with English summary.]

1956

Bergman, G. 1956. Beteendestudier over ungar av skrantarna (Hydroprogne tschegrava). [On the development of the behavior in chicks of the Caspian Tern.] Var Fagelvarld 15: 223-245. [In Swedish with English summary.]

Houston, S. 1956. The Caspian Tern in Saskatchewan--with first nesting record. Blue Jay 14: 116-117.

Mayaud, N. 1956. Etude sur la migration et les zones d'hivernage des Sternes caspiennes d' Eurasie. Alauda 24: 206-218. [In French.]

Milon, P. 1956. Sternes caspiennes en Camargue. Alauda 24: 232. [In French.]

Rijsdijk, A. 1956. Een nieuwe waarneming van de Reuzenstern, Hydroprogne caspia (Pall.). Ardea 44: 243-244. [In Dutch.]

1955

Bergman, G. 1955. Die Beziehungen zwischen Bodenfarbe der Riviere und Farbe der Kucken bei Hydroprogne tschegrava und Sterna macrura. [On the color variation of the chicks of Hydroprogne tschegrava and Sterna macrura, and the influence of the ground color on the chicks' coloration.] Ornis Fenn. 32: 69-83. [In German with English and Finnish summaries.]

Gustavsson, U. and B. J. O. Wahlin. 1955. Havstrutar (Larus marinus) och skrantarnor (Hydroprogne tschegrava) vid Roxen. Var Fagelvarld 14: 123.

1954

Atkeson, T. Z., Jr. and D. C. Hulse. 1954. Northern Alabama notes on the Caspian Tern (Hydroprogne caspia). Ala. Birdlife 2: 35.

Beretzk, P. 1954. Die Raubseeschwalbe (Hydroprogne caspia [Pall.]) in Ungarn. Allattani Kozl. 44: 133-147.

Emblen, D. L. 1954. Caspian Terns nesting at San Diego Bay. Condor 56: 109-110.

Sharrock, J. T. R. 1954. Caspian Tern in Kent. Brit. Birds 47: 403-404.

Wolff, A. B. H. 1954. Waarneming van een viertal Reuzensterns, Hydroprogne caspia (Pall.), aan de zuidelijke IJsselmeerkust. Ardea 42: 345-346. [In Dutch.]

1953

Bergman, G. 1953. Verhalten und Biologie der Raubseeschwalbe (Hydroprogne tschegrava). [Behavior and biology of the Caspian Tern.] Acta Zool. Fenn. 77: 1-50. [In German.]

Blomgren, A. 1953. Skrantarnans upptradande i inlandet. Norrbottens Nat. 2: 39.

1952

Hickey, J. J. 1952. Survival studies of banded birds. U.S. Fish Wildl. Serv. Spec. Sci. Rep. Wildl. 15. 177 pp.

1950

Kux, Z. 1950. Occurrence of the Caspian Tern in South Moravia. Sylvia 11/12: 79.

Low, S. H. 1950. A twenty-two-year-old Caspian Tern. Bird-Banding 21: 115.

1949

Southern, H. H. 1949. Caspian Tern and Ring-billed Gull colonies, Green Island, Prince Edward County, Ont. Can. Field-Nat. 63: 115-116.

1947

Suchsdorff, A. 1947. Skrantarna har hackat vid insjo i Sodermanland. Var Fagelvarld 6: 162-163.

Thomas, B. L. 1947. The life cycle of _Diphyllobothrium_ _oblongatum_. J. Parasitol. 33: 107-117.

1946

Cottam, C. 1946. Late nesting of Caspian Tern in Utah. Condor 48: 94-95.

1943

Miller, A. H. 1943. Census of a colony of Caspian Terns. Condor 45: 220-225.

1942

East, B. 1942. City of the Caspians. Fauna 4: 18-21.

Ludwig, F. E. 1942. Migration of Caspian Terns in the Great Lakes area. Bird-Banding 13: 1-9.

1941

Witherby, H. F. 1941. Caspian Tern ringed in U.S.A. found in Yorkshire. Brit. Birds 34: 184.

1940

Lincoln, F. C. 1940a. An American Caspian Tern in England. Auk 57: 569.

_____. 1940b. Caspian Tern in Haiti. Auk 57: 569.

1934

Tomkins, I. 1934. A curious tern accident. Wilson Bull. 46: 128.

1932

Beardslee, C. S. 1932. Caspian Tern in Connecticut. Auk 49: 85.

Potter, J. K. 1932. Caspian Tern (_Sterna_ _caspia_ _imperator_) in Camden County, N.J. Auk 49: 476-477.

1931

DeGroot, D. S. 1931. History of a nesting colony of Caspian Terns of San Francisco Bay. Condor 33: 188-192.

1930

Kitchin, E. A. 1930. Caspian Tern added to the Washington list. Murrelet 11: 19-20.

1929

Emlen, J. T., Jr. 1929. Caspian Terns (Sterna caspia imperator) at Palmyra, N.J. Auk 46: 534.

1928

Harms, M. 1928. Das Vorkommen und die Brutvehaltnisse der Raubseeschwalbe in Estland. [The appearance and breeding circumstances of the Caspian Tern in Estland.] J. Ornithol. 76: 420-427. [In German.]

Janvrin, E. R. P. 1928. Caspian Tern on Long Island, N.Y. Auk 45: 497.

1927

Yoder, W. and J. K. Potter. 1927. Caspian Tern at Stone Harbor, N.J. Auk 44: 92.

1924

Magee, M. J. 1924. Caspian Tern (Sterna caspia) in Michigan. Auk 41: 149-150.

1923

Shufeldt, R. W. 1923. Nesting of the Caspian Tern and the Snowy Heron. Oologist 40: 174-176.

1922

Pemberton, J. R. 1922. A large tern colony in Texas. Condor 24: 37-47.

1919

O'Donoghue, C. H. and J. N. Gowanlock. 1919. Notes on the Caspian Tern (Sterna caspia) and the Parasitic Jaeger (Stercorarius parasiticus) in Manitoba. Can. Field-Nat. 33: 1-6.

1917

Bowles, J. H. 1917. Two new records for the state of Washington. Condor 19: 187.

1906

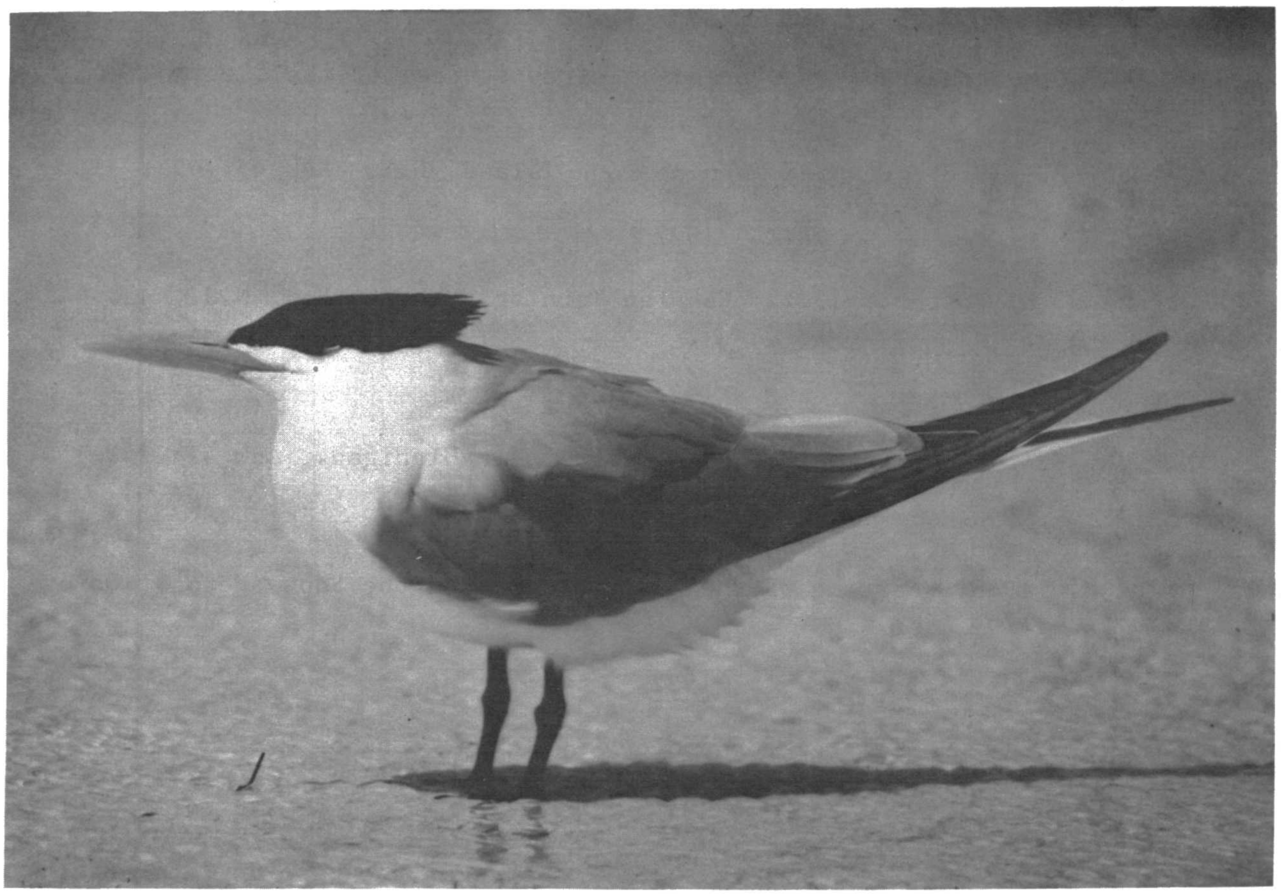
Ward, H. L. 1906. Notes on the Herring Gull and the Caspian Tern (*Larus argentatus* and *Sterna caspia*). Bull. Wis. Nat. Hist. Soc. 4: 113-134.

1898

Wustnei, C. 1898. Das Brutgebiet von *Sterna caspia*. Ornithol. Monatsber. 6: 72-73. [In German.]

1893

Van Winkle, E. 1893. Caspian or Imperial Tern. Oologist 10: 114-115.



Adult Royal Tern in breeding plumage. Photograph by Clayton Taylor.

ROYAL TERN

(Sterna maxima)

[FR: Sterne royale, GE: Rotschnabelseeschwalbe, IT: Rondine di mare reale, SP: Charran real]

GENERAL DISTRIBUTION

North America Royal Terns breed primarily in southeastern North America. They have bred occasionally, but not recently, on the Pacific coast near San Diego, California (Small 1974). To the south Royal Terns breed more regularly at Scammons Lagoon and Isla San Roque in west-central Baja California, along the coast of northwestern mainland Mexico, and offshore Mexico in the Tres Marias Islands (AOU 1957). On the Atlantic coast they breed locally from Maryland south to Duval and Brevard Counties in Florida (AOU 1957, Barbour et al. 1976, Map 13). In the Gulf of Mexico Royal Terns have bred along the northern coast of Florida and have important breeding areas off Louisiana and Texas. They also breed on Cayos Arcas and Alacran Reef off Yucatan in the southern Gulf (Paynter 1955). Royal Terns breed widely in the Caribbean, in the Bahamas and West Indies (AOU 1957, Bond 1971). Birds have straggled as far north as Nova Scotia (Godfrey 1966).

In the New World Royal Terns winter along both coasts and in the Gulf of Mexico. They winter along the Pacific coast from central California south to Mollendo, Peru, and on the Atlantic coast from North Carolina (Map 14) south to the Caribbean and as far south as Buenos Aires, Argentina (AOU 1957, Blake 1977).

World Distribution Off South America Royal Terns breed on coastal islands off Venezuela (LeCroy 1976) and on Soldado Rock, Trinidad. They may also breed along coastal Uruguay and in northern Argentina (Blake 1977). A small proportion of the total breeding population, distinguished as a separate race, *S. m. albididorsalis*, is found in the Old World. This race breeds on the Banc d'Arguin off the north coast of Mauritania (Etchecopar and Hue 1964), and winters from the Straits of Gibralter to Angola (AOU 1957, White 1965). Some have wandered as far as Mozambique on the eastern seaboard of Africa (Clancy 1970) as well as to England, Ireland (BOU 1971), and Norway (Numme 1977).

DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

North Carolina Royal Terns occur along the coasts of the Carolinas throughout the year but are less abundant from late December to mid-March (Potter et al. 1980). Repeated censuses of coastal seabirds in North Carolina in recent years have shown that large numbers of Royal Terns breed there

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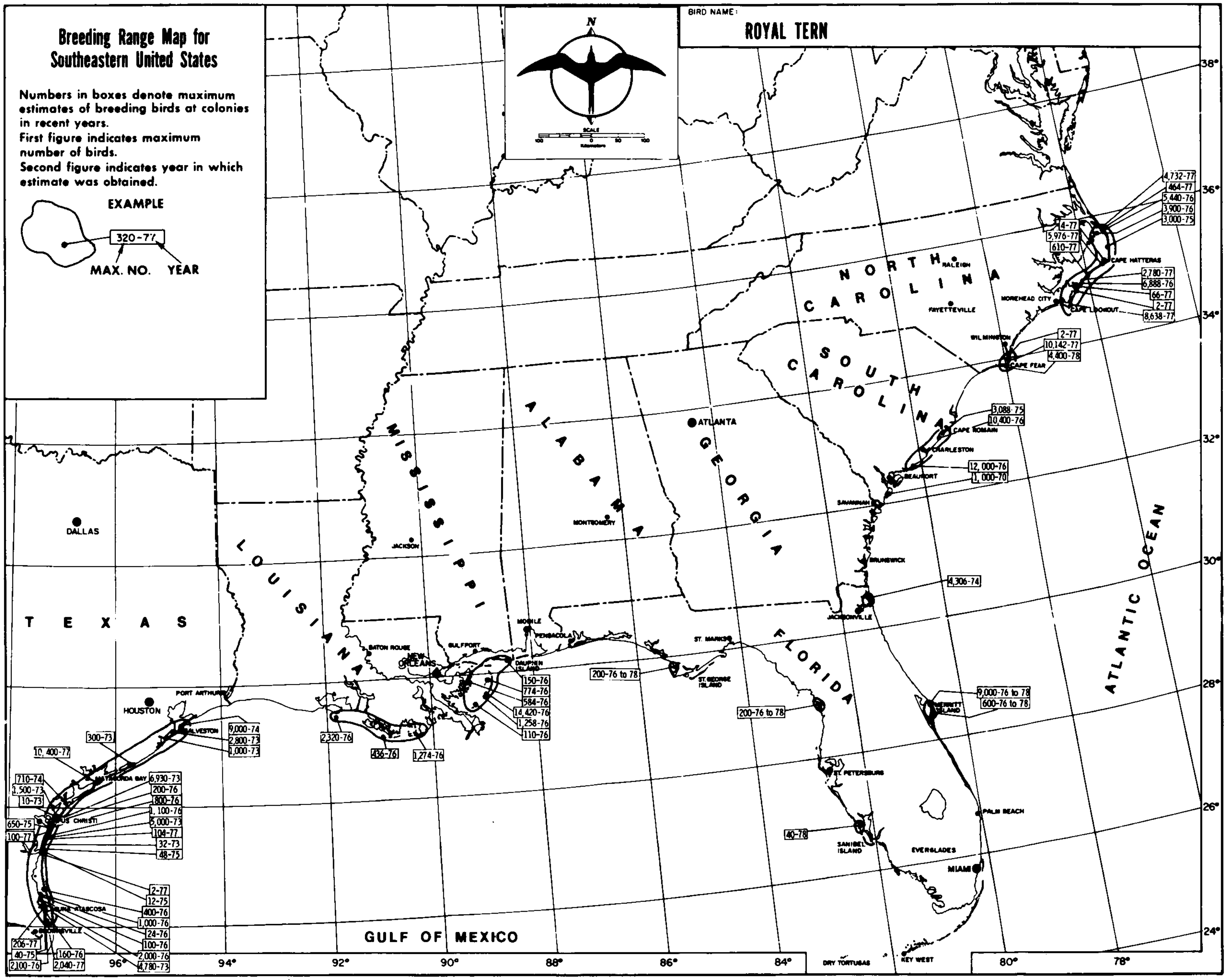
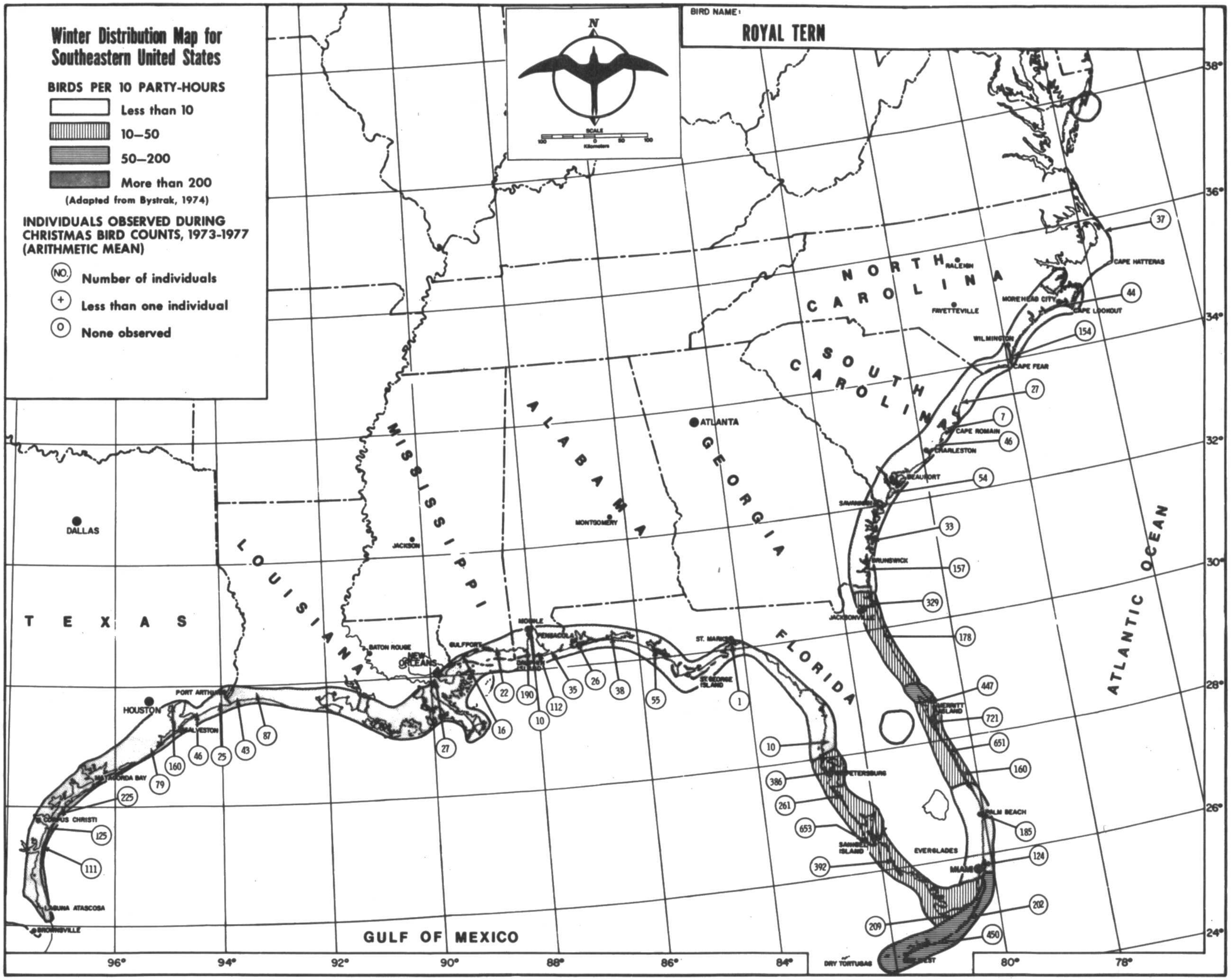
Taxonomic note: Also appears in recent literature as *Thalasseus maximus*.


Breeding Range Map for
Southeastern United States
Numbers in boxes denote maximum estimates of breeding birds at colonies in recent years.
First figure indicates maximum number of birds.
Second figure indicates year in which estimate was obtained.
EXAMPLE
320-77
MAX. NO.
YEAR
N
BIRD NAME:
ROYAL TERN
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI
LOUISIANA
TEXAS
FLORIDA
ATLANTIC OCEAN
GULF OF MEXICO
RALEIGH
FAYETTEVILLE
MOREHEAD CITY
WILMINGTON
CAPE HATTERAS
CAPE LOOKOUT
CAPE FEAR
CAPE ROMAIN
CHARLESTON
BEAUFORT
SAVANNAH
BRUNSWICK
JACKSONVILLE
ATLANTA
MONTGOMERY
JACKSON
DALLAS
HOUSTON
PORT ARTHUR
BATON ROUGE
NEW ORLEANS
GULFPORT
MOBILE
PENSACOLA
DAUPHIN ISLAND
ST. MARKS
ST. GEORGE ISLAND
MERRITT ISLAND
ST. PETERSBURG
SANIBEL ISLAND
EVERGLADES
PALM BEACH
MIAMI
KEY WEST
DRY TORTUGAS
CORPUS CHRISTI
BROWNSVILLE
4,732-77
464-77
5,440-76
3,900-76
3,000-75
4-77
5,976-77
610-77
2,780-77
6,888-76
66-77
2-77
8,638-77
2-77
10,142-77
4,400-78
3,088-75
10,400-76
12,000-76
1,000-70
4,306-74
9,000-76 to 78
600-76 to 78
200-76 to 78
200-76 to 78
40-78
150-76
774-76
584-76
14,420-76
1,258-76
110-76
2,320-76
436-76
1,274-76
9,000-74
2,800-73
1,000-73
300-73
10,400-77
710-74
1,500-73
10-73
650-75
100-77
6,930-73
200-76
800-76
1,100-76
5,000-73
104-77
32-73
48-75
2-77
12-75
400-76
1,000-76
24-76
100-76
2,000-76
4,780-73
206-77
40-75
2100-76
160-76
2,040-77
38°
36°
34°
32°
30°
28°
26°
24°
96°
94°
92°
90°
88°
86°
84°
80°
78°

Map 13

395



Winter Distribution Map for Southeastern United States
BIRDS PER 10 PARTY-HOURS
Less than 10
10–50
50–200
More than 200
(Adapted from Bystrak, 1974)
INDIVIDUALS OBSERVED DURING CHRISTMAS BIRD COUNTS, 1973-1977 (ARITHMETIC MEAN)
NO.
Number of individuals
+
Less than one individual
0
None observed
BIRD NAME:
ROYAL TERN
N
SCALE
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI
LOUISIANA
TEXAS
FLORIDA
ATLANTIC OCEAN
GULF OF MEXICO
RALEIGH
FAYETTEVILLE
CAPE HATTERAS
MOREHEAD CITY
CAPE LOOKOUT
WILMINGTON
CAPE FEAR
CAPE ROMAIN
CHARLESTON
BEAUFORT
SAVANNAH
BRUNSWICK
JACKSONVILLE
ATLANTA
MONTGOMERY
JACKSON
DALLAS
HOUSTON
PORT ARTHUR
GALVESTON
MATAGORDA BAY
CORPUS CHRISTI
LAGUNA ATASCOSA
BROWNSVILLE
BATON ROUGE
NEW ORLEANS
GULFPORT
MOBILE
PENSACOLA
ST. MARKS
ST. GEORGE ISLAND
ST. PETERSBURG
SANIBEL ISLAND
EVERGLADES
PALM BEACH
MIAMI
DRY TORTUGAS
37
44
154
27
7
46
54
33
157
329
178
447
721
651
160
185
124
202
450
209
392
653
261
386
10
1
55
38
26
35
112
10
190
22
16
27
87
43
25
46
160
79
225
125
111
38°
36°
34°
32°
30°
28°
26°
24°
96°
94°
92°
90°
88°
86°
84°
80°
78°

Map 14

(Table 42). Soots and Parnell (1975a) reported 35,334 nests present in 1973, implying a breeding population of about 70,700 birds. Data from succeeding years consistently indicate populations about half this size. Approximately 36,000 bred in North Carolina in 1975 (Parnell in Weske 1977 ms); about 32,800 bred there in 1976 (Portnoy et al. 1981); and about 33,400 bred there in 1977 (Parnell and Soots 1979 ms).

Small numbers of Royal Terns winter in North Carolina, but most migrate south. They return to the breeding sites in April and eggs are usually laid by early May. The breeding season extends from late April to early or mid-August (Parnell and Soots 1979 ms).

Parnell and Soots (1979 ms) listed six important breeding areas for Royal Terns in North Carolina: Oregon, Hatteras, and Ocracoke Inlets, the northern part of Core Sound, the channel to Barden's Inlet, and the lower Cape Fear River. The largest colony in the state in recent years was on a dredged island in the Cape Fear River (Parnell and Soots 1979 ms). It contained about 27% and 30% of the state population in 1976 and 1977, respectively. In 1978 this island contained only a few birds because the majority of this population had moved to two other islands in the river (Parnell and Soots 1979 ms).

South Carolina Royal Terns breed abundantly along the South Carolina coast and occur there throughout the year. They are most abundant from late March to early April (Sprunt and Chamberlain 1949), when populations of returning breeding birds are swelled by transients returning to colonies further north. Royal Terns are least abundant in the state from late December to late March (Sprunt and Chamberlain 1949), when most of the breeding population winters to the south.

Most nesting occurs from June through July and peak numbers of eggs usually hatch in late June and July (Sprunt and Chamberlain 1949). Blus et al. (1979) estimated that there were approximately 29,400 and 34,400 breeding Royal Terns in South Carolina in 1974 and 1975, respectively. Map 13 presents some subsequent data for individual colonies. In 1976 and 1977 the entire breeding population was found in two colonies---one on Bird Bank in Cape Romain NWR, the other on Deveaux Bank in the mouth of the North Edisto River (Blus et al. 1979, Portnoy et al. 1981).

Georgia Denton et al. (1977) reported that Royal Terns are common all year round along the Georgia coast but breed there only occasionally. Former breeding localities included Blackbeard Island and Oysterbed Island near the mouth of the Savannah River (Burleigh 1958). The last known nesting for the state occurred in 1962, when Kale found 38 nests with eggs on 23 June (Kale et al. 1965).

Florida - Atlantic Coast Royal Terns are common to abundant along the Florida Atlantic coast throughout the year. Numbers peak during the winter when local breeding populations are augmented by migrants from the large breeding colonies to the north. They have bred at several localities along the coast (Map 13), but presently nest at two localities---one in Nassau Sound, the other on dredge-spoil islands in the Banana River at Merritt Island NWR (Kale 1979 ms a).

Florida - Keys Royal Terns formerly bred abundantly in the Florida Keys, primarily in the Dry Tortugas. They last bred there in numbers in the late 1800's and, except for a single nesting attempt in 1952, have not nested there since. At present, the species is a regular visitor to the Dry Tortugas, sometimes in large numbers (Robertson 1964).

Florida - Gulf Coast Royal Terns are abundant all year along the Florida Gulf coast, but only a small number breed there at a few scattered localities (Map 13, Kale 1979 ms b). Formerly, the species was much more widespread and numerous as a breeder (Howell 1928) and its return in recent years may be related to the increase in nesting habitat made available by man-made spoil islands.

Alabama Royal Terns occur along the Alabama coast year round and are abundant summer residents (Imhof 1976b). Large concentrations are occasionally noted (Table 43), but most of the birds seen in Alabama breed elsewhere. Records of banded birds recovered in Alabama (Imhof 1976b) suggest that many of the birds observed in summer are from large breeding colonies in the Chandeleur Islands, Louisiana. Some, but probably few, of the wintering birds may be from breeding colonies along the Atlantic coast (Weske 1977 ms).

Royal Terns breed in Alabama sparingly, presumably because so little undisturbed nesting habitat is available (Imhof 1976b). The most recent nesting known to us occurred in 1958, when about 50 nests with eggs were found on Sand Island on 10 June (Imhof 1976b, Portnoy 1977).

Mississippi Royal Terns are common to abundant year round on the Mississippi coast (Burleigh 1944), but they breed there only irregularly and in small numbers. Burleigh (1944) believed that their abundance on the coast changed little from month to month, and that mid-summer flocks were no different in size than those seen in mid-winter.

The first well-documented instance of breeding by Royal Terns in Mississippi occurred in 1962, when about 500 pairs nested on Petit Bois Island (Williams 1962a). In subsequent years smaller numbers nested there, on Horn Island, and on a spoil island in Horn Island Pass. Recent populations have been small and located on the spoil island. Populations nesting there in 1976, 1977, and 1979 contained about 150, 50, and 40 birds, respectively. Eggs are present from about mid-June through mid-July and young are present through the end of July (Jackson et al. 1980).

Louisiana Found in Louisiana throughout the year, Royal Terns are one of the state's most abundant breeding marine birds. Detailed information on breeding and the size of breeding populations is incomplete and scattered, but it is clear that many thousands of these terns have bred on offshore islands for many years. Records listed by Portnoy (1977) suggest breeding populations of 10,000 to 15,000 birds from the early 1900's through the early 1970's. Reports of

10,000 to 15,000 young on Curlew Island in the Chandeleurs in June 1975, in addition to Portnoy's aerial survey in 1976 (Portnoy 1977, Table 42) indicate recent breeding populations of more than 20,000 terns. It is not clear whether populations are larger than those of earlier years because Royal Tern populations vary considerably from season to season, and because the existing data are inadequate for year to year comparisons.

In 1976 eggs were present from mid- to late April through late July and most (ca. 74%) of the breeding population was concentrated in two colonies on Curlew Island (Portnoy 1977). Two other colonies, one on Shell Keys, the other west of East Timbalier Island, contained another 17% of the breeding population. The larger colony on Curlew Island, containing about 14,420 birds, was the largest in North America in 1976 and held nearly 15% of the population breeding in the southeastern states.

Texas Like Louisiana and the Carolinas, the Texas coast is a major nesting ground for Royal Terns. These terns are abundant throughout the year in primary bays and in the open Gulf, but are less common in winter (Oberholser 1974).

The breeding season in Texas is from late March to late July and eggs have been recorded from 8 April through 18 June (Oberholser 1974). Breeding localities are evenly distributed along the Texas coast. In 1969 about 10,600 Royal Terns were found in Texas, about half on the central coast and the rest evenly divided between the northern and southern coast (Oberholser 1974). Recent censuses of breeding populations vary greatly from year to year. The average number recorded from 1973 to 1978 was about 10,960 birds (Blacklock et al. 1978, Blacklock et al. 1978 ms), but the numbers censused ranged from around 3,790 birds in 1977 to around 37,410 birds in 1978. At present the species breeds most abundantly on sparsely vegetated islands on the upper Gulf coast (Blacklock et al. 1978 ms). One of the largest recent colonies, at Sundown Island, Matagorda County, contained an average of about 8,250 breeding birds from 1973 through 1976. Another large colony at Pelican Island, Neuces County, contained about 4,570 birds during the same period.

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

Breeding Royal Terns breed primarily in North America and the Caribbean. They also breed off west Africa and may breed along the coast of South America. Most of the U.S. population, and probably more than half the world population, breeds in the southeastern United States. The principal breeding areas in the southeast are in the Carolinas and along the western part of the northern Gulf of Mexico (Table 42, Map 13).

Within the United States Royal Terns also breed in Maryland and Virginia, but total populations are small compared to those further south. In 1977, about 9,200 Royal Terns bred in Virginia and about 270 bred in Maryland (Erwin 1979a). Both states have harbored larger breeding populations in recent years. A maximum of 2,320 bred in Maryland in 1976 (Therres et al. 1978), and as many as

Table 42. Recent estimates of Royal Tern populations nesting in the southeastern United States.

State	Number found breeding in 1976 (a)	Percent of southeastern breeding population	Maximum number found breeding in recent years and year
North Carolina	32,840	33.1	ca. 36,000 (1975)
South Carolina	22,400	22.6	ca. 34,410 (1975)
Georgia	none	---	none
Florida-Atlantic Coast	4,000	4.0	ca. 8,200 (1974)
Florida-Keys	none	---	none
Florida-Gulf Coast (b)	none (?)	---	ca. 300 (1970) (c)
Alabama	none	---	ca. 100 (1958)
Mississippi	150	0.2	ca. 1,000 (1962)
Louisiana	21,180	21.4	21,180 (1976)
Texas	18,620	18.8	37,414 (1978)
	99,190		

(a) Totals rounded to the nearest 10

(b) Our data for Florida are incomplete; data for the Bird Islands, Georgia, present in Portnoy et al. (1981), apparently refer to Bird Island in Nassau Sound, Florida.

(c) Stevenson (1972b) saw numbers of both Royal and Sandwich Terns during his visit to Shell Island off Port St. Joe on 31 July 1970 and stated that "the small island was populated by about 250 Thalasseus terns ranging in age from chicks a few days old to birds that could barely fly." He thought that about two-thirds of the young were Royal Terns. Assuming that each young represented the offspring of a single pair, and lacking better information, we have assumed that there were probably not less than 300 breeding Royal Terns in this colony.

10,800 (Erwin 1979a) to 13,500 (Buckley and Buckley 1972a) bred in Virginia in 1967.

There is little information on the size of breeding populations elsewhere in the world. About 8,400 birds nested on Isla Raza, Baja California, in 1975 (Boswall and Barrett 1978), and Dragesco (1961a) estimated that 4,500 to 5,000 nests of this species were present in three colonies in Mauritania. The numbers of Royal Terns that breed in the Caribbean and Gulf of Mexico are poorly known.

Winter North American Royal Terns winter primarily in the southeastern United States, the Caribbean, and the coasts of Mexico south to Colombia and Guyana in the Atlantic, and to Ecuador and Peru in the Pacific. The status of Royal Terns elsewhere in South America is poorly known. Those nesting off

Africa regularly occur south to Angola (White 1965).

Weske's (1977 ms) preliminary account provides the most detailed information on wintering areas of birds breeding in the northern portion of their range on the Atlantic coast of North America. The primary wintering areas of most birds breeding from Virginia to South Carolina are both coasts of Florida and the eastern Antilles (Hispaniola, Cuba, and Jamaica); few winter farther west along the northern Gulf coast or farther southeast in the Caribbean. Royal Terns from the east coast also frequently winter along the Yucatan Peninsula and south along the Caribbean coast to Guyana. Colombia is apparently the main South American wintering ground for east coast Royal Terns, and a few winter on the west coast of South America in Colombia, Ecuador, and Peru. Only very small numbers of Royal Terns winter north of North Carolina's Outer Banks.

Few Royal Terns have been banded in coastal Florida or other states bordering the Gulf coast. Consequently, little is known of their dispersal and migration. Judging from Christmas Counts (Map 14), considerable numbers winter along the Texas coast.

Migration After fledging in July and August, both young and adults either remain for some time near nesting colonies in the northern part of the Atlantic range, or rapidly depart from the area (Weske 1977 ms). Young birds from colonies in Maryland, Virginia, and North Carolina tend to remain near the breeding areas or disperse north to New Jersey and Delaware; they do not occur to the south in any numbers until October. Young from colonies in South Carolina, on the other hand, move either north or south, but by September most are moving south and arriving in the wintering areas. Adults usually move south after breeding and only occasionally wander to the north. Few data are available on concentrations of migrant or wintering Royal Terns. Some are listed in Table 43.

HABITAT

Nesting Royal Terns nest colonially, mostly on isolated, sparsely vegetated barrier islands, spits, and small islets. Buckley and Buckley (1972a) pointed out four general characteristics of sites in Virginia and North Carolina: (1) absence of four-legged predators; (2) isolation from disturbance combined with excellent visibility; (3) proximity to areas of extensive shallows; and (4) proximity to inlets between bay and ocean.

In 7 out of 8 colonies studied by the Buckleys, the edge of the colony was within 10 m (33 ft) of water; the edge of the eighth colony was 30 m (98 ft) from the water's edge. Most of the colonies were no more than 0.3 m above mean high water. The highest colonies above water were 3 m (10 ft) and 1-5 m (3-16 ft) high at Fisherman's Island, Virginia, and at Hatteras Inlet, North Carolina, respectively.

The nest substrate for most nests was bare sand; one colony was among oystershell over sand, and some nests were found on high wrack and vegetation.

Table 43. Peak concentrations of wintering and migrant Royal Terns in the coastal southeastern United States.

Date seen		Number seen	Locality	Source
			NORTH CAROLINA	
1965	27 Mar.	ca. 700	Cape Hatteras	Parnell 1965b
			FLORIDA	
1955	1 Jan.	1,172	Key West	Stevenson 1955b
1906	31 May	ca. 3,000	Passage Key	Howell 1928
1962	12 Oct.	8,800	flying south along coast of St. John's Co.	Stevenson 1963a
1913	15 Oct.	2,500-3,000	Mosquito Inlet	Howell 1928
			ALABAMA	
1965	2 Jan.	572	Dauphin Island	Imhof 1976b
1958	16 May	4,200+	Dauphin Island	Imhof 1976b
			MISSISSIPPI	
1960	8 Sep.	450	Pass Christian	Gandy and Turcotte 1970
1977	1st wk Sep.	2,000	Marsh Point	Weber and Jackson 1978
1960	22 Sep.	400	Gulfport	Gandy and Turcotte 1970

Differences in substrate had no effect on average maximum density of nests. At one colony an average of 7.5 nests/sq m (74 nests/100 sq ft) was found for nests on sand compared to 7.3 nests/sq m (68 nests/100 sq ft) for nests on wrack.

Habitats used for nesting in the southeastern United States vary depending on what is available and the degree to which they have been developed. In North Carolina, Royal Terns formerly nested primarily on natural beaches and shoals associated with inlets, but in recent years have shown a strong preference for dredge-spoil islands. In 1973 and 1977, 93% and 92% of the breeding population were on dredge-spoil islands (Soots and Parnell 1975a, Parnell and Soots 1979 ms). Weske's (1977 ms) incomplete survey of North Carolina colonies in 1975 and 1976 revealed that 82% and 78% of the breeding birds were found nesting on dredge-spoil islands in each of the two years; the rest were nesting on natural bay islands. In North Carolina, Royal Terns typically nest in areas of bare or nearly bare sand, or on sand and shell (Parnell and Soots 1979 ms).

Colonies elsewhere in the southeast are in similar sites. Recent colonies in Florida and Mississippi have been mostly on spoil islands, while most birds in Louisiana nest on barrier beaches in the Chandeleur Islands. Royal Terns in Texas nest on both natural and spoil islands, but a large proportion of sites recorded in recent years have been on dredge-spoil islands.

Like several other species that frequently lose colonies to storm tides, Royal Terns vary in their degree of site tenacity. Some sites may be used year after year, but others that seem equally favorable may be used infrequently or not at all. Choice of sites within a colony may vary with the age of the bird. Preliminary results of banding studies suggested to Weske (1977 ms) that older, more experienced, Royal Terns nest earlier and choose more desirable sites (i.e., on higher ground and less exposed to flooding) than do younger terns.

Feeding Many observers (Howell 1928, Barbour and Schreiber 1978) have remarked that Royal Terns are predominantly inshore feeders. Rowlett (1980) reported that Royal Terns in the northern Chesapeake Bight forage over shallow coastal waters, usually within 20 km (12 mi) of shore. Buckley and Buckley (1972a) noted that breeding birds in Virginia and North Carolina consistently feed inshore and apparently prefer large shallow bays, shallow waters around inlets, and areas offshore just beyond the breakers along barrier beaches. Some individuals may forage long distances from their colony sites, however. The Buckleys frequently saw Royal Terns that had been marked at the colony at Fisherman's Island, Virginia, 24-40 km (15-25 mi) south and about 65 km (40 mi) northeast of the breeding site. Erwin (1977a) studied feeding ecology of this species at Fisherman's Island and at Metomkin Island, Virginia, and found that open bay and beach-inlet areas were preferred feeding areas. Tidal creeks and tidal and marsh pools were used much less often.

Nonbreeding and Offshore Royal Terns away from their breeding sites are found in harbors, estuaries, shoals along the coast, and near the mouths of rivers. They usually occur inshore, but on occasion may be found well out to sea. Nonbreeding birds along coasts are usually seen in small numbers (Howell 1928, Burleigh 1958), but they occasionally occur in large congregations. Kale (1979 ms b) noted reports of Royal Terns 80-90 mi (129-145 km) off Pinellas County, Florida, in February and April, as well as "hundreds" 80 mi (129 km) west of Naples in November. Buckley and Buckley (1972a) remarked that this species remains near land, whether wandering north of its breeding area or on the wintering grounds in Florida or in the Caribbean. They noted that these terns "congregate almost exclusively on large bars and shoals at inlets...", and stated that Royal Terns regularly move 20-30 km (12-19 mi) up tidal rivers running into the Chesapeake Bay.

FOOD AND FEEDING BEHAVIOR

Royal Terns feed largely by diving and seizing fish with their bill. At Padre Island, Texas, these terns varied their dives from steep plunges in which the body was completely submerged, to short dives in which only the belly and head were submerged (Zusi 1962, pers. comm.). Zusi noted that these terns only dive beneath the surface for short distances, probably seldom more than 2 ft (0.6 m).

Royal Terns also obtain food by swooping to the surface of the water and seizing prey with the bill, by scavenging food from behind fishing boats, and by stealing food from other Royal Terns (Zusi 1962).

Feeding activity at the breeding areas is more a function of tide than time; the largest numbers of birds fed at half-tide on an incoming tide at Fisherman's Island, Virginia (Buckley and Buckley 1972a). Most Royal Terns at Fisherman's Island fed alone or in groups of two to three birds, but larger flocks formed over schools of fish. Foraging terns usually flew 5-10 m (16-33 ft) over the water parallel to the beach for several hundred meters and often turned to retrace their course. Royal Terns at Padre Island, Texas foraged solitarily or in loose flocks 15-40 ft (5-12 m) above the water (Zusi 1962, pers. comm.). Erwin (1977a) reported that terns at one colony caught fish at a rate of 0.17 fish/minute.

Buckley and Buckley (1974) compared the feeding ecology of adult and juvenile Royal Terns wintering in the Netherlands Antilles at Bonaire. They found that adults fed more efficiently than juveniles, although there was no great difference between age groups in the initial success with which food was captured. Juveniles caught fish on 29 of 77 dives and adults caught fish on 32 of 85 dives. Juveniles dropped their prey much more frequently than the adults, however, and fed more slowly (adults averaged 0.605 dives/min; juveniles 0.365 dives/min). Juveniles were also more likely to hover in place without diving, and they more frequently failed to complete dives. As a result, the number of fish eaten per minute by adults was 1.6 times greater than by juveniles.

The Buckleys also noted that wintering adults tend to avoid other adults when feeding and usually forage alone or with juveniles. Juveniles forage alone frequently, but feed with other juveniles more frequently than adults feed with other adults. Observations of the proportion of different age-groups in roosting birds seen throughout the day led the Buckleys to suggest that adults feed more than juveniles early in the day, from before daylight to after 0900, and that juveniles do most of their fishing later, between 0900 and 1200.

Differences in feeding techniques between adult and juvenile Royal Terns were also noted by the Buckleys. They stated that "adults hovered precisely over the intended dive, then plunged neatly and rapidly, leaving the water directly after the dive, whether successful or not." Juveniles "repeatedly circled back and forth over an area, making many intention movements to plunge and often aborting dives at any point between the top and the water surface." Juveniles also tended to make dives at oblique angles to the water while adults tended to make vertical dives. The Buckleys believed that adults forage at greater heights over the water than do juveniles, but they were unable to obtain quantitative data to test this hypothesis.

The diet of Royal Terns is poorly known for many parts of their range, but most reports have indicated that their food consists almost entirely of fish of a wide variety of species (Erwin 1977a, Blus et al. 1979). McAtee and Beal (1912) reported that Royal Terns ate yellow perch (Perca flavescens) in North Carolina and fed upon menhaden (Brevoortia tyrannus) in Alabama and Georgia. Royal Terns obtained in Florida in February, August, and from October through December had fed on menhaden and those collected in March had eaten bluefish (Pomatomus saltatrix).

Blus et al. (1979) presented data on the stomach contents of 60 Royal Terns collected along the south Atlantic and Gulf coasts of the United States from 1904 to 1923. These data incorporate some of the information presented by McAtee and Beal, but also contain supplementary information. Fish occurring most frequently in the stomachs of the terns were menhaden (57.4%), anchovies (Anchoviella spp. - 5.9%), bluefish (4.4%), and silversides (Menidia spp. - 2.9%). Shrimp (Penaeus spp.) also were found in 16.2% of the stomachs.

Buckley and Buckley (1972a) noted that blue crabs (Callinectes sapidus) are an important food source for terns in Virginia. Blus et al. (1979), however, found no evidence that crabs are a significant dietary item at colonies in South Carolina.

Other foods eaten at colonies in North Carolina and Virgina include squid (Loligo sp.), shrimp (Crangon? sp.), and fish. Most fish brought to colonies in this area are 5-10 cm (2.0-3.9 in) long. Adults occasionally bring fish too large for the chick to eat (Buckley and Buckley 1972a). Erwin (1977a) reported that the mean weight of fresh prey found in colonies in Virginia was 15.4 g (0.54 oz). Fish brought most commonly to colonies in Virginia and North Carolina are silversides, killifishes (Fundulus), anchovies, menhaden, toadfishes (Opsanus), pipefishes (Syngnathus), jacks (Caranx), flounders (Pleuronectidae), and sand lance (Ammodytes) (Buckley and Buckley 1972a; F. Buckley, pers. comm.).

Loftin (1977) reported on food obtained from chicks in a mixed Royal Tern-Sandwich Tern colony at Bird Island, Nassau Sound, Florida in late July 1976. Some of this material may have come from the latter species, but most came from young Royal Terns. Most of the food items (97.5%) eaten by these birds were fish, but a few shrimp (Penaeus sp. - 0.4%) and squid (Illex illecebrosus - 2.1%) were also ingested. The most important fish in the diet was the Atlantic croaker (Micropogonias undulatus), which made up 91.8% of the food eaten. Menhaden made up only 2.1% of the food items, and none of the other species eaten (Atlantic bumper [Chloroscombrus chrysurus], jacks [Caranx sp.], striped anchovy [Anchoa hepsetus], shad [Alosa sp.], and cusk-eels [Ophidiidae]) made up as much as 1.5% of the diet.

IMPORTANT BIOLOGICAL PARAMETERS

Egg Laying Scattered information in the literature suggests that northern populations of Royal Terns in the southeastern United States tend to lay eggs later than those farther south. Judging from egg dates given by Bent (1921), as well as from studies conducted by Buckley and Buckley (1972a), Blus et al. (1979), and others, egg laying in the Carolinas occurs between late April and early August. Egg laying was evenly spread over a 1-2 month period in Virginia (Buckley and Buckley 1972a). Probably most laying in most years occurs from mid-May to late June. Most egg laying in Louisiana and Texas occurs from late April or early May (Oberholser 1974, Chaney et al. 1978) to mid-June, but eggs may be present through late July (Portnoy 1977).

Royal Terns lay their eggs in large, dense colonies. One colony observed at Royal Shoal, North Carolina, in June 1939 contained 73 nests in 100 sq ft (7.9 nests/sq m) (Pearson et al. 1942). Buckley and Buckley (1972a) reported that colonies at Fishermans's Island, Virginia, had an average maximum nest density of 6.8 nests/sq m (63 nests/100 sq ft) in 1967, and a density of 7.4 nests/sq m (68 nests/100 sq ft) in 1968.

Mean Clutch Size The number of eggs found in a Royal Tern nest varies from one to four, but most birds lay only one egg. The mean clutch size apparently varies little from one part of the breeding range to another (Table 44).

Table 44. Mean clutch sizes reported for the Royal Tern (a).

Mean clutch size	Number of clutches	Percent of nests one egg	Locality and year of observation	Source
1.03	367	97.3	Virginia, Fisherman's Is., 1968	Buckley and Buckley 1972a
1.01	911	98.6	Virginia & North Carolina, 1967-69	Buckley and Buckley 1972a
1.02	31,369	97.7	South Carolina, 1970-1977 (b)	Blus et al. 1979
1.02	296	98.0	Georgia, Little Egg Island, 1961	Kale et al. 1965
1.05	38	94.7	Georgia, Little Egg Island, 1962	Kale et al. 1965
1.02	85	97.7	Texas, Galveston Bay, 1977	Chaney et al. 1978

(a) Some of these figures are derived from counts of nest contents during short-term visits. They may not adequately represent clutch size for the population because some birds may still have been laying eggs.
(b) Mean clutch size calculated from figures provided by Blus et al. (1979).

Incubation Period Chaney et al. (1978) reported that the incubation period was 28-31 days for Royal Terns in Texas, but they provided no other details. Buckley and Buckley (1972a) did not have precise information on the incubation period, but they believed that most incubation periods are about 30-31 days.

Hatching Success Eggs hatched at 69% of 313 nests in South Carolina during the mid-1970's. Figures for hatching success ranged from 49% to 80% at different colonies (Blus et al. 1979). Sixty-nine of 87 (79.3%) eggs hatched in 85 nests in Galveston Bay, Texas, in 1977 (Chaney et al. 1978).

Age at Fledging Age at first flight is not known precisely. Buckley and Buckley (1972a) noted that birds that hatched on 26 June at one colony in Virginia began to fly on 21 July, 25 days later. Young Royal Terns, like many other species of terns, remain partially dependent on their parents for food for some time after they can fly well enough to forage for themselves. Adults have been seen feeding young in Peru in December and early January (Ashmole and Tovar 1968), and Buckley and Buckley (1972a) observed similar feeding in fall and mid-winter in areas along the Atlantic coast, in mid-winter in Puerto Rico, and in February and March in the Netherlands Antilles.

Fledging Success Few precise figures on fledging success (expressed either as the number of eggs laid that fledged young or as the number of hatched eggs that produced young) are available. Most studies estimated productivity based on the probable number of young that departed from a breeding colony, and presented the data as the number of young produced per pair. Few studies distinguished between birds produced as a result of initial nesting attempts and those resulting from subsequent attempts. Blus et al. (1979) estimated that 0.0 to 0.50 young fledged per nest at 10 colonies observed in South Carolina from 1972 to 1976. In six of the colonies the number of young produced per nest ranged from 0.36 to 0.44. (These figures include young Sandwich Terns present in some of the colonies.)

Mortality of Eggs and Young Flooding of nesting colonies is the primary source of nesting mortality in much of the southeastern United States. Weske (1977 ms) considered flooding caused by summer storms the greatest hazard to nesting terns in the Delmarva area, and the most important cause of egg loss in South Carolina during the 1970's. The extent to which individual colonies in South Carolina were affected by flooding varied widely, with losses of as little as 5% at one colony to losses of about 90% at another (Blus et al. 1979). Blus et al. (1979) also noted an instance of total nesting failure due to flooding.

Because Royal Terns usually nest on islands free of ground predators, these animals are seldom a source of egg mortality. Avian predators are a more serious problem. Buckley and Buckley (1972a) considered Laughing Gulls the only serious predators of tern eggs at colonies in Virginia and North Carolina, although other potential avian predators were sometimes present. In South Carolina, Laughing Gulls destroyed about 0.1% of the eggs during studies conducted from 1970 to 1977 (Blus et al. 1979). Blus et al. believed that this loss was largely the result of human disturbance of the colonies. Neither Herring Gulls nor Fish Crows (*Corvus ossifragus*) caused severe egg loss at colonies in Virginia and North Carolina. An immature Herring Gull preyed upon some eggs at one colony in South Carolina, but rats (*Rattus* sp.) were the most serious predators and eliminated several subcolonies.

Although Laughing Gulls may cause considerable egg loss, they constitute little or no hazard to young chicks (Buckley and Buckley 1972a, Blus et al. 1979). At colonies in Virginia and North Carolina, these gulls seize disgorged or abandoned fish but have never been seen seizing young terns (Buckley and Buckley 1972a).

Renesting Some Royal Terns relay if their nests are lost early in the breeding season. The age of the breeding bird and the stage of development of the eggs when lost may influence the extent of replacement. Beckett (1966) indicated that birds nesting on Devaux Bank, South Carolina, might relay once or twice, but knew of only four instances that represented a fourth nesting attempt during a single breeding season.

Age at First Breeding No detailed information on the age at which young Royal Terns first breed is available. Buckley and Buckley (1974) believed that Royal Terns do not breed until they are at least two or three years old. A preliminary report of work done along the Atlantic coast (Scott et al. 1978) indicated that only a small proportion of the Royal Terns breeding in Virginia breeds at three years of age and that the numbers doing so varies considerably from year to year. Most four-year-olds breed and make up the largest year class in the breeding population.

Maximum Natural Longevity The oldest known Royal Tern was a young bird banded in Maryland that was recaptured in Virginia 17 years later (Clapp et al. 1982a).

Weight Weights of Royal Terns are presented in Table 45.

SUSCEPTIBILITY TO OIL POLLUTION

Blus et al. (1979) thought that Royal Terns in South Carolina were unaffected by pollution or environmental disturbance. However, they believed that increased harvest of fish and offshore oil drilling might threaten Royal and Sandwich Tern populations.

Despite their feeding habits and large concentrations, there is little evidence that Royal Terns are highly susceptible to oil pollution. Although large numbers have been banded in the United States, only five records in the files of the Bird Banding Laboratory indicate that the recovery was attributed to oil. Three of these birds were recovered in Florida, one in Louisiana, and one in Jamaica. F. Buckley (pers. comm.) has also seen oiled Royal Terns in Virginia, North Carolina, and Texas. The wings of the first Royal Tern obtained in Britain (Kennedy 1955) were somewhat oiled, but this bird had been dead a long time before it was found and could easily have been oiled after death.

A preponderance of the world's Royal Terns breed in the southeastern United States; most nest in a few large colonies. In 1976 five colonies in the southeastern United States contained almost half of the Royal Tern population nesting in the eastern U.S. These were: Curlew Island in Louisiana, Deveaux Bank and Bird Banks in South Carolina, a colony in the Cape Fear River, North Carolina, and one at Sundown Island in Texas. Although this species may suffer little direct mortality from oil spills away from the breeding areas, primary and secondary effects of oil pollution in the vicinity of major colonies may have a disproportionately greater effect on the overall population of the species than for other marine birds whose breeding populations are not as lo-

Table 45. Weights (in grams) of Royal Terns (a).

Mean weight	Range	Number of weights	Sample and season	Area	Source
461	374-532	24	adults	Texas	Zusi 1962, pers. comm.
422.0	358-486	9	adults, May-June	Texas	Maedgen et al. 1982
440	---	6	males	Florida	Hartman 1955
541	---	1	male, late Apr.	Baja California	this paper
317	---	1	emaciated male	South Carolina	Locke et al. 1974
451	---	9	females	Florida	Hartman 1955
509.7	480-540	3	females, late	Baja California	this paper
492		1	female, mid-Feb.	Alabama	Stewart and Skinner 1967
489	---	5	ca. late Sep.	California	Grinnell 1919
300+	---	1	fledging chick	North Carolina	Buckley and Buckley 1972a
56.8	50-62	4	newly hatched chicks	North Carolina	Buckley and Buckley 1972a
52.9	50-58	7	newly hatched chicks (dry)	North Carolina	Buckley and Buckley 1972a
64.4	58.0-70.0	25	incubated eggs	North Carolina	Buckley and Buckley 1972a; F. Buckley, pers. comm.

(a) Figures for range from Meadgen et al. are the mean $\pm$ 2 SD.

calized. Destruction of inshore feeding grounds near colonies by massive oil spills and destruction of available nesting habitat as a result of onshore development could severely effect the reproductive success of such colonies, and the well-being of the species itself. Proposed activities in the vicinity of major colonies should be scrutinized carefully before the development of petroleum or other resources continues.

BIBLIOGRAPHY

1983

Vleck, C. M., D. Vleck, H. Rahn and C. V. Paganelli. 1983. Nest microclimate, water-vapor conductance, and water loss in heron and tern eggs. Auk 100: 76-83.

1982

King, K. A., C. A. LeFever and B. M. Mulhern. 1982. Organochlorine and metal residues in Royal Terns nesting on the central Texas coast. (Abstract only.) Colonial Waterbirds 5: 177.

Loftin, R. W. 1982. Diet of Black Skimmers and Royal Terns in northeastern Florida. Fla. Field Nat. 10: 19-20.

Maedgen, J. L., C. S. Hacker, G. D. Schroder and F. W. Weir. 1982. Bioaccumulation of lead and cadmium in the Royal Tern and Sandwich Tern. Arch. Environ. Contam. Toxicol. 11: 99-102.

1981

Grant, G. S. 1981. Belly-soaking by incubating Common, Sandwich, and Royal Terns. J. Field Ornithol. 52: 244.

Kilham, L. 1981. Courtship feeding and copulation of Royal Terns. Wilson Bull. 93: 390-391.

Sinclair, J. C. and D. A. Turner. 1981. First sight record of the Royal Tern *Sterna maxima* in southern Africa. Cormorant 9: 41.

1980

Jacobson, E. R., B. L. Raphael, H. R. Mguyen, E. C. Greiner and T. Gross. 1980. Avian pox infection, aspergillosis and renal trematodiasis in a Royal Tern. J. Wildl. Dis. 16: 627-631.

1979

Blus, L. J., R. M. Prouty and B. S. Neely, Jr. 1979. Relation of environmental factors to breeding status of Royal and Sandwich Terns in South Carolina, USA. Biol. Conserv. 16: 301-320.

Loftin, R. W. and A. Smith. 1979. A Royal Tern of known age and origin in interior of Georgia. Oriole 44: 17.

Loftin, R. W. and S. Sutton. 1979. Ruddy Turnstones destroy Royal Tern colony. Wilson Bull. 91: 133-135.

Villa-R., B. 1979. Watching and scientific research of the seabirds in Isla Rasa, Baja California 1979 season. (Abstract only.) Pac. Seabird Group Bull. 6: 33.

Vincente, V. P. 1979. The occurrence of a nesting colony of the Royal Tern, Sterna (Thalasseus) maxima on the south coast of Puerto Rico. Am. Birds 33: 147.

1978

Barbour, D. B. and R. W. Schreiber. 1978. Species of special concern. Royal Tern. Pp. 91-92 in H. W. Kale, II (ed.). Rare and endangered biota of Florida. Vol. 2. Birds. Univ. Presses of Florida, Gainesville, FL.

Boswall, J. and M. Barrett. 1978. Notes on the breeding birds of Isla Raza, Baja California. West. Birds 9: 93-108.

Chaney, A. H., B. R. Chapman, J. P. Karges, D. A. Nelson, R. R. Schmidt and L. C. Thebeau. 1978. Use of dredged material islands by colonial seabirds and wading birds in Texas. U.S. Army Waterways Exp. Stn., Vicksburg, MS. Tech. Rep. D-78-8. 170 [and 146] pp.

Erwin, R. M. 1978b. Coloniality in terns: the role of social feeding. Condor 80: 211-215.

Scott, T. G., P. H. Eschmeyer, and H. C. Schultz (eds.). 1978. Fisheries and wildlife research 1978. U.S. Fish Wildl. Serv., Washington, DC. iv and 170 pp.

Spaans, A. L. 1978. Status of terns along the Surinam coast. Bird-Banding 49: 66-76.

Therres, G. D., J. S. Weske and M. A. Byrd. 1978. Breeding status of Royal Tern, Gull-billed Tern, and Black Skimmer in Maryland. Md. Birdlife 34: 75-77.

1977

Blus, L. J., L. N. Locke and C. J. Stafford. 1977. Ruptured-yolk peritonitis and organochlorine residues in a Royal Tern. Avian Dis. 21: 445-447.

Buckley, P. A. and F. G. Buckley. 1977b. Hexagonal packing of Royal Tern nests. Auk 94: 36-43.

Erwin, R. M. 1977a. Foraging and breeding adaptations to different food regimes in three seabirds: the Common Tern, Sterna hirundo, Royal Tern, Sterna maxima, and Black Skimmer, Rynchops niger. Ecology 58: 389-397.

Loftin, R. W. 1977. A tern prey sample. Fla. Field Nat. 5: 47-48.

Numme, G. 1977. Kongeterne i Vestfold, en ny art for Norge. [Royal Tern in Vestfold, first record in Norway.] Sterna 16: 93-97. [In Norwegian with English summary.]

Weske, J. S. 1977 ms. The status, dispersal, and survival of the Royal Tern (*Sterna maxima*). Unpubl. Prog. Rep., Natl. Fish Wildl. Lab., Natl. Mus. Nat. Hist., Washington, D.C. 22 pp.

1976

Barbour, D. B., S. A. Nesbitt and D. T. Gilbert. 1976. A second recent Royal Tern nesting colony on the Gulf coast of Florida. Fla. Field Nat. 4: 9-10.

Buckley, P. A. and F. G. Buckley. 1976b. Late blooming terns. Nat. Hist. 85: 46-55.

1975

Schreiber, E. A. and R. W. Schreiber. 1975. Royal Tern nesting on west-coast peninsular Florida. Fla. Field Nat. 3: 46-47.

1974

Buckley, F. G. and P. A. Buckley. 1974. Comparative feeding ecology of wintering adult and juvenile Royal Terns (Aves: Laridae, Sterninae). Ecology 55: 1053-1063.

Locke, L. N., L. J. Blus and E. Cromartie. 1974. Aspergillosis in a Royal Tern from Cape Romain National Wildlife Refuge, S.C. Chat 38: 24-25.

1973

van Velzen, W. T. and R. de Benedict. 1973. Recoveries of Royal Terns banded in Virginia. Part II. Central and South America. Ring 7: 38-40.

1972

Buckley, F. G. and P. A. Buckley. 1972a. The breeding ecology of Royal Terns *Sterna* (*Thalasseus*) *maxima maxima*. Ibis 114: 344-359.

Buckley, P. A. and F. G. Buckley. 1972b. Individual egg and chick recognition by adult Royal Terns (*Sterna maxima maxima*). Anim. Behav. 20: 457-462.

Stevenson, H. C. 1972b. Recent breeding of the Sandwich Tern (*Thalasseus sandvichensis*) in Florida. Fla. Nat. 45: 94-95.

van Velzen, W. T. and R. de Benedict. 1972. Recoveries of Royal Terns banded in Virginia. Part I. The Caribbean. Raven 43: 39-41.

1971

Escalante, R. 1971. El gaviotin real en la Argentina. Neotropica 17: 101-104. [In Spanish.]

van Velzen, W. T. 1971. Recoveries of Royal Terns banded in the Carolinas. Chat 35: 64-66.

1970

Buckley, P. A. and F. G. Buckley. 1970. Color variation in the soft parts and down of Royal Tern chicks. Auk 87: 1-13.

Buckley, P. A. and J. P. Hailman. 1970. Black-headed Gull and five species of terns skimming water. Brit. Birds 63: 210-212.

Clancey, P. A. 1970. Miscellaneous taxonomic notes on African birds. XXIX. The Royal Tern *Sterna maxima* Boddaert in South-Eastern Africa. Durban Mus. Novit. 8: 375-377.

Haverschmidt, F. 1970. Notes on the Royal Tern in Surinam. Condor 72: 246.

1969

Buckley, P. A. and F. G. Buckley. 1969. Juvenile Royal Tern killing a downy conspecific. Ardea 58: 95-96.

Valentine, J. M., Jr. 1969. Royal and Sandwich Terns of the Chandeleur Islands. La. Ornithol. Soc. News 51: 3-4.

1968

Ashmole, N. P. and H. Tovar. 1968. Prolonged parental care in Royal Terns and other birds. Auk 85: 90-100.

Davenport, M. and J. N. Hollyer. 1968. Royal Tern in Kent. Brit. Birds 61: 559-561.

Escalante, R. 1968. Notes on the Royal Tern in Uruguay. Condor 70: 243-247.

Eyster, M. B. 1968. Birds of the Chandeleur Islands. La. Ornithol. Soc. News 49: 5-7.

van Velzen, W. T. 1968. The status and dispersal of Virginia Royal Terns. Raven 39: 55-60.

1966

van Velzen, W. T. 1966. Royal Tern recovery from Tiger Shark. EBBA News 29: 210.

1965

ffrench, R. and C. T. Collins. 1965. Royal and Cayenne Terns breeding in Trinidad, West Indies. Auk 82: 277.

Hopkins, M., Jr. 1965. Banded Royal Tern recovered at Sapelo Island, Georgia. Oriole 30: 81.

Kale, H. W., II, G. W. Sciple and I. R. Tomkins. 1965. The Royal Tern colony of Little Egg Island, Georgia. Bird-Banding 36: 21-27.

1963

Penner, L. R. and B. Fried. 1963. Philopthalmos regeneri sp.--an ocular trematode from birds. J. Parasitol. 49: 974-977.

Tomkins, I. R. 1963a. A Royal Tern choked by a fish. Wilson Bull. 75: 198.

_____. 1963b. Skimmer-like behavior in the Royal and Caspian Terns. Auk 80: 549.

Voous, K. H. 1963. Tern colonies in Aruba, Curacao, and Bonaire, South Caribbean Sea. Proc. Internatl. Ornithol. Congr. 13: 1214-1216.

1962

Sciple, G. W. 1962. Flight-pair display of Royal Terns. Oriole 27: 43-45.

Williams, L. E. 1962. A summer visit to the Chandeleurs. La. Ornithol. Soc. News 31: 2-3.

1961

Dragesco, J. 1961a. La Sterne Royale. Sci. Nat. 46: 1-4. [In French.]

_____. 1961b. Observations ethologiques sur les oiseaux du Banc d'Arguin. Alauda 29: 81-98. [In French.]

1960

Weske, J. S. 1960. Unusual terns blown to Maine. Maine Field Nat. 16: 89.

1959

de Naurois, R. 1959. Premieres recherches sur l'avifaune des iles du Banc d'Arguin (Mauritanie). Alauda 27: 241-308. [In French.]

Heim de Balsac, H. and N. Mayaud. 1959. Voyage de R. de Naurois aux iles de labaie et du Banc d'Arguin. Une enigme eclaircie. Alauda 27: 144-147.

1958

Christmas, J. Y. 1958. An observation of luminosity in marine birds. Auk 75: 224.

Kale, H. W. and J. M. Teal. 1958. Royal Tern nesting on Little Egg Island. Oriole 23: 36-37.

1955

Kennedy, P. J. 1955. Royal Tern in Dublin: a new British bird. Brit. Birds 48: 116-117.

1953

Penner, L. H. 1953. The biology of a marine dermatitis-producing schistosome cercaria from Batillaria minima (Gmelin). J. Parasitol. 39: 20.

1952

Hallman, R. C. 1952. Royal Tern nesting near Port St. Joe. Fla. Nat. 25: 38-39.

1946

Fischer, R. B. 1946. Royal Terns on Long Island. Proc. Linn. Soc. N.Y. 54-57: 47-48.

1944

Denton, J. F. 1944. Royal Tern at Augusta. Oriole 9: 36-37.

1940

Grey, J. 1940. Banding Royal Terns. Chat 4: 107-109.

1939

Brimley, H. H. 1939. The Royal Terns of Royal Shoal. Chat 3: 70.

Chamberlain, E. B. 1939. Leg color in Royal Terns. Auk 56: 64-67.

1937

Griscom, L. 1937. Royal Tern in Massachusetts. Auk 54: 206.

1936

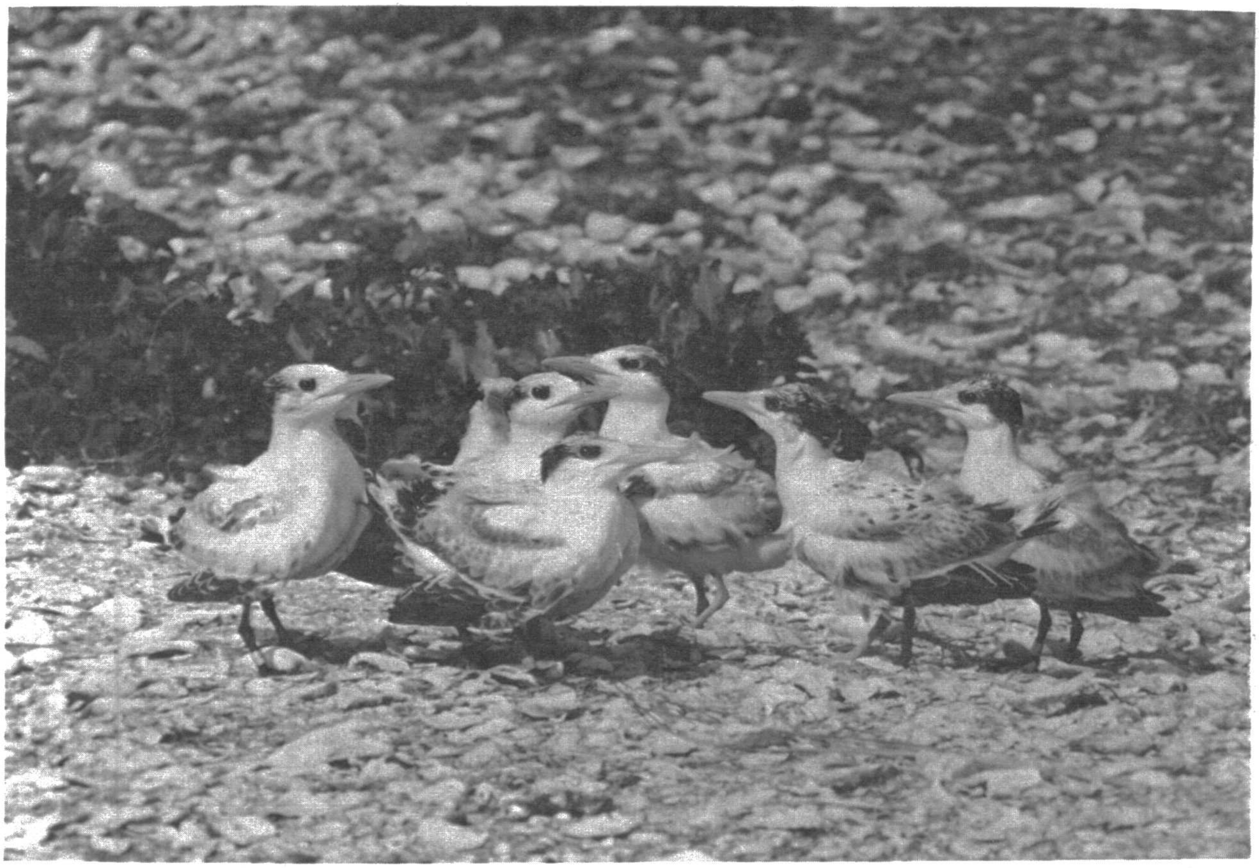
Tatum, J. W. 1936. Notes from Brigantine Beach, N.J. Auk 53: 95.

1932

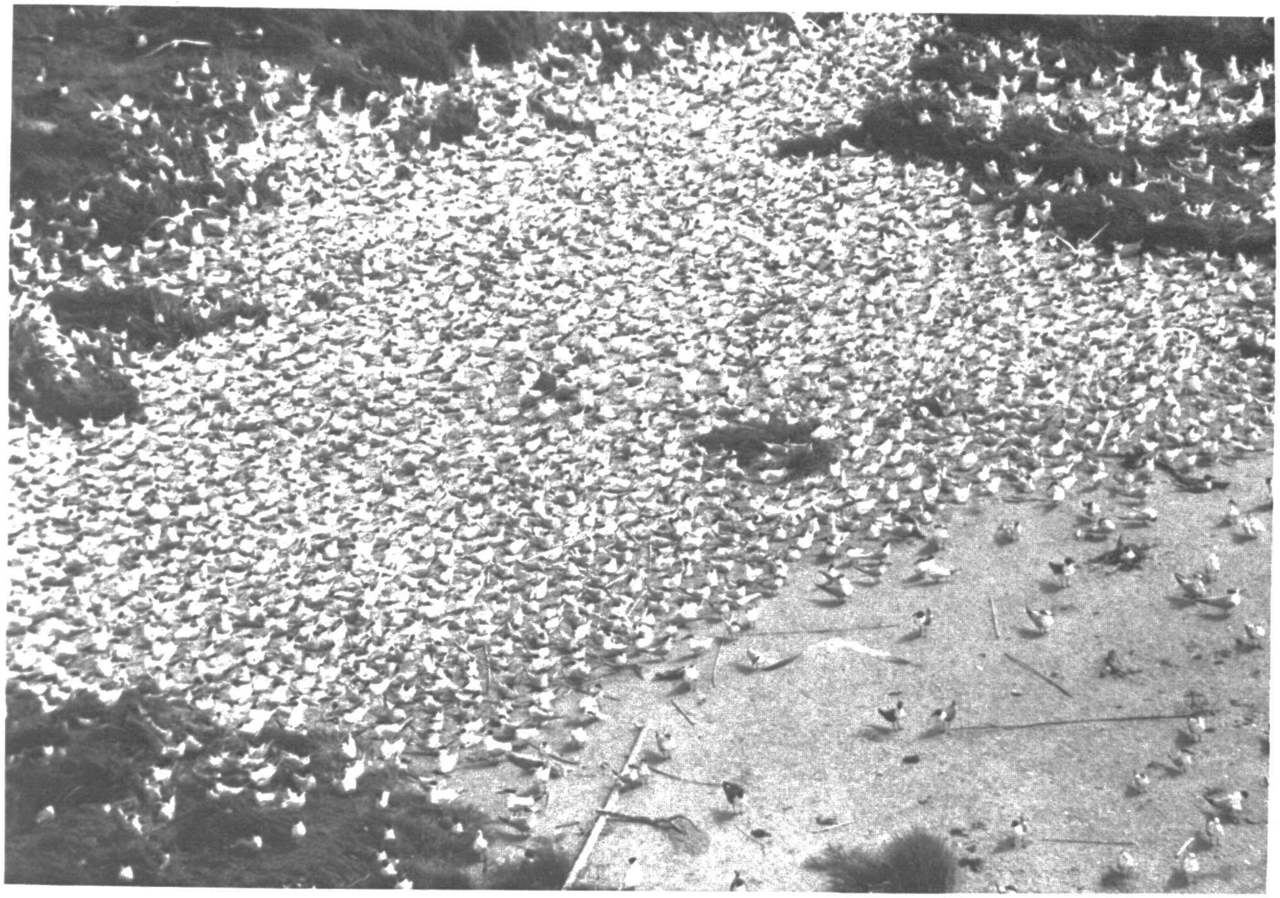
Allen, R. P. 1932. Eggs of Royal Tern in Laughing Gull's nest. Auk 49: 219-220.

1888

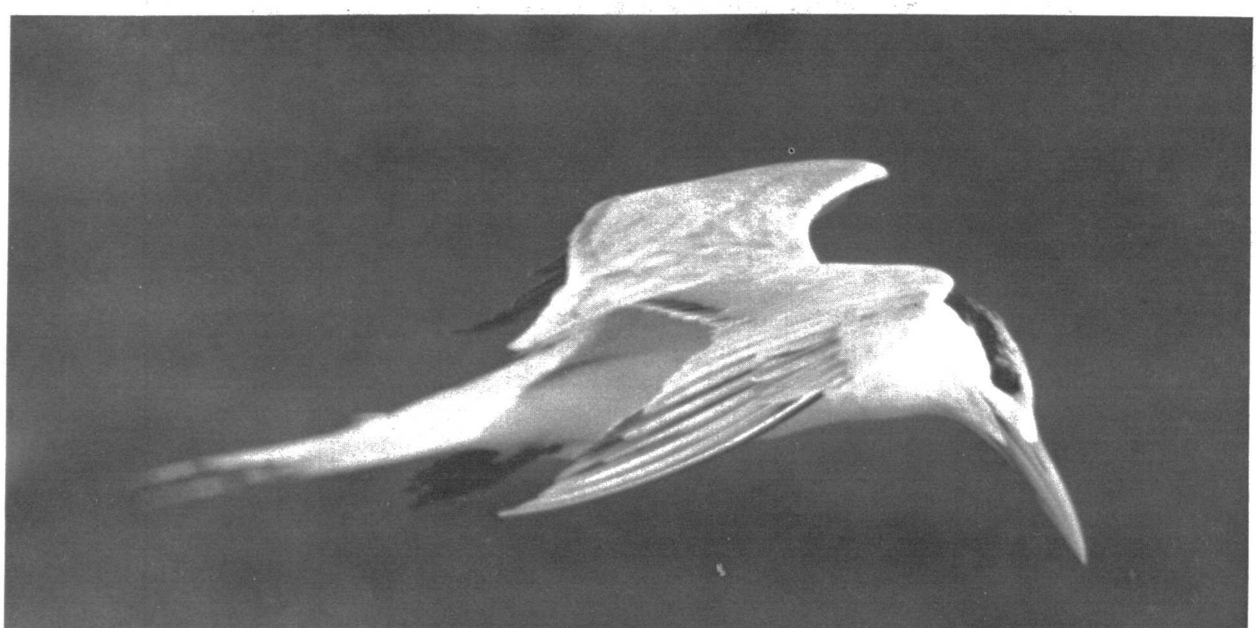
Smyth, E. A., Jr. 1888. Notes on coloration in Sterna maxima. Proc. Elliott Soc. 2: 189-192.



A group of young Royal Terns. Photograph by Roger B. Clapp.



A Royal and Sandwich Tern colony in Louisiana. Photograph by J. A. Spendelow.



Adult Royal Tern in postbreeding plumage. Photograph by Roger B. Clapp.

SANDWICH TERN

(Sterna sandvicensis)

[DA: Splitterne, DU: Grote Stern, FI: Kentin tiira, FR: Sterne caugek, GE: Brandseeschwalbe, IC: Paraperna, IT: Beccapesci, NW: Splitterne, PO: Rybitwa czubata, PR: Garajau, Pardau; RU: (Spotty-nosed Tern), SP: Charran de Cabot, Charran patinegro; SW: Kentsk tarna, US: Cabot's Tern]

GENERAL DISTRIBUTION

North America In North America, Sandwich Terns are slowly extending their range north, with breeding recorded recently as far north as Maryland (Weske et al. 1977). They now breed regularly along the Atlantic coast from Virginia through South Carolina. In 1974 they were found breeding in northern Duval County on the Atlantic coast of Florida (Loftin and Sutton 1975) and many years ago bred on the Dry Tortugas (Howell 1932). Sandwich Terns bred along the Florida Gulf coast in the 19th century but were not found breeding there again until 1970 (Stevenson 1972b). Elsewhere in the Gulf, the largest breeding concentration in North America (and perhaps in the world) is found on the Chandeleur Islands off Louisiana. Smaller numbers nest on the coasts of Texas and Mississippi, and on Alacran Reef off Yucatan (Paynter 1955).

In Central America these terns formerly nested on Northern Two Cays off Belize (Russell 1964). Breeding populations are also present in the Caribbean in the Bahamas, off southern Cuba (Bond 1971), in the U.S. Virgin Islands (Dewey and Nellis 1980), in the Netherland Antilles (Blake 1977), and on Soldado Rock off Trinidad (ffrench 1973). Sandwich Terns probably breed elsewhere in the region, but little is known of the breeding distribution and populations of seabirds in the Caribbean.

North American birds winter from the southern coast of Mexico south to Ecuador and Peru on the Pacific coast; to the east, Sandwich Terns winter from the Gulf of Mexico and southern Atlantic coast south to the West Indies and to the Caribbean coast of South America from Columbia south to Brazil and Argentina (AOU 1957, Blake 1977). Scharringa (1979) recently reported a juvenile banded in North Carolina in 1978 and found dead in the Netherlands six months later.

World Distribution Sandwich Terns are a cosmopolitan species with an erratic distribution, but they breed primarily in eastern North America, eastern

Taxonomic note: The South American Cayenne Tern has often been treated as a distinct species, Sterna eurygnatha. We include it here as a race of the Sandwich Tern, S. s. eurygnathus, following Blake (1977). The other two races are the nominate, referring to Eurasian and African populations, and Sterna s. acuflavidus, from the northern portion of the New World. This species has been included in the genus Thalasseus until fairly recently.

South America, and western Eurasia. A small number breed in northwestern Africa. In North Africa Sandwich Terns breed in southeastern Tunisia (Vaurie 1965, BOU 1971, Isenmann 1972). In South America Sterna s. eurygnatha breeds on islands off Venezuela (Las Aves and Los Roques) and along the coast of Argentina at Chabut and Santa Cruz. A distinct breeding population may occur in coastal Uruguay and Argentina (Blake 1977).

In Eurasia Sandwich Terns breed in four distinct areas. One is in northern Europe, where they breed on the coasts of East and West Germany, Denmark, Brittany (in France), the Netherlands, and Great Britain (Cramp et al. 1974). In 1974, these terns bred for the first time on the south coast of Norway (Bergersen 1975). The second area is along the Mediterranean, where Sandwich Terns breed (or have bred) in Sicily, Sardinia, in the Carmargue of southern France, and in Spain (Isenmann 1972a, Cramp et al. 1974). Brichetti (1979) recently reported breeding in Italy. The third breeding area is on islands of the Black Sea from the mouth of the Dneipr River to Sivash Lagoon (Borodulina 1960, Vaurie 1965). The fourth area is on the eastern and southern coasts of the Caspian Sea (Vaurie 1965).

Eurasian Sandwich Terns winter south of their breeding range, the localities dependent in part on the area of origin. Those from the Black and Caspian Seas winter on the Mediterranean, in Africa, and on the Persian Gulf in the Near East (Borodulina 1960); those from the Camargue in France winter on the Atlantic coast of Africa (Isenmann 1972a); those from western Europe winter primarily off the west coast of Africa from Senegal to Ghana and south to Angola (Cramp et al. 1974). Others from western Europe may winter as far from the breeding colonies as South Africa and western India (Blake 1977).

DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

North Carolina Potter et al. (1980) regarded Sandwich Terns as fairly common in the Carolinas but with a very local breeding distribution. Most terns are present from April to October; a few birds remain to winter. Most nesting occurs from late April through July, but renesting attempts sometimes result in nesting through August (Soots and Parnell 1979 ms).

These terns, formerly regarded as uncommon visitors to North Carolina, were not discovered nesting in the state until 1907 (Pearson 1908). Numbers breeding in North Carolina in the early 1900's and for several subsequent decades were probably small. Scattered observations summarized by Pearson et al. (1942) and Wray and Davis (1959) suggest that total breeding populations contained no more than a few hundred birds. Recent surveys indicate that present populations are the largest ever present in North Carolina; Soots and Parnell (1975a) noted that the breeding population in 1973 contained about 510 birds. Although Sandwich Tern nests were not always distinguished from Royal Tern nests, Blus et al. (1979) presented figures suggesting breeding populations of about 1,550 and 1,810 birds in 1974 and 1975, respectively. About 1,360 birds bred there in 1976 (Portnoy et al. 1981, Table 46), and about 3,880 birds nested there in 1977 (Parnell and Soots 1979 ms).

The number of colonies present in North Carolina is small and most of the breeding population is concentrated at one or two sites. Five colonies were found in 1976, but one found on a dredged island on northern Core Sound held 1,152 birds (Portnoy et al. 1981, Map 15), or 84% of the breeding population. Six colonies were found the following year (Parnell and Soots 1979 ms), but the three largest contained over 90% of the breeding population.

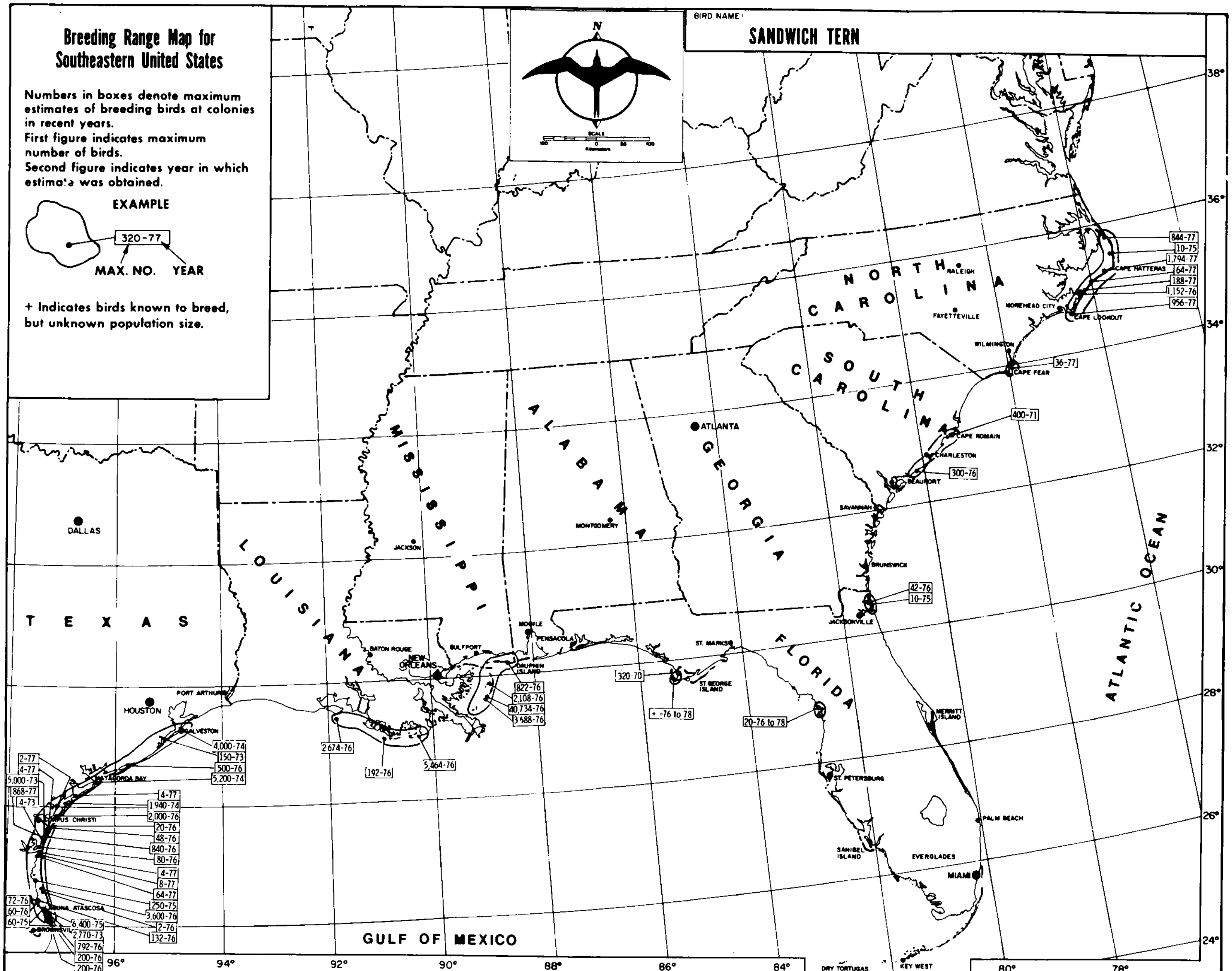
All Sandwich Terns nesting in North Carolina in recent years have been found among colonies of Royal Terns (Buckley and Buckley 1972a). Usually the Sandwich Terns are greatly outnumbered. Occasionally, however, as in Louisiana, Sandwich Terns may be numerically dominant in the mixed-species colonies. One of the largest Sandwich Tern colonies in recent years, found on a dredge-spoil island in Old House Channel, Dare County, in 1976, contained about 840 Sandwich Terns and about 460 Royal Terns (Soots and Parnell 1979 ms). Soots and Parnell (1979 ms) pointed out that numbers present at any given site may vary considerably from year to year because this species readily shifts from one nesting area to another.

South Carolina Sprunt and Chamberlain (1949) regarded Sandwich Terns as fairly common coastal residents during the summer. They gave dates of occurrence as 8 April-30 October. Sandwich Terns were first found nesting in South Carolina in the early 1900's. Little is known of populations early in the century, but observations summarized by Sprunt and Chamberlain suggest that there were less than 100 birds. Breeding populations slowly increased (Burton 1970), and reached about 300 breeding pairs around the mid-1960's. More recent population estimates suggest that more birds now breed in South Carolina than ever before. Blus et al. (1979) estimated breeding populations of about 1,260 and 1,780 birds in 1974 and 1975, respectively. Portnoy et al. (1981) indicated that about 300 birds were present at Deveaux Bank in 1976, but this figure does not represent how many nested in the state because they also nested in 1976 on Bird Bank (Blus et al. 1979), an area that was not censused.

Sandwich Terns in South Carolina historically have used only a few nesting areas and at present nest primarily on Deveaux Bank, Marsh Island, and Bird Bank, the latter two localities within Cape Romain NWR. The sites containing most of the breeding population may vary widely from year to year (e.g., ca. 79% nested on Deveaux Bank in 1974 but ca. 78% nested on Marsh Island the following year).

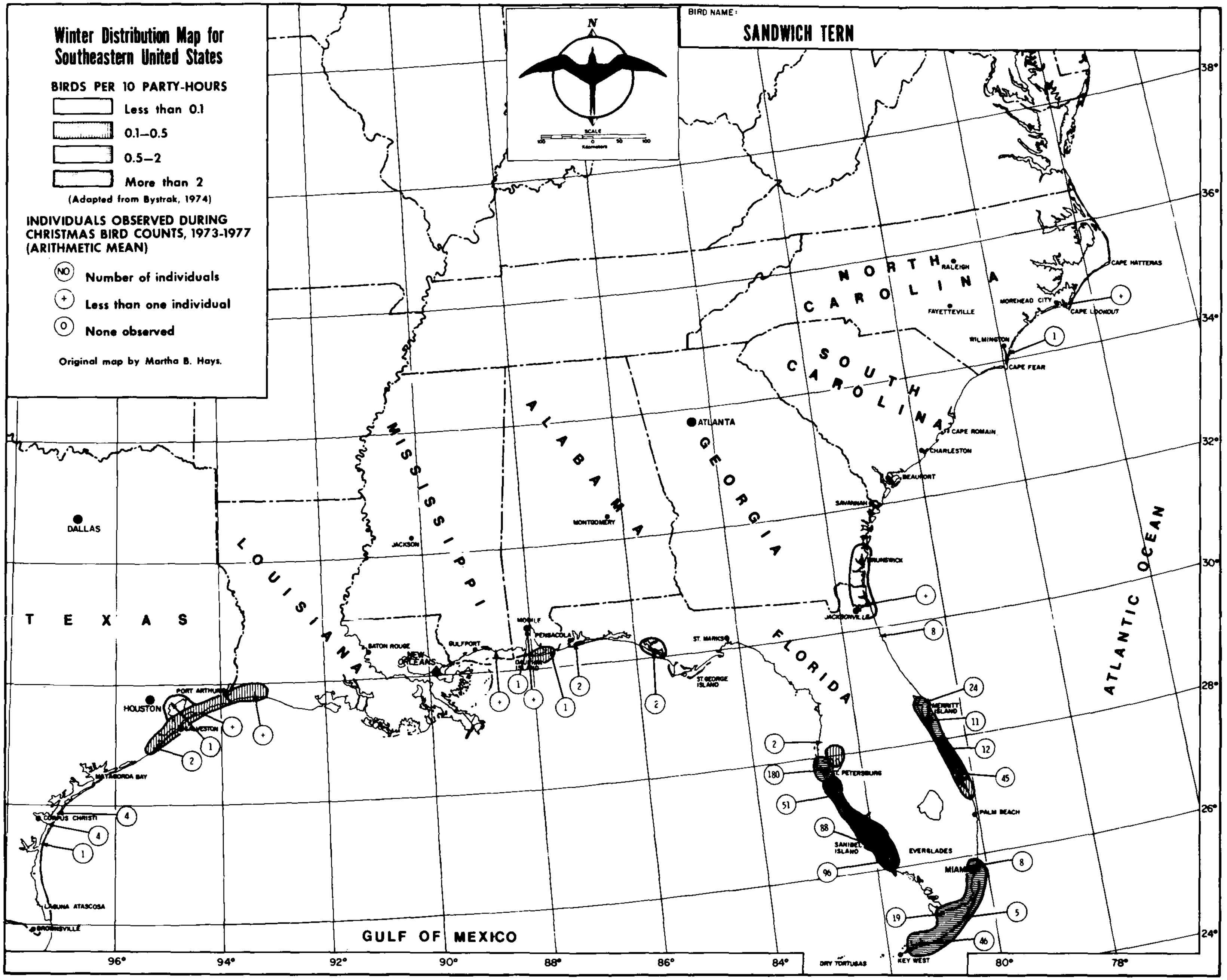
Georgia Burleigh (1958) considered the Sandwich Tern a scarce transient along the coast and knew of no records of breeding within the state. Subsequent observations along the coast led Sciple (1963) to conclude that these terns "occur not infrequently on the sea islands" of Georgia. Tomkins (1958) reported that they occurred regularly but uncommonly in the Savannah River Delta from about mid-August to mid-October. The largest number seen at one time in this area was eleven birds.

Florida - Atlantic Coast Formerly rare along the Florida Atlantic coast (Kale 1979 ms a), Sandwich Terns have been discovered breeding there only recently. At least five pairs attempted to breed in a colony of Royal Terns



Breeding Range Map for Southeastern United States
Numbers in boxes denote maximum estimates of breeding birds at colonies in recent years.
First figure indicates maximum number of birds.
Second figure indicates year in which estimate was obtained.
EXAMPLE
320-77
MAX. NO.
YEAR
+ Indicates birds known to breed, but unknown population size.
N
BIRD NAME:
SANDWICH TERN
NORTH CAROLINA
RALEIGH
FAYETTEVILLE
MOREHEAD CITY
CAPE HATTERAS
CAPE LOOKOUT
844-77
10-75
1,794-77
64-77
188-77
1,152-76
956-77
WILMINGTON
CAPE FEAR
36-77
SOUTH CAROLINA
CAPE ROMAIN
400-71
CHARLESTON
BEAUFORT
300-76
ATLANTA
GEORGIA
SAVANNAH
BRUNSWICK
42-76
10-75
JACKSONVILLE
ALABAMA
MONTGOMERY
MISSISSIPPI
JACKSON
LOUISIANA
BATON ROUGE
NEW ORLEANS
GULFPORT
MOBILE
PENSACOLA
DAUPHIN ISLAND
822-76
2,108-76
40,734-76
3,688-76
2,674-76
192-76
5,464-76
ST. MARKS
320-70
+-76 to 78
ST GEORGE ISLAND
FLORIDA
20-76 to 78
MERRITT ISLAND
ST. PETERSBURG
PALM BEACH
SANIBEL ISLAND
EVERGLADES
MIAMI
DRY TORTUGAS
KEY WEST
ATLANTIC OCEAN
GULF OF MEXICO
TEXAS
DALLAS
HOUSTON
PORT ARTHUR
GALVESTON
MATAGORDA BAY
CORPUS CHRISTI
LAGUNA ATASCOSA
BROWNSVILLE
4,000-74
150-73
500-76
5,200-74
2-77
4-77
5,000-73
868-77
4-73
4-77
1,940-74
2,000-76
20-76
48-76
840-76
80-76
4-77
8-77
64-77
250-75
3,600-76
2-76
132-76
72-76
60-76
60-75
6,400-75
2,770-73
792-76
200-76
200-76
38°
36°
34°
32°
30°
28°
26°
24°
96°
94°
92°
90°
88°
86°
84°
80°
78°

Map 15


Winter Distribution Map for Southeastern United States
BIRDS PER 10 PARTY-HOURS
Less than 0.1
0.1–0.5
0.5–2
More than 2
(Adapted from Bystrak, 1974)
INDIVIDUALS OBSERVED DURING CHRISTMAS BIRD COUNTS, 1973-1977 (ARITHMETIC MEAN)
Number of individuals
Less than one individual
None observed
Original map by Martha B. Hays.
BIRD NAME:
SANDWICH TERN
N
TEXAS
LOUISIANA
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
SOUTH CAROLINA
NORTH CAROLINA
ATLANTIC OCEAN
GULF OF MEXICO
DALLAS
HOUSTON
PORT ARTHUR
CORPUS CHRISTI
LAGUNA ATASCOSA
BROWNSVILLE
MATAGORDA BAY
BATON ROUGE
NEW ORLEANS
JACKSON
GULFPORT
MOBILE
PENSACOLA
MONTGOMERY
ATLANTA
ST. MARKS
ST. GEORGE ISLAND
JACKSONVILLE
BRUNSWICK
SAVANNAH
BEAUFORT
CHARLESTON
CAPE ROMAIN
CAPE FEAR
WILMINGTON
MOREHEAD CITY
CAPE LOOKOUT
CAPE HATTERAS
RALEIGH
FAYETTEVILLE
MERRITT ISLAND
PALM BEACH
ST. PETERSBURG
SANIBEL ISLAND
EVERGLADES
MIAMI
KEY WEST
DRY TORTUGAS
38°
36°
34°
32°
30°
28°
26°
24°
96°
94°
92°
90°
88°
86°
84°
80°
78°

Map 16

on a sand island near Bird Island, Nassau Sound, in June and July 1974. Whether or not these birds fledged young is unknown (Loftin and Sutton 1975). A maximum of about 40 birds bred there in 1976 (Map 15).

Kale (1979 ms a) considered Sandwich Terns uncommon offshore in fall and winter and accidental there in summer, but thought they occur more regularly along inlets in winter. Examination of recent Christmas Count data (Map 16) suggests that Sandwich Terns winter along the Florida Atlantic coast in greater numbers than anywhere else on the Atlantic coast.

Florida - Keys Through the mid-1850's, Sandwich Terns evidently bred on the Dry Tortugas (Bryant 1859), but they are not known to have nested there since. They are now uncommon fall migrants (Stevenson 1973) and rare summer visitors (Ogden 1972) at the Tortugas.

Florida - Gulf Coast Sandwich Terns bred regularly along the Gulf coast of Florida in the 18th century but no longer nested there by the early part of the 19th century (Howell 1932). They were breeding again on the Florida Gulf coast in 1970, when Stevenson (1972b) found them nesting on St. George Island. Stevenson was unsure of the number, but he estimated there were at least 250 Sandwich and Royal Tern chicks present. About one-third were thought to be Sandwich Terns. Breeding on this coast has occurred sporadically subsequently but is poorly documented.

Sandwich Terns now occur along the Florida Gulf coast throughout the year, often among flocks of Royal Terns. They usually occur in small numbers (Kale 1979 ms b) but winter there more abundantly than elsewhere in the southeastern United States (Map 16).

Alabama Sandwich Terns are rare in winter and common to uncommon summer residents of coastal Alabama (Imhof 1976b). Little is known about their breeding status in the state. They are believed to have bred on an island at the mouth of Mobile Bay in the early 1890's (Howell 1928). Although they may have bred on spoil islands in this area in recent years, this has not been documented.

Mississippi Burleigh (1944) considered Sandwich Terns the least common of terns occurring along the Mississippi coast and noted records from late May to mid-October. The first record of breeding within the state occurred in 1962, when Williams (1962a) found approximately 5,000 terns breeding on Petit Bois Island. It is likely that Sandwich Terns bred there previously but went unrecorded as information on the historic and present status of Mississippi birds has never been adequate. No recent breeding population has been as large as that recorded in 1962, but about 800 birds bred on a spoil island in Horn Island Pass in 1976 (Portnoy 1977) and 1979 (Jackson et al. 1980). Observations summarized by Portnoy (1977) and Jackson et al. (1980) indicate that eggs are present from at least late May or early June to mid-July and that young are present from at least late June through late July.

Louisiana Sandwich Terns are uncommon to locally abundant in summer along the Louisiana coast, but are rare in winter (Lowery 1974). Portnoy's (1977) summary of unpublished census data, as well as scattered comments in *American Birds*, indicate that breeding populations in the late 1960's and early 1970's on offshore islands were very large, possibly the largest breeding populations of this species in the world. As many as 93,200 birds bred at Stake Island in the Chandeleurs in 1969 (Portnoy 1977); 80,000-100,000 bred on Breton Island NWR in 1970 (Stewart 1970, Portnoy 1977); about 46,800 bred in the main Chandeleurs in 1971 (Stewart 1971); at least 60,000 birds bred at Curlew Island in the Chandeleurs in 1975 (J. Stewart 1975, Portnoy 1977); and about 54,860 bred in Louisiana in 1976 (Portnoy 1977).

As in North Carolina, a very large proportion of the population may be concentrated in one colony; Portnoy (1977) found only five colonies and the largest, found on Curlew Island, contained an estimated 40,734 breeding birds in 1976, or nearly 75% of those breeding in Louisiana. This colony, the largest in North America, contained over half the Sandwich Terns breeding in the southeastern United States in 1976 (Table 46).

Texas Sandwich Terns usually nest from mid-April to mid-July in large numbers on the Texas coast; eggs have been found from 25 April through 2 July. From mid-November to mid-March they are locally uncommon to scarce on the central coast, and rare elsewhere (Oberholser 1974). Oberholser reported that about 5,300 were found along the coast during the breeding season of 1969 and suggested that the species is maintaining its population in Texas. From 1973 through 1978, the smallest number recorded by the Texas Colonial Waterbird Census (Blacklock et al. 1978, Blacklock et al. 1978 ms) was about 8,300 birds in 1977; the largest number recorded was ca. 30,100 the following year.

Colonies in Texas that contained particularly large numbers of Sandwich Terns in recent years include one with ca. 5,000 birds on an islet near South Bird Island, Kleberg County, in 1973; one with ca. 4,000 birds at Pelican Island, Galveston County in 1974; one with 5,200 at Sundown Island, Matagorda County, in 1974; one with ca. 6,400 on spoil in Willacy County in 1975; and one with ca. 3,600 on spoil in Kenedy County in 1976 (Blacklock et al. 1978).

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

Breeding Sandwich Terns breed primarily in the southeastern United States, in northwest Europe, along the Mediterranean, and along the Black and Caspian Seas. Populations of unknown size breed in the Caribbean, southern Gulf of Mexico, and in South America. Most of the birds breeding in the United States are found in the southeast, primarily in Texas and Louisiana (Table 46, Map 15). Elsewhere in the United States, very small breeding populations are found on the Atlantic coast to the north. About 5 pairs bred in Virginia in 1977 (Erwin 1979a), but other recent populations there have been larger and reached a maximum of about 130 birds in 1973 (Weske et al. 1977). Recent breeding populations in Maryland have been reported as under a dozen birds (Weske et al. 1977).

Table 46. Recent estimates of Sandwich Tern populations nesting in the southeastern United States.

State	Number found breeding in 1976 (a)	Percent of southeastern breeding population	Maximum number found breeding in recent years and year
North Carolina	1,360	1.8	3,880 (1977)
South Carolina	300 (b)	0.4	ca. 1,780 (1975)
Georgia	none		none
Florida-Atlantic Coast	40	0.05	40 (1976)
Florida-Keys	none		none
Florida-Gulf Coast	none		320 (1970)
Alabama	none		none
Mississippi	820	1.1	820 (1976)
Louisiana	54,860	73.1	80,000+ (1970)
Texas	17,680	23.6	30,100 (1978)
	75,060		

(a) Totals rounded to the nearest 10. The total listed for Bird Islands, Georgia (in Portnoy et al. 1981) actually referred to Bird Island, Nassau Sound, Florida, and is so included here.
(b) Survey was incomplete.

Information on the size of breeding populations in the Old World is scattered, inaccessible, or out-of-date. Substantial numbers breed there but have been diminishing with great decreases in both Scotland and the Netherlands. The decrease in Scotland is attributed primarily to disturbance and predation, and that in the Netherlands to pollution (Smith 1975).

About half of the west European population now breeds in Ireland and Britain, where there are about 12,000 pairs (Cramp et al. 1974). Numbers reported elsewhere in the Old World include 2,250 pairs on Griend Island in the Netherlands in 1975 (Veen 1977), ca. 9,500 pairs nesting in the U.S.S.R. in the 1950's (Borodulina 1960), and ca. 2,800 pairs on the Banc d'Arguin in southwest France in 1976 (Campredon 1978). During the early 1970's, a few pairs bred in Tunisia and Spain, but the most important breeding ground around the Mediterranean was in the Camargue, with about 550 pairs in 1971 (Isenmann 1972a).

Winter North American Sandwich Terns winter primarily along the Mexican coasts south to Peru in the Pacific and to Brazil and Argentina in the Atlantic. Few winter in the southeastern United States; the largest wintering populations there are found along the coasts of Florida (Map 16). Sandwich Terns also winter in the Caribbean, but the origins and sizes of populations wintering there are for the most part unknown. Populations in the Old World generally winter south of the breeding range primarily off the coasts of Africa. Although Langham (1971) regarded the data from recoveries of British banded birds as too few to be conclusive, he believed these data suggested that older Sandwich Terns tend to winter further north than younger ones.

Migration Although large populations of Sandwich Terns occur in the southeastern United States, few have been banded and, as a result, little is known of their dispersal and migration. Concentrations observed in the southeast (Table 47) suggest that peak fall movement occurs from August through October, and that peak spring movement occurs in April.

Sandwich Terns fledging from British colonies tend to move both north and south in July and August; birds that move to the north eventually migrate south to winter mainly from Senegal to Angola. Campredon (1978) noted that migration routes and wintering grounds of Sandwich Terns from the Banc d'Arguin in southwestern France were roughly the same as those found for British populations by Langham (1971).

A similar northward movement following fledging has been reported for young from other European localities (Muller 1959 in Langham 1971). Young Sandwich Terns tend to remain on the wintering grounds through May of their third summer. They may return to their natal areas during their third year, usually arriving too late to breed (Langham 1971). A similar pattern of dispersal and migration may occur in populations from the North Atlantic coast.

HABITAT

Nesting Veen (1977) found that Sandwich Terns breeding at Griend Island in the Netherlands (1) preferred to nest in bare sandy areas near the borders of vegetation and avoided areas where shells were an abundant part of the substrate; (2) always chose higher sites in preference to lower ones, although growth of vegetation during the breeding season precluded later use of the higher sites; and (3) always were associated with at least one other species of nesting larid.

Veen examined the association between Sandwich Terns and other larids in the Netherlands and found that they were associated with either Black-headed Gulls (*Larus ridibundus*) or Common Terns in 24 out of 25 colonies, and with both in 19 out of 25 colonies. He concluded that the association of larids in these colonies is not a matter of chance, but reflects an interspecific attraction between the species. Sandwich Terns nesting in the southeastern United States also are usually found nesting with other larids, most frequently with Royal Terns (Buckley and Buckley 1980a).

Colonies of Sandwich Terns, like those of the Royal Terns, are often densely packed with nests. At the Banc d'Arguin in southwestern France, density was greatest in the center of the major subcolony (about 10 nests/sq m [93 nests/100 sq ft]) and decreased to about 2 nests/sq m (19 nests/100 sq ft) on the periphery. Overall the density was about 5-7 nests/sq m (47-65 nests/100 sq ft) (Campredon 1978).

Table 47. Peak concentrations of wintering and migrant Sandwich Terns in the southeastern United States.

Date seen		Number seen	Locality	Source
			NORTH CAROLINA	
1969	5 Nov.	23	Wrightsville Beach	Parnell 1970
1967	25 Nov.	61	Wrightsville Beach	Parnell 1968
			GEORGIA	
1968	13 Aug.	27	Cabretta Island	Dopson and Richardson 1968
1961	7 Oct.	35	Sea Island	Chamberlain 1962a
			FLORIDA - ATLANTIC COAST	
1960	mid-Aug.	35	Miami	Stevenson 1960d
1973	15 Sep.	120	Port Canaveral	Edscorn 1974
1971	13 Oct.	65	off Brevard County	Robertson 1972
1959	2 Nov.	75	Daytona Beach	Stevenson 1960a
			FLORIDA - KEYS	
1961	fall	400	Lower Matecumbe Key	Robertson 1968
1972	19 Sep	125	Dry Tortugas	Stevenson 1973
1967	Nov.	100's	salt ponds, Key West	Robertson 1968
1969	10 Nov.	100+	Dry Tortugas	Robertson 1970
1960-61	winter	250	Lower Matecumbe Key	Stevenson 1961
			FLORIDA - GULF COAST	
1975	16 Apr.	400	Mullet Key	Kale 1975
1968	20 Apr.	130	St. George Island	Robertson 1968
1961	2nd week Aug.	3,000	in 1 mi of shore and marsh, Pensacola	James and James 1961
1973	Aug-Oct.	150-300	Mullet Key/Sunshine Skyway	Edscorn 1974
			ALABAMA	
1956	21 Apr.	350	Gulf Shores-Ft. Morgan	Newman 1956a
1958	16 May	450	Dauphin Island	Imhof 1976b
1971	18 Aug.	300	Fort Morgan	Imhof 1976b

Table 47. Concluded.

Date seen	Number seen	Locality	Source
		LOUISIANA	
1976 16 Apr.	400	Grand Terre	Imhof 1976a
		TEXAS	
1957 13 Oct.	61	Galveston	Webster 1958b
1965 1 Dec.	44	Rockport	Webster 1966a

Densities of nests reported for other colonies have ranged from 2.1 nests/sq m (19.5/100 sq ft) at one subcolony in Northumberland (Langham 1968) to 3-4 nests/sq m (28-37/100 sq ft) at the center of subcolonies at L'ile de Meaban, to 7 nests/sq m (65/100 sq ft) at L'ile de Dumet (Le Faucheux 1963 in Campredon 1978).

Because most of the Sandwich Terns in the southeastern United States nest with Royal Terns, habitat requirements for the two species in the southeast are much the same. In this area Sandwich Terns prefer to nest on bare sand on isolated spits, on sandbars, and on barrier beaches. In some states most colonies and most of the breeding population are found on man-made dredge-spoil islands. All five colonies in North Carolina in 1976 were on dredged islands (Portnoy et al. 1981). The following year 5 out of 6 colonies and 95% of the nesting populations of Sandwich Terns in North Carolina were found on man-made or man-modified sites; the other colony was on a natural estuarine island (Soots and Parnell 1979 ms).

Colony sites elsewhere in the southeast are similar to those in North Carolina and are found on both natural and dredge-spoil islands. The type of island used is apparently dependent on the number of natural sites available. Sandwich Terns in South Carolina nest exclusively on barrier islands (Blus et al. 1979) while those in Florida nest on both natural and dredged islands (Kale 1978c). Most Sandwich Terns in Louisiana nest on the extensive natural beaches of the Chandeleurs. The only colony in Mississippi is located on a man-made island. Sandwich Terns in Texas nest on many different types of islands.

Feeding Most reports suggest that Sandwich Terns feed near their breeding sites. Pearson (1968) estimated that breeding Sandwich Terns in the Farne Islands had maximum foraging ranges of 15.4 mi (24.8 km). He based this figure on a mean of 61.8 min spent in foraging flights and an estimated flight speed of 30 mi/hr (48.2 km/hr). The main feeding area of birds breeding at Griend Island, the Netherlands, was 15-25 km (9-16 mi) from the colony (Veen 1977).

Some birds nesting on inland loughs in Ireland brought food overland from 12-15 mi (19-24 km) away, but breeding birds occasionally forage even farther away; one fish tag found in a Scottish colony suggested that a tern may have captured a fish some 42 mi (68 km) away (Cramp et al. 1974). Borodulina (1960) indicated that Sandwich Terns in the southern U.S.S.R. usually feed in inlets where the water is 1.5-2 m (4.9-6.6 ft) deep.

Nonbreeding and Offshore Nonbreeding Sandwich Terns typically occur near land and often roost with other larids along coastal beaches or on isolated sandspits. Those on the wintering grounds in Sierra Leone feed inshore in marine or estuarine waters (Dunn 1972a). Occasionally these terns are found far offshore. Kale (1979 ms b) mentioned a single report of hundreds feeding over fish about 80 mi (129 km) west of Naples, Florida.

FOOD AND FEEDING BEHAVIOR

Sandwich Terns feed primarily by plunge-diving (Dunn 1972a, Veen 1977), usually submerging to seize the fish with their bill. They also contact-dip (i.e., seize prey from just above or below the surface of the water while in flight), and make shallow plunges from heights of 1.5-3.0 m (5-10 ft) (Dunn 1972a). Cramp et al. (1974) stated that Sandwich Terns dive from greater heights and submerge more deeply with a greater splash than do smaller species of *Sterna*. Those wintering in Sierra Leone usually dive from heights of 5-10 m (16-33 ft) (Dunn 1972a). Dunn remarked that newly fledged juveniles typically dive from lower heights than adults but found that both first-winter and older birds dove from about 6 m (20 ft).

Sandwich Terns foraging in the Netherlands tend to disperse over their feeding areas, but they congregate quickly where individuals are successful and sometimes form feeding flocks of several hundred birds (Veen 1977).

Young forage less successfully than adults. Sandwich Terns in their first winter (about 7-9 months old) in Sierra Leone obtained fish on 13.4% of their dives, a figure significantly less than the success rate (16.6%) for older birds (Dunn 1972a). On the average, older birds captured fish at a rate of 14 fish per hour, compared to a rate of 10 fish per hour for first-winter birds. Dunn never observed adults dropping their prey, but he saw four young drop captured fish. First-winter and older birds dove at the same rate (an average of 1.7 plunge-dives per minute).

Pearson (1968) estimated that breeding Sandwich Terns in the Farne Islands spent 39-76% of the daylight hours fishing. Young at the Banc d'Arguin are fed mostly in the early morning and the late afternoon (Campredon 1978). Borodulina (1960) reported that young are fed 8-12 times per day; Pearson (1968) indicated that broods containing one chick are fed an average of 14 times per day at the Farne Islands.

In the Netherlands, day-old chicks are fed mostly on clupeids about 5 cm (2 in) long, and four-day-old chicks eat clupeids up to 12 cm (4.7 in) and ammodytids 8-14 cm (3.1-5.5 in) long (Veen 1977). Campredon (1978) estimated that the daily food requirement of chicks was 65 gm/day (2.3 oz/day).

The number and size of fish fed to young may depend on local weather conditions. During stormy weather (days with windspeeds in excess of 20 mi/hr [32.2 km/hr]), the number of large fish fed to all sizes of young decreases markedly and the number of fish of any size fed to older young also decreases (Veen 1977). Veen suggested this was because larger fish are harder to catch during stormy weather and because Black-headed Gulls, frequent kleptoparasites of this species, tend to steal larger fish. He noted that the proportion of fish stolen by Black-headed Gulls increases markedly after stormy weather.

Earlier information on the diet of Sandwich Terns in North America presented by McAtee and Beal (1912) was combined with supplementary data by Blus et al. (1979), who reported the contents of 33 stomachs collected on the south Atlantic and Gulf coasts of the United States from 1904-1923. Items found most frequently in the stomachs were shrimp (*Penaeus* sp. - 35.4%), anchovies (*Anchoviella* spp. - 27.3%), silversides (*Menidia* spp. - 15.2%), rough silversides (*Membras martinica* - 9.1%), and menhaden (*Brevoortia* spp. - 9.1%). Insects were also frequently (18.2%) found in the stomachs of Sandwich Terns, but not as often in the stomachs of the Royal Terns that often nest with this species.

Fish of the families Ammodytidae and Clupeidae make up most of the diet of Sandwich Terns throughout much of their range in western Europe (Veen 1977). Sandwich Terns in the North Sea feed largely on *Ammodytes* spp.; those in the Camargue feed largely on *Sardina pilchardus*. Because so little information is available on the diet of Sandwich Terns in North America, we summarize below some of the reports of their diet in the Old World; further information on their diet is provided by papers listed in the species bibliography.

Most prey brought to the colony at the Sands of Forvie, Scotland, consisted of clupeids and ammodytids. About 5% of the fish were gadiods (Gadidae) and flounders (Pleuronectidae); shrimps (Crustacea) were uncommon. Sand lance (Ammodytidae) brought to small chicks averaged 7.0-9.6 cm (2.8-3.8 in) long in 1973 and 1974 while clupeids ranged from 5.9-6.4 cm (2.3-2.5 in) long. Fish brought to larger young and to adults during courtship and incubation were larger (Fuchs 1977a). In the Farne Islands, England, most (98%) of the food was fish, with ammodytids and clupeids predominating. The rest of the diet consisted of marine invertebrates with Crustacea and cephalopods taken in about even proportions (Pearson 1968).

Foods eaten at Griend Island in the Netherlands were much the same as in the Farne Islands. Food fed by one adult to another and to the young consisted largely of *Ammodytes* (*lancea* and/or *lancolata*) and *Clupea* (*harengus* and/or *sprattus*). Over three seasons (1966, 1967, 1970), these fish made up 97.3% to 98.3% of the fish found in the diets of young birds, and 96.2% of the fish fed to other adults in 1966 (Veen 1977).

Young at the Banc d'Arguin, France, were fed primarily on *Engraulis encrassilochus* and *Atherina presbiter* in 1975 and 1976 (Campredon 1978). In 1966 the principal food eaten there was Ammodytes tobianus (Davant 1967 in Campredon 1978).

IMPORTANT BIOLOGICAL PARAMETERS

Egg Laying Egg laying in northern U.S. Sandwich Tern colonies occurs primarily in May and June; terns at more southern localities (Louisiana, Texas) lay somewhat earlier (Portnoy 1977, Chaney et al. 1978). Laying within one region may vary considerably from colony to colony. In 1975 Sandwich Terns at Marsh Island and Deveaux Bank, South Carolina, had largely completed laying by the end of May, but those at Bird Bank did not finish laying until a month later (Blus et al. 1979). The later laying at Bird Bank may have been the result of relaying because two other sites had been deserted before Blus et al. conducted their survey.

Populations nesting in the northern portions of the Old World lay approximately on the same schedule. In 1971, laying occurred from early May through mid-July at Griend Island in the Netherlands, but most eggs were laid from early May through late May (Veen 1977). During five years of observation at this locality, a marked peak of egg laying occurred in May, with a second, smaller peak 4-5 weeks later. Examination of banded birds revealed that the peak of laying was by birds that had bred before in previous years, and that the second peak was produced by birds breeding for the first time (Veen 1977).

Most eggs at British colonies are laid in May (Langham 1968, Chestney 1970), but some laying occurs in June (Langham 1968, authors cited in Fuchs 1977b). Laying on the Banc d'Arguin in southwest France occurs mainly in May (Campredon 1978). Laying is begun in mid-May in the southern U.S.S.R (Borodulina 1960). Langham (1968) mentioned that the length of the laying period may vary by as much as 25 days from year to year.

Egg laying may be highly synchronized in some parts of a colony. At one colony in the Netherlands, 80-90% of the birds initiated laying within a 2-5 day period and most completed laying within one to three weeks (Veen 1977). Veen indicated that larger colonies also tend to be more synchronous in laying than small ones. Langham (1968) remarked that the duration of laying within subcolonies varied little from large subcolonies to small ones.

Mean Clutch Size Sandwich Terns usually lay one to three eggs, but the number laid varies from area to area and from season to season. Sandwich Terns in more northern nesting localities may lay larger clutches (Table 48), but geographical differences in clutch size are not documented satisfactorily. Mean clutch size (1.11) at the perimeter of a colony in Northumberland was less than at the center (1.28), and later clutches tended to have only one egg (Langham 1968).

Incubation Period The incubation period of Sandwich Terns at Northumberland is about 25 days (Langham 1974). Campredon (1978) reported that the first egg takes 23 to 25 days to hatch at the Banc d'Arguin. Smith (1975) reported

Table 48. Mean clutch sizes reported for the Sandwich Tern (a).

Mean clutch size	Number of clutches	Locality and year of observation	Source
1.79 (b)	918	Caspian Sea, Osuschnoi Island, 1971	Poslawski and Kriwonosow 1978
1.51	1,258	Southern USSR, Sinalenyi Island, 1957	Borodulina 1960
1.63	520	Scotland, Sands of Forvie, 1974	Fuchs 1977b
1.77	161	England, Lancashire, 1930	Robinson 1930
1.41	164	England, Northumberland, 1965	Langham 1974
1.24	1,664	England, Northumberland, 1967	Langham 1974
1.15	454	England, Northumberland, 1966	Langham 1974
1.61 (c)	190	Netherlands, Griend Island, 1970	Veen 1977
1.80 (c)	233	Netherlands, Griend Island, 1971	Veen 1977
1.90	2,810	France, Banc d'Arguin, 1976	Campredon 1978
1.82	2,185	France, Banc d'Arguin, 1975	Campredon 1978
1.01	539	Louisiana, Chandeleur Islands, 1969	Valentine 1969
1.20	10	Texas, island in Laguna Madre, 1977	Chaney et al. 1978
1.00	23	Texas, Galveston Bay, 1977	Chaney et al. 1978

(a) Some of these figures are derived from counts of contents of nests during short-term visits. They may not adequately represent clutch size for the population because some proportion of the population may have been still laying eggs.
(b) Calculated from data given in Table 1 of cited source.
(c) Calculated from Table 4 of cited source.

that incubation in Scotland averaged about 25 days, with a range of 21-29 days.

Hatching Success Langham (1974) reported that hatching success increases with increased colony size (Table 49) and that hatching success in the center (76%) of a colony is significantly greater than on the perimeter (62%). Various rates of hatching success at different localities are listed in Table 49.

Age at Fledging Sandwich Terns fledged at 22-33 days (mean = 27 days) at the Farne Islands (Pearson 1968). In the Netherlands, young Sandwich Terns normally fly in 25-30 days, and most depart the nesting area within another two weeks (Veen 1977).

Fledging Success Precise figures for fledging success are few and vary considerably from year to year. Langham (1974) reported that 47.0 to 91.1% of the eggs laid resulted in fledged young during a three-year study conducted in England.

Table 49. Rates of hatching success reported for the Sandwich Tern (a).

Percent of eggs laid that hatch	Number of eggs	Locality and year of observation	Source
		All clutches	
ca. 56.0	846	Scotland, Sands of Forvie, 1974	Fuchs 1977b
65.6	1,102	England, Northumberland, 1965-66	Langham 1974
95.7	1,982	England, Northumberland, 1967	Langham 1974
79.3	87	Texas, Galveston Bay, 1977	Chaney et al. 1974
		One and two-egg clutches	
82.0	306	Netherlands, Griend Island, 1970	Veen 1977
73.3	419	Netherlands, Griend Island, 1971	Veen 1977
		One-egg clutches	
64.9	941	England, Northumberland, 1965-66	Langham 1974
87.8	74	Netherlands, Griend Island, 1970	Veen 1977
72.3	47	Netherlands, Griend Island, 1971	Veen 1977
		Two-egg clutches	
69.6	161	England, Northumberland, 1965-66	Langham 1974
80.2	232	Netherlands, Griend Island, 1970	Veen 1977
73.4	372	Netherlands, Griend Island, 1971	Veen 1977

(a) In some instances we have recalculated percentages from figures given in the original papers and have calculated the number of eggs from data given therein. Data from Langham (1974) are from Table 7 of that source.

Fledging success may vary throughout the season, from one clutch size to another, and between eggs of a clutch. Eggs laid early in the nesting season are more likely to result in fledged young than those laid late in the season. Of eggs laid early in the nesting season (1970-1972) at Griend Island in the Netherlands, 55.4-69.0% of the eggs from 1-egg clutches and 34.4-51.9% of the eggs from 2-egg clutches produced fledged young. Comparable figures for 1-egg and 2-egg clutches laid late in the season were 0.4-18.8% and 2.3-22.6%, respectively (Veen 1977). Langham (1974) also found that early clutches produced more young than late ones in England.

In the Netherlands, more young fledged from nests with two-egg clutches, but the rate at which eggs produced fledged young was considerably higher in 1-egg clutches. Of the eggs laid in 1-egg nests, 70.3% and 63.8% produced fledglings in 1970 and 1971, respectively, as opposed to 42.1% and 40.1% of the eggs in 2-egg nests (Veen 1977). At Northumberland, the difference in fledging success for different sized clutches was not consistent. In 1-egg clutches, 46.3% and 63.5% of the young fledged in 1966 and 1967 compared to 57.7% and 58.1% of the young from 2-egg clutches (Langham 1974).

Fledging success also varies with the hatching sequence. Over a three-year period in the Netherlands, chicks from 1-egg clutches and those that hatched first from a 2-egg clutch fledged at similar rates which were considerably greater than for chicks that hatched from the second egg of a clutch. The proportion of hatched eggs that produced fledged young ranged from 42.8 to 83.8% for chicks that hatched first from a 2-egg clutch, and from 11.8 to 20.0% for chicks that hatched second (Veen 1977). Both Langham (1974) and Gauzer (1981) noted that the second chick has a smaller chance of survival at colonies in England and the U.S.S.R., respectively.

Productivity (the number of young produced per pair or nest) also varies. Figures for the number of young produced per pair from France, the Netherlands, and England range from 0.55 in Northumberland in 1966 to 1.86 at the Banc d' Arguin, France in 1976 (Langham 1974, Veen 1977, Campredon 1978). Terns nesting in an undisturbed area at a colony in Norfolk, England, produced 0.84 young per pair in contrast to a rate of 0.33 per pair for birds nesting in a disturbed area (Chestney 1970).

Mortality of Eggs and Young Sandwich Terns suffer from the same sources of nesting failure as do the Royal Terns with which they often nest. Storms and high tides frequently wash away eggs and cause extensive nesting failure, but the extent of damage varies greatly from season to season. High tides caused the loss of 17.8% of the eggs laid at Griend Island, the Netherlands, in 1966, but accounted for the loss of only 1.8% of the eggs laid the following year (Veen 1977). The principal causes of loss of eggs and chicks in this area from 1966 to 1972 were "predation (eggs, 14.3%; chicks, 11.7%), high tides (eggs, 3.8%), hatching failure (eggs, 6.9%), food shortage, diseases and physical defects (together, 33.0% of chicks)" (Veen 1977).

Mammalian and avian predators are also a source of nest failure. Avian predators include various species of gulls, (Chestney 1970, Veen 1977, Fuchs 1977b, Blus et al. 1979), corvids (Veen 1977, Fuchs 1977b), Short-eared Owls (Asio flammeus) (Chestney 1970, Fuchs 1977b), and Oystercatchers (Haematopus ostralegus) (Veen 1977). At Sands of Forvie, Scotland, Black-headed Gulls (Larus ridibundus) prey primarily on eggs but also take chicks. Herring Gulls prey mostly on young but also take eggs. Great Black-backed Gulls sometimes also take chicks (Fuchs 1977b). Black-headed Gulls are the primary predator of eggs at Griend Island in the Netherlands while Herring and Great Black-backed Gulls prey mostly on chicks (Veen 1977). Herring and Great Black-backed Gulls have been considered the primary predator at some Sandwich Tern colonies in Germany (authors cited in Veen 1977). Laughing Gulls are the main avian predators of eggs at colonies in South Carolina (Blus et al. 1979). Common

Gulls (Larus canus) are also known to be predators, but evidently are unimportant ones (Veen 1977).

Most Sandwich Tern colonies are found in areas free of mammalian predators. When mammals are present, however, they may cause severe losses (Chestney 1970, Blus et al. 1979). Rats (Rattus spp.) (Chestney 1970, Fuchs 1977b, Veen 1977, Blus et al. 1979), various mustelids (Chestney 1970, Veen 1977), foxes (Vulpes vulpes) (Veen 1977), and dogs (Blus et al. 1979) are among reported mammalian predators.

Human disturbance is often a source of increased mortality at Sandwich Tern colonies. This disturbance may lead to complete abandonment of the site (Chestney 1970), or to greater mortality of young as a result of increased attacks by adults other than the parents.

Renesting Blus et al. (1979) indicated that this species will renest after a clutch is lost. They suggested, however, that the chances of successful renesting are poor unless large numbers of birds nested in a compact group.

Age at First Breeding Robinson (1910) indicated that a year-old bird bred in England, but this record is considered highly doubtful by Langham (1971), who noted that there was one record of a two-year-old bird breeding in Aberdeenshire. The distribution of recoveries led Langham to conclude that some British Sandwich Terns breed in their fourth summer, but that many probably do not breed until the following year when they are about four years old.

Maximum Natural Longevity The oldest known Sandwich Tern in the New World, banded as a juvenile in the Chandeleur Islands, Lousisiana, was 16 years and one month old when recovered in Mobile Bay, Alabama (Clapp et al. 1982a). Greater ages have been reached by Sandwich Terns in the Old World. Rydzewski (1978) listed two birds banded as young, evidently in the Netherlands, that attained minimum ages of 23 years and 7 months, and 21 years, respectively.

Weight We found little information on the weight on Sandwich Terns (Table 50).

SUSCEPTIBILITY TO OIL POLLUTION

Little published information exists on the prevalence of oiling in Sandwich Terns in the New World, probably because little effort has been made to obtain any data. F. Buckley (pers. comm.) has seen oiled Sandwich Terns in both Texas and North Carolina. Two seen at Oregon Inlet, North Carolina, were in poor condition.

In the Old World Sandwich Terns have been severely affected by oil at least once. Following the wreck of the GERD MAMRSK off the mouth of the Elba River in January 1955, contamination of eggs in the next breeding season reduced breeding success (Rittinghaus 1956 in Vermeer and Vermeer 1974). Terns became oiled when oil washed up onshore, and eggs became oiled from contact with the oily plumage of incubating birds. At least some of the eggs "did not

Table 50. Weights (in grams) of Sandwich Terns (a).

Mean weight	Range	Number of birds	Sample and season	Area	Source
237	-----	8	adults	England	Pearson 1968
197.5	167.2-227.8	11	adults, May-June	Texas	Maedgen et al. 1982
185.1	-----	1	male, early April	Peru	Campbell 1971
255.3	214-311	18	males	S U.S.S.R.	Borodulina 1960
191.4	170.9-216.8	3	females, early April	Peru	Campbell 1971
256.6	227-294.0	8	females	S U.S.S.R.	Borodulina 1960
255.6	234-303	6	fledglings, August	S U.S.S.R.	Borodulina 1960
-----	22-24	-	newly hatched chicks	S U.S.S.R.	Borodulina 1960

(a) Figures given for range from Maedgen et al. 1982 are the mean $\pm$ 2 SD.

hatch even after 50 days of incubation" (Rittinghaus 1956 in Hartung 1965).

White et al. (1979a) conducted field experiments on the effects of oil on Sandwich Tern eggs in Matagorda Bay, Texas, and supplemented them with observations of artificially incubated eggs at Patuxent Wildlife Research Center in Laurel, Maryland. Eggs in both areas were treated with 20 microliters of No. 2 fuel oil. The naturally incubated controls had no embryonic mortality, but 56% of the eggs treated with oil had embryonic mortality, a statistically significant difference. Sixty-one percent of 44 artificially incubated, unoiled eggs hatched, but none of 44 oiled eggs did. White et al. (1979a) did not make a statistical comparison between survival rates for the oiled and unoiled artificially incubated eggs because "examination of the control eggs...that failed to hatch revealed that most of the dead embryos were between 1 and 8 days old", and because the authors believed that mortality may have occurred during transport of the eggs to the laboratory. Nonetheless, they concluded that No. 2 fuel oil significantly reduced hatchability.

The Sandwich Tern is threatened in Europe (Smith 1975), and is considered "a species of special concern" in Florida (Kale 1978c) and North Carolina (Soots and Parnell 1979 ms). Blus et al. (1979) reported that increased fish harvest and offshore oil drilling pose a potential threat to Sandwich and Royal Terns in South Carolina. At present, Sandwich Terns are one of the most abundant breeding marine birds in the southeastern United States, where a large proportion of the world population nests. Large numbers are found in a few colonies. Consequently, human disturbance of their nesting areas, whether from activities related to oil development or for other reasons, can cause severe damage to perhaps the largest remaining populations of this species.

BIBLIOGRAPHY

1983

Vleck, C. M., D. Vleck, H. Rahn and C. V. Paganelli. 1983. Nest microclimate, water-vapor conductance, and water loss in heron and tern eggs. Auk 100: 76-83.

1982

Gochfeld, M. and J. Burger. 1982a. Feeding enhancement by social attraction in the Sandwich Tern. Behav. Ecol. Sociobiol. 10: 15-17.

Maedgen, J. L., C. S. Hacker, G. D. Schroder and F. W. Weir. 1982. Bioaccumulation of lead and cadmium in the Royal Tern and Sandwich Tern. Arch. Environ. Contam. Toxicol. 11: 99-102.

Vilagrasa, F. X., C. Carrera and R. Pardo. 1982. Hivernage de la Sterne caugek Sterna sandvicensis sur les cotes de la Catalogne et du Levant (Espagne). [Overwintering of the Sandwich Tern Sterna sandvicensis on the Catalonian coasts and the Levant (Spain).] Alauda 50: 108-113. [In French with English summary.]

1981

de Prato, S. R. D., J. M. Dickson and F. L. Symonds. 1981. Sandwich Terns in the Firth of Forth in winter. Scott. Birds 11: 226-227.

Gauzer, M. E. 1981. [Socially conditioned mortality of nestlings in the Thalasseus sandvicensis colonies on the Krasnovodsk Bay islands. 1. General characteristics of juvenile mortality and its possible causes.] Zool. Zh. 60: 530-539. [In Russian with English summary.]

Gloe, P. 1981b. Zur feldornithologischen Unterscheidung von Lachseeschwalbe (Gelochelidon nilotica) und Brandseeschwalbe (Sterna sandvicensis). Ornithol. Mitt. 33: 322-324. [In German.]

Grant, G. S. 1981. Belly-soaking by incubating Common, Sandwich, and Royal Terns. J. Field Ornithol. 52: 244.

Ouweneel, G. L. 1981. Winterwaarnemingen von Grote Sterns Sterna sandvicensis 1978-81. [Winter records of Sandwich Terns Sterna sandvicensis 1978-81.] Limosa 54: 96-97.

1980

Mathiasson, S. 1980. Sandwich Terns Sterna sandvicensis in a changing bird community and the need for alternative breeding sites. Acta Ornithol. 17: 87-105.

1979

Blus, L. J., R. M. Prouty and B. S. Neely, Jr. 1979. Relation of environmental factors to breeding status of Royal and Sandwich Terns in South Carolina, USA. Biol. Conserv. 16: 301-320.

Brichetti, P. 1979. Sulla nidificazione in Italia di Sterna s. sandvicensis Latham (Beccapesci). Riv. Ital. Ornitol. 49: 197-207. [In Italian with English summary.]

Foschi, U. F. 1979. Accertamento di nidificazione in Italia del Beccapesci (Sterna sandvicensis). Uccelli d'Italia 4: 271-272. [In Italian.]

Kiss, J. B. 1979. Verhaltensunterschiede zwischen Brandseeschwalben (Sterna sandvicensis Lath.) und Fluss-Seeschwalbe (S. hirundo Linne) wahrend der gegenseitigen Ablosungs-Rituale am nest. Tibiscus 1979: 201-210. [In Romanian with German summary.]

Pegowskii, Z. 1979. Gniezdzenie sie tybitw czubatych (Sterna sandvicensis) w rejonie Wisley. [The actual record of Sandwich Tern (Sterna sandvicensis) breeding in Poland.] Notatki Ornitol. 20: 50-51. [In Polish with English summary.]

Rittinghaus, H. 1979. Beitrage zur Okologischen Potenz einiger Seeschwalbenarten (Sterna albifrons, Sterna hirundo, Sterna paradisaea, Sterna sandvicensis). Ornithol. Mitt. 31: 73-85, 99-119. [In German.]

Scharringa, J. 1979. American Sandwich Tern Sterna sandvicensis acuflavidus in the Netherlands. Dutch Birding 1: 60.

Taylor, I. R. 1979a. The kleptoparasitic behaviour of the Arctic Skua Stercorarius parasiticus with three species of terns. Ibis 121: 274-282.

Thonnerieux, Y. 1979. Premiere citation rhonalpine de la Sterne caugek, Sterna sandvicensis. Le Bievre No. 1: 95-96.

White, D. H., K. A. King and N. C. Coon. 1979a. Effects of No. 2 fuel oil on hatchability of marine and estuarine bird eggs. Bull. Environ. Contam. Toxicol. 21: 7-10.

1978

Campredon, P. 1978. Reproduction de la Sterne caugek, Thalasseus sandvicensis Lath. sur le Banc d'Arguin (Gironde). Apercu de sa distribution hivernale. [Reproduction of the Sandwich Tern (Thalasseus sandvicensis Lath.) on the Banc d'Arguin (Gironde). Survey of their winter distribution.] Oiseau Rev. Fr. Ornithol. 48: 123-150, 263-279. [In French with English summary.]

Grant, P. J. 1978. Upperwing pattern of adult Gull-billed and Sandwich Terns. Brit. Birds. 71: 468-469.

Kale, H. W., II. 1978c. Species of special concern. Sandwich Tern. Pp. 92-95 in H. W. Kale, II (ed.). Rare and endangered biota of Florida. Vol. 2. Birds. Univ. Presses of Florida, Gainesville, FL. xix and 121 pp.

Kiss, J. B. 1978. [Lachmowen-angriffe in See-Schwalben-Kolonien.] Studii si Comuncari Muz. Brukenthal St. Nat. 22: 367-371. [In Rumanian with German summary.]

Mead, C. J. 1978. Tern mortality in West Africa as shown by British and Dutch ringing results. (Abstract only.) Ibis 120: 110.

Poslawski, A. N. and G. A. Kriwonosow. 1978. Die Brandseeschwalbe (Sterna sandvicensis) am Kaspischen meer. Ihre spezielle Anpassung an extreme Bedingungen an der Grenze des Verbreitungsgebiets. Ornithol. Mitt. 30: 211-222. [In German.]

Siokhin, V. D. 1978. [On interspecific relations of Sterna sandvicensis Lath. in mixed colonies.] Vestn. Zool. 1978: 73-74. [In Russian.]

1977

Britton, P. L. 1977b. Further records of the Sandwich Tern Sterna sandvicensis on the North Kenya coast. Scopus 1: 48.

Campredon, P. 1977. [Breeding of the Sandwich Tern (Thalasseus sandvicensis) on the Banc d'Arguin (Gironde); glimpse of its winter distribution.] Diploma, Bordeaux. 67 pp. [In French.]

Clancy, P. A. 1977. Notes on recent tern "wrecks" on the Natal coast. Bokmakierie 29: 17.

Fuchs, E. 1977a. Kleptoparasitism of Sandwich Terns Sterna sandvicensis by Black-headed Gulls Larus ridibundus. Ibis 119: 183-190.

_____. 1977b. Predation and anti-predator behavior in a mixed colony of terns Sterna spp. and Black-headed Gulls Larus ridibundus with special reference to the Sandwich Tern Sterna sandvicensis. Ornis Scand. 8: 17-32.

Veen, J. 1977. Functional and causal aspects of nest distribution in colonies of the Sandwich Tern (Sterna s. sandvicensis Lath.). Behaviour (Suppl.) 20.

Weske, J. S., R. B. Clapp and J. M. Sheppard. 1977. Breeding records of Sandwich and Caspian Terns in Virginia and Maryland. Raven 48: 59-66.

1976

Petit, P. 1976. Presence et nidification d'une Sterne voyageuse (Sterna bengalensis) dans une colonie de Sterne caugek (Sterna sandvicensis) sur le Banc d'Arguin (France). Ardea 64: 81-82. [In French with English summary.]

Poslavskii, A. N. and G. A. Krivonodov. 1976. Ecology of the Sandwich Tern (Thalasseus sandvicensis Lath.) at the boundary of the distribution range. Sov. J. Ecol. 7: 232-236.

Strijbos, J. P. 1976. Operatie grote sterns. Vogeljaar 24: 117-119.

1975

Bergersen, L. 1975. Splitterne funnet hekkende pa lista 1974. [First breeding of Sandwich Tern in Norway.] Sterna 14: 101-102. [In Norwegian with English summary.]

Dunn, E. K. 1975. The role of environmental factors in the growth of tern chicks. J. Anim. Ecol. 44: 743-754.

Forster, J. A. 1975. Electric fencing to protect Sandwich Terns against foxes. Biol. Conserv. 7: 85.

Isenmann, P. 1975. Uber einen Versuch zur Messung der Futterungshaufigkeit von fast fluggen Jungvogeln bei der Brandseeschwalbe (Sterna sandvicensis) in der Camargue (Sud-Frankreich). Vogelwarte 28: 159-160. [In German.]

Koeman, J. H. 1975. The toxicological importance of chemical pollution for marine birds in the Netherlands. Vogelwarte 28: 145-150.

Lloyd, C. S., C. J. Bibby and M. J. Everett. 1975. Breeding terns in Britain and Ireland in 1969-74. Brit. Birds 68: 221-237.

Loftin, R. W. and S. Sutton. 1975. Sandwich Tern breeds on the Atlantic coast of Florida. Fla. Field Nat. 3: 18.

Ouweneel, G. L. 1975. Overwinterende Grote Sterns Sterna sandvicensis in Nederland. [Wintering Sandwich Terns in the Netherlands.] Limosa 48: 197-201. [In Dutch with English summary.]

Smith, A. J. M. 1975. Studies of breeding Sandwich Terns. Brit. Birds 68: 142-156.

1974

Bourne, W. R. P. and A. J. M. Smith. 1974. Threats to Scottish Sandwich Terns. Biol. Conserv. 6: 222-224.

Filonov, K. P., V. I. Lysenko and V. D. Siokhin. 1974. [Peculiarities of Limicolae and Lari nesting on islands of Molochny Estuary (the Sea of Azov).] Vestn. Zool. 1974: 52-58. [In Russian with English summary.]

Langahm, N. P. E. 1974. Comparative breeding biology of the Sandwich Tern. Auk 91: 255-277.

Madge, G. 1974. A probable Sandwich Tern on the Kenya coast. Bull. East Afr. Nat. Hist. Soc. 1974: 30.

McFarlane, R. W. 1974. Unusual avian migrants in Tarapaca. Idesia 3: 181-184.

Ouweneel, G. L. 1974. In Januari-Februari 1974 Wederom Grote Sterns _Sterna sandvicensis_ in Zeeland. [Sandwich Terns _Sterna sandvicensis_ in _Zeeland_ in January-February 1974.] Limosa 47: 152-153. [In Dutch with English summary.]

Taverner, J. H. 1974. The effect on tern populations of Black-headed Gull numbers. Seabird Rep. 4: 36-39.

Taylor, I. R. 1974. The feeding behaviour and ecology of Sandwich, Common, and Arctic Terns on the Ythan Estuary, Aberdeenshire. Ph.D. thesis, Univ. Aberdeen/Aberdeen, Scotland.

Webster, R. E. 1974. Sandwich Tern ring recovery. Lammergeyer 21: 49.

1973

Dunn, E. K. 1973a. Changes in fishing ability of terns associated with windspeed and sea surface conditions. Nature 244: 520-521.

Hays, H., E. Dunn and A. Poole. 1973. Common, Arctic, Roseate, and Sandwich Terns carrying multiple fish. Wilson Bull. 85: 233-236.

King, B. 1973. Probable Sandwich Tern showing runt and albinistic characters. Brit. Birds 66: 538-539.

Krause, R. 1973. Erstnachweis der Brandenseeschwalbe (_Sterna sandvicensis_) fur die Oberlausitz. Abh. Ber. Naturkundemus. Gorlitz 46 (18): 13-14.

Ouweneel, G. L. 1973. December-en Januariwaarneming van een Grote Stern _Sterna sandvicensis_. [December-January record of the Sandwich Tern _Sterna sandvicensis_.] Limosa 46: 243-244. [In Dutch with English summary.]

Rowlett, R. A. 1973. Status of the Sandwich Tern in Maryland. Md. Birdlife 29: 81-82.

1972

Dunn, E. K. 1972a. Effect of age on the fishing ability of Sandwich Terns (Sterna sandvicensis). Ibis 114: 360-366.

_____. 1972b. Studies on terns with particular reference to feeding ecology. Ph.D. thesis, Univ. Durham/Durham, England.

Harvey, W. G. 1972. Two unusual tern species in Dar Es Salaam. Bull. East Afr. Nat. Hist. Soc. 1972: 175.

Haverschmidt, F. 1972. Further evidence of the 'portlandica' plumage phase of terns. Brit. Birds 65: 117-119.

Isenmann, P. 1972a. Aire de repartition de la Sterne caugek Sterna sandvicensis en Mediterranee et donnees sur sa biologie en Carmargue. Nos Oiseaux 31: 150-162. [In French with English summary.]

Langham, N. P. E. 1972. Chick survival in terns (Sterna spp.) with particular reference to the Common Tern. J. Anim. Ecol. 41: 385-395.

MacIvor, J. A. and J. D. Navarro Medina. 1972. Sobre invernada de Sterna sandvicensis en el Sureste. Ardeola 16: 263-264.

Rooth, J. and D. A. Jonkers. 1972. The status of some piscivorous birds in the Netherlands. TNO-nieuws 27: 551-555.

Stevenson, H. M. 1972b. Recent breeding of the Sandwich Tern (Thalasseus sandvicensis) in Florida. Fla. Nat. 45: 94-95.

Viksne, J. 1972. [The Sandwich Tern Sterna s. sandvicensis Lath. on the coast of the Gulf of Riga in summer 1971.] Zool. Mus. Raksti 9: 71-74. [In Latvian with English summary.]

1971

Campbell, K. E., Jr. 1971. First report of Sandwich Terns in Peru. Auk 88: 676.

Elliott, C. C. H. 1971. Analysis of the ringing and recoveries of three migrant terns. Ostrich Suppl. 9: 71-82.

Langham, N. P. E. 1971. Seasonal movements of British terns in the Atlantic Ocean. Bird Study 18: 155-175.

Nehls, H. W. 1971. Ueber den Einfluss des Brutzyklus auf die Scheitelfeder-mauser der Brandseeschwalbe (Sterna sandvicensis). [On the effect of the breeding cycle on the molt of the head feathers of the Sandwich Tern (Sterna sandvicensis).] J. Ornithol. 112: 230-231. [In German.]

1970

Chestney, R. 1970. Notes on the breeding habits of Common and Sandwich Terns on Scolt Head Island. Trans. Norfolk Norwich Nat. Soc. 21: 353-363.

Escalante, R. 1970. Notes on the Cayenne Tern in Uruguay. Condor 72: 89-94.

Holgersen, N. E. 1970. Sandwich Tern in Delaware. Cassinia 52: 33.

Taverner, J. H. 1970. Further observations on the breeding behavior of Sandwich Terns. Seabird Rep. 1969: 46-47.

1969

Besson, J. 1969. Hivernage de Sternes caugek (Sterna sandvicensis) dans le golfe de Saint-Tropez (Var.). Alauda 37: 255. [In French.]

Nehls, H. W. 1969. Zur Umseidlung, Brutortstreue und Brutreife der Brandseeschwalbe (Sterna sandvicensis) nach Ringfunden auf Langenwerder. Vogelwarte 25: 52-57. [In German.]

Valentine, J. M., Jr. 1969. Royal and Sandwich Terns of the Chandeleur Islands. La. Ornithol. Soc. News 51: 3-4.

1968

Eyster, M. B. 1968. Birds of the Chandeleur Islands. La. Ornithol. Soc. News 49: 5-7.

Hutchinson, R. E., J. G. Stevenson and W. H. Thorpe. 1968. The basis for individual recognition by voice in the Sandwich Tern (Sterna sandvicensis). Behaviour 32: 150-157.

Langham, N. P. E. 1968. The comparative biology of terns, Sterna spp. Ph.D. thesis, Univ. Durham/Durham, England.

Pearson, T. H. 1968. The feeding biology of sea-bird species breeding on the Farne Islands, Northumberland. J. Anim. Ecol. 37: 521-552.

Voous, K. H. 1968. Geographical variation in the Cayenne Tern. Ardea 56: 184-187.

1967

Davant, P. 1967. Premiere nidification de la Sterne caugek *Sterna sandvicensis* Lath. sur le Banc d'Arguin (Bassin d'Arcachon). Acta Soc. Linn. Bordeaux 104: 1-11. [In French.]

Gyeressy, A. 1967. The first occurrence of the Sandwich Tern (*Sterna s. sandvicensis* Latham) in Hungary. Vertebr. Hung. 9: 167-169.

Koeman, J. H., A. A. G. Oskans, J. Veen, E. Brouwer, J. Rooth, P. Zwart, E. van der Broek and H. van Genderen. 1967. Insecticides as a factor in the mortality of the Sandwich Tern (*Sterna sandvicensis*). A preliminary communication. Meded. Rijksfac. Landbouwwet. Gent 32: 841-854.

Rautavaara, A., M. Hario and S. Hannus. 1967. Riuttatira (*Sterna sandvicensis*) tavattu Yyterissa. [The Sandwich Tern (*Sterna sandvicensis*) seen at Ysteri, near Pori, western Finland.] Ornis Fenn. 44: 110. [In Finnish.]

Veen, J. 1967. Gechloreerde koolwaterstoffen in eieren en weefsels van de Grote Stern (*Sterna s. sandvicensis* Lath.) in Nederland. Ph.D. thesis, Inst. voor Vet. Farm. en Toxicologie/Utrecht, The Netherlands.

1966

Broekhuysen, G. J. 1966. Recovery of ringed Sandwich Terns. Ostrich 37: 191.

Jacoby, H. 1966. Brandseeschwalben (*Sterna sandvicensis*) am Bodensee. Egretta 9: 41-42.

Nehls, H. W. 1966. Eine neue Brandseeschwalben-Kolonie auf Langenwerder. Falke 13: 126-128. [In German.]

Schloss, W. 1966. Ringfunde der Brandseeschwalbe (*Sterna sandvicensis*). Auspicium 2: 195-217. [In German.]

Smith, A. J. M. 1966. Colour marking of Sandwich Terns. Seabird Bull. 2: 49-50.

Swahn, B. E. 1966. Kentska tarnan (*Sterna sandvicensis*) som hackfagel i Blekinge. [Sandwich Tern (*Sterna sandvicensis*) breeding in the province of Blekinge.] Var Fagelvarld 25: 59-60. [In Swedish with English summary.]

1965

ffrench, R. and C. T. Collins. 1965. Royal and Cayenne Terns breeding in Trinidad, West Indies. Auk 82: 277.

Lincoln, C. 1965. Cabot's Tern at Stone Harbor. Cassinia 48: 39-40.

Taverner, J. H. 1965. Observations on breeding Sandwich and Common Terns. Brit. Birds 58: 5-9.

Zapata, A. R. P. 1965. Neuvas localidades de nidification de Leucophaeus scoresbii (Traill) y Sterna sandvicensis eurygnatha Sunders (Aves, Laridae). Physis 25: 383-385. [In Spanish.]

1964

Smidt, A. and S. Broekhuizen. 1964. Griend, 1964, waarnemingen over het verloop van het broedseizoen en onderzoek naar de relatie tussen kapmeeuwen en Grote Sterns. Ph.D. thesis, Rijksunivers. Utrecht/Utrecht, The Netherlands.

1963

Lind, H. 1963b. Nogle sociale reaktioner hos terner. [Notes on social behavior in terns.] Dan. Ornithol. Foren. Tidsskr. 57: 155-175. [In Danish with English summary.]

Mahnke, W. and H. W. Nehls. 1963. Brutvorkommen der Brandseeschwalbe 1962 in der Wismar-Bucht. Falke 10: 15-17. [In German.]

Sandeman, G. L. 1963. Roseate and Sandwich Tern colonies in the Forth and neighboring areas. Scott. Birds 2: 286-293.

Sciple, G. W. 1963. Sandwich Terns present on outer coastal islands and offshore. Oriole 28: 11-12.

1962

Reichholf, J., K. Witt and W. Wust. 1962. Brandseeschwalben (Sterna sandvicensis) in Bayern. Anz. Ornithol. Ges. Bayern 6: 284-285.

Rittinghaus, H. 1962. Die Seeschwalben auf der Insel Minsener Oldenog. Oldenb. Jahrb. 61: 93-104. [In German.]

Thomson, A. L. 1962. Migration of the Sandwich Tern. Pp. 142-145 in D. A. Bannerman, The birds of the British Isles, Volume II. Edinburgh and London.

Williams, L. E. 1962. A summer visit to the Chandeleurs. La. Ornithol. Soc. News 31: 2-3.

1961

Gyllin, R. 1961. Stenknack (Coccothraustes coccothraustes) och kentsk tarna (Sterna sandvicensis) mojligen arsvissa hackfaglar i Smaland. Var Fagelvarld 20: 169-170.

Ringleben, H. 1961. Brandseeschwalben im niedersachsichen Binnenland. Beitr. Naturkd. Nieders. 14: 4-6.

1960

Ansingh, F. H., H. J. Koelers, P. A. van der Werf and K. H. Voous. 1960. The breeding of the Cayenne or Yellow-billed Sandwich Tern in Curacao in 1958. Ardea 48: 51-65.

Castan, R. 1960. Nidification de la Sterne caugek, Sterna sandvicensis sandvicensis Lath., sur les ilots des Bibans (sud Tunisien). Alauda 28: 281-283. [In French.]

Cullen, J. M. 1960a. Some adaptations in the nesting behaviour of terns. Proc. Internatl. Ornithol. Congr. 12: 153-157.

1959

Muller, H. 1959. Die Zugverhaltnisse der europaischen Brandseeschwalben (Sterna sandvicensis) nach Beringungsergebnissen. Vogelwarte 20: 91-115. [In German.]

Rooth, J. and M. Morzer Bruijns. 1959. De Grote Stern (Sterna s. sandvicensis Lath.) als broedvogel in Nederland. [The Sandwich Tern as a breeding bird in the Netherlands.] Limosa 32: 13-23. [In Dutch with English summary.]

Thybusch, D. and A. Stiefel. 1959. Brut. der Brandseeschwalbe und Brutversuch der Schwarzkopfmowe 1958 auf der Fahrinsel. Falke 6: 10-13.

1958

Dost, H. 1958. Britvorkommen der Brandseeschwalbe auf Rugen. Falke 5: 188-195. [In German.]

Lennerstedt, I. 1958. En invasion av kentska tarnor Sterna sandvicensis pa Vastkusten 1956. [An accumulation of Sandwich Terns (Sterna sandvicensis) on the Swedish west coast in 1956.] Var Fagelvarld 17: 43-44. [In Swedish with English summary.]

Makatsch, W. 1958. Brandseeschwalben wieder Brutvogel an der deutschen Ostseekuste. Vogelwelt 79: 28-29.

Rooth, J. 1958. Relations between Black-headed Gulls (Larus ridibundus) and terns (Sterna spp.) in the Netherlands. Internatl. Comm. Bird. Preserv. Bull. 7: 117-119.

van Iersel, J. J. A. and A. C. A. Bol. 1958. Preening of two tern species. A study on displacement activities. Behaviour 13: 1-88.

1957

Hellebrekers, W. P. J. 1957. Over de authenticiteit der tweelegsels van Sterna sandvicensis sandvicensis Lath. in de Nederlands kolonies. [On the authenticity of the sets of Sterna sandvicensis sandvicensis Lath. consisting of two eggs in colonies in the Netherlands.] Limosa 30: 34-40. [In Dutch with English summary.]

Larsson, E. 1957. Kentsk tarna hackende i sodra Halland. Fauna Flora 52: 76-77.

Linder, S. 1957. Kentska tarnans upptradande i Goingebygden eftersommaren 1956. Fauna Flora 52: 75-76.

1956

Matthiason, S. 1956. Den kentska tarnan en sarpraglad skanefogel. Skanes Nat. 43: 35-44.

Hanstrom, B. 1956. Okad frekvens av kentsk tarna vid Steninge, Halland, sommaren 1956. Fauna Flora 51: 270.

1955

Hollom, P. A. D. 1955. Sandwich Tern playing with object in flight. Brit. Birds 48: 282.

Junge, G. C. A. and K. H. Voous. 1955. The distribution and the relationship of Sterna eurygnatha Saunders. Ardea 43: 226-247.

Loetscher, F. W., Jr. 1955. Cabot's Sandwich Tern in New Jersey. Wilson Bull. 67: 65.

1954

Duchrow, H. 1954. Brandseeschwalbe, Sterna s. sandvicensis Latham, am Steinhuder Meer. Beitr. Naturkd. Nieders. 7: 80-81.

van den Assem, J. 1954a. Waarnemingen over het gedrag van de Grote Stern. Levende Nat. 57: 1-9. [In Dutch.]

_____. 1954b. Kokmeeuwen als belagers van Grote Sterns. Levende Nat. 57: 141-145. [In Dutch.]

_____. 1954c. Reproductive behaviour in the Sandwich Tern, Sterna s. sandvicensis. Unpubl. rep., Leiden Univ./Leiden, The Netherlands.

Swanberg, P. O. 1954. Kentska tarnor (Sterna sandvicensis) vid Morups Tange. Fauna Flora 49: 91-92.

1952

Chadwick, P. J. 1952. Sandwich Tern carrying fish on migration. Brit. Birds 45: 429.

Smout, T. C. and H. F. Dixon. 1952. Sandwich Tern carrying food on migration. Brit. Birds 45: 73-74.

1950

Sciple, G. W. 1950. A second Georgia specimen of Cabot's Tern. Oriole 15: 8.

1947

Salomonsen, F. 1947. Maagekolonierne paa Hirsholmene. [The gull-colonies on Hirsholmene.] Dan. Ornithol. Foren. Tidsskr. 41: 174-186. [In Danish with English summary.]

1943

Thomson, A. L. 1943. The migration of the Sandwich Tern. Results of British ringing. Brit. Birds 37: 62-69.

1941

Hardy, E. 1941. The Sandwich Terns of Ravenglass. Aquarist 11: 19-21.

1940

Riviere, B. B. 1940. Moult of head in Sandwich Tern in breeding season. Brit. Birds 34: 91.

Robinson, H. W. 1940. The Sandwich Tern breeding in winter plumage and in immature plumage. Ibis (14th Ser.) 4: 150-151.

1936

Dobbrick, W. 1936. Ein neuer Brutvogel an der Danziger Kuste--*Sterna s. sandvicensis* Lath. Brandseeschwalbe. Ornithol. Monatsber. 44: 184-186.

1934

Robinson, H. W. 1934b. Large clutches of eggs in terns. Brit. Birds 28: 150.

Tekke, M. J. 1934. Overzicht der terugmeldingen van in Nederland geringde vogels ii. De Grote Stern *Sterna sandvicensis sandvicensis* Lath. Org. Club Ned. Vogelkd. 6: 127-134.

1933

Robinson, H. W. 1933. Great mortality among young terns in Lancashire. Brit. Birds 27: 138-139.

1932

Dircksen, R. 1932. Die Biologie des Austernfischers, der Brandseeschwalbe und der Kustenseeschwalbe nach Beobachtungen und Untersuchungen auf Noord-eroog. J. Ornithol. 80: 427-520. [In German.]

1931

Charteris, G. 1931. Sandwich Terns breeding in South Uist. Brit. Birds 25: 82.

Steinbacher, G. 1931. Beitrage zur Brutbiologie von Silbermowe und Brandsee-schwalbe. J. Ornithol. 79: 349-353. [In German.]

1930

Robinson, H. W. 1930. Size of clutches in Sandwich Terns. Brit. Birds 24: 132-133.

1929

Dresselberger, H. 1929. Soziologische Beobachtungen an Brandseeschwalben. Ornithol. Monatsber. 37: 14-18. [In German.]

1926

Collinge, W. E. 1926. An investigation of the food of terns at Blakeney Point, Norfolk. Trans. Norfolk Norwich Nat. Soc. 12: 35-52.

Robinson, H. W. 1926. Young Sandwich Terns going to ground in hot weather. Brit. Birds 20: 108-109.

1921

Carroll, J. C. 1921. Notes for seasons 1918-19-20 on the Irish colonies of Sandwich and Roseate Terns discovered in 1917. Brit. Birds 14: 253-256.

1918

Ruttledge, R. F. 1918. Sandwich Terns breeding in Co. Galway. Irish Nat. 27: 15.

<u>1917</u>

Carroll, J. C. 1917. On newly discovered Irish colonies of Roseate and Sandwich Terns. Brit. Birds 11: 122-124.

<u>1910</u>

Robinson, H. W. 1910. Marked Sandwich Tern apparently nesting in its first year. Brit. Birds 4: 88.

<u>1909</u>

Robinson, H. W. 1909. Notes on the breeding of the Common and Sandwich Terns. Brit. Birds 3: 169-171.

<u>1908</u>

Pearson, T. G. 1908. Cabot's Tern (<u>Sterna sandvicensis acuflavida</u>) breeding in North Carolina. Auk 25: 312.

Adult Sandwich Tern in breeding plumage. Photograph by Clayton Taylor.

ROSEATE TERN

(Sterna dougallii)

[DA: Dougallsterne, DU: Dougall's Stern, FI: Ruusutiira, FR: Sterne de Dougall, GE: Rosenseeschwalbe, IC: Rothaderna, IT: Rondine di mare del Dougall, PO: Rybitwa rozowa, PR: Andorinha do mar, SP: Charran de Dougall, Charran rosadó; SW: Dougalls tarna, Rosentarna]

GENERAL DISTRIBUTION

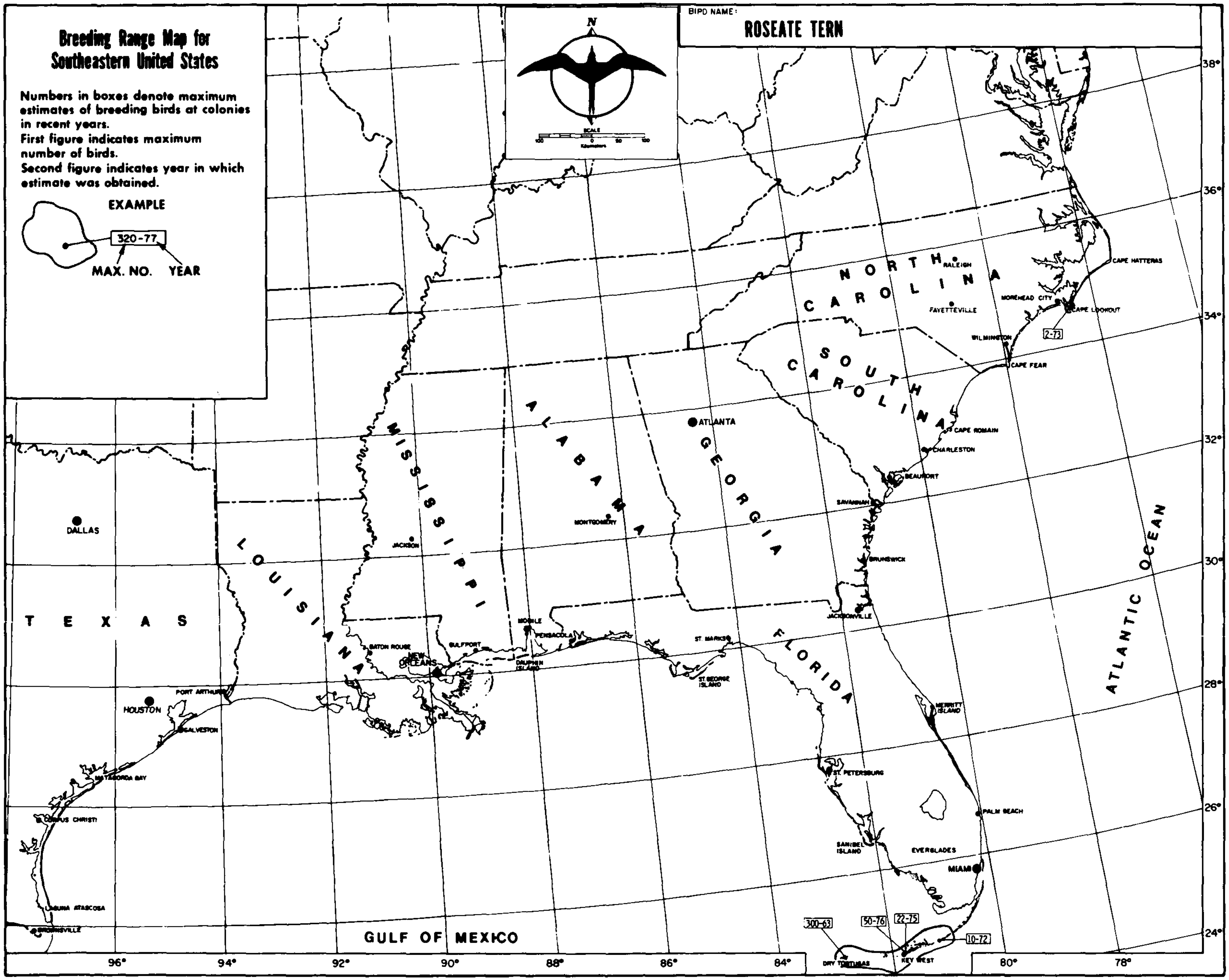
North America In Canada and the United States Roseate Terns breed mainly along the northern Atlantic coast. Scattered colonies are found from Quebec to North Carolina, but most of the population is concentrated between Cape Cod, Massachusetts and Long Island, New York (Nisbet 1980, Buckley and Buckley 1981). Although Roseate Terns breed regularly in Nova Scotia (Godfrey 1966), numbers there are declining (Nisbet 1980). A few recently bred in Quebec and New Brunswick (Smith 1979 in Nisbet 1980). The only place in the United States south of New York where Roseate Terns breed regularly is in scattered colonies in the southernmost part of Florida (Map 17).

Roseate Terns formerly bred in Bermuda (AOU 1957) and now breed widely in the West Indies. They breed in the Bahamas and the Greater and Lesser Antilles (Bond 1971), but details of distribution and population size are poorly known. The only documented breeding areas in Central America are at Sandy Cay, ca. 35 km (22 mi) off the northern coast of Honduras (Udvardy et al. 1973), and on islets off Belize (Pelzl 1969 in Gochfeld 1983), but there may be other undiscovered colonies in Central America.

Migrants from populations in the northeastern United States winter primarily in the waters off Trinidad and northern South America from the Pacific coast of Columbia to eastern Brazil (Nisbet 1980). Wintering grounds of Caribbean populations are still unknown, but two returns in Guyana of chicks banded in the Virgin Islands (Nisbet 1980) suggest Caribbean birds winter in the same areas as those from the northeastern United States. Roseate Terns straggle north to Newfoundland (2 records: Nisbet 1980), inland to Indiana (AOU 1957, Nisbet 1980) and western New York (AOU 1957), and south to El Salvador and Nicaragua (Nisbet 1980).

World Distribution Roseate Terns have a widely scattered distribution in temperate and tropical waters; they occur primarily between 56°N and 35°S (BOU 1971). Within this area they are absent from most of the Pacific Ocean and only barely reach South America in the Atlantic Ocean, where they breed on the Los Roques islands off Venezuela (Gochfeld 1983).

Roseate Terns in northwestern Europe breed primarily in Great Britain, Brittany (in France), and in the Azores, although they occasionally breed in


Breeding Range Map for Southeastern United States
Numbers in boxes denote maximum estimates of breeding birds at colonies in recent years.
First figure indicates maximum number of birds.
Second figure indicates year in which estimate was obtained.
EXAMPLE
320-77
MAX. NO.
YEAR
BIRD NAME:
ROSEATE TERN
N
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI
LOUISIANA
TEXAS
FLORIDA
ATLANTIC OCEAN
GULF OF MEXICO
RALEIGH
FAYETTEVILLE
MOREHEAD CITY
CAPE HATTERAS
CAPE LOOKOUT
2-73
WILMINGTON
CAPE FEAR
CAPE ROMAIN
CHARLESTON
BEAUFORT
ATLANTA
SAVANNAH
BRUNSWICK
JACKSONVILLE
MONTGOMERY
JACKSON
DALLAS
MOBILE
PENSACOLA
BATON ROUGE
GULFPORT
NEW ORLEANS
DAUPHIN ISLAND
ST MARKS
ST GEORGE ISLAND
PORT ARTHUR
HOUSTON
GALVESTON
MATAGORDA BAY
CORPUS CHRISTI
LAGUNA ATASCOSA
BROWNSVILLE
MERRITT ISLAND
ST. PETERSBURG
PALM BEACH
SANIBEL ISLAND
EVERGLADES
MIAMI
300-63
50-76
22-75
10-72
DRY TORTUGAS
KEY WEST
38°
36°
34°
32°
30°
28°
26°
24°
96°
94°
92°
90°
88°
86°
84°
80°
78°

Map 17

the Camargue in France, and in northwest Germany (Nisbet 1980). There is also one record from Belgium (Burggraeve 1977). Formerly, colonies were found in Tunisia (Nisbet 1980), but most of the Roseate Terns breeding in Africa now are found off the eastern coast, particularly off the coast of Kenya and less commonly off Tanzania (Britton 1977a). Some Roseate Terns also breed in Oman in the Persian Gulf (Dunn in Nisbet 1981a, Feare in Gochfeld 1983), and in a few scattered localities in extreme southern Africa and off Madagascar (Nisbet 1980).

In the Indian Ocean and in Asia, Roseate Terns breed at least in the Seychelles and Carajos Cargados, on islands off India and Ceylon, and on islands in the Molucca Sea through the East Indies to the Ryu Kyus in the South China Sea (Cramp et al. 1974). They also breed in western Australia and on the Great Barrier Reef, but recent information on the breeding status in much of this area is lacking (Nisbet 1980).

Migrants from Europe winter primarily in waters off West Africa from the equator to 10°N (Cramp et al. 1974). Movements of other Old World populations are poorly known. Roseate Terns in Australia are relatively sedentary. They usually remain within the breeding range but may occasionally move north from the more southern colonies (Serventy et al. 1971).

DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

North Carolina The few records from North Carolina suggest that this species occurs primarily in the fall as an offshore transient in small numbers, but Roseate Terns have nested at least once in the state. On 2 June and 19 July 1972, a single bird was found in a mixed colony of Common Terns, Gull-billed Terns and Black Skimmers in Lighthouse Bay, Carteret County (Soots and Parnell 1975b). The behavior of this bird did not suggest that it was breeding, but the following year a pair with a nest with two eggs was found on 23 May at the edge of the Common Tern colony. We know of no more recent nesting in North Carolina, but occasional June sightings suggest that a few pairs may nest there.

Roseate Terns probably occur more frequently off North Carolina during migration than the scattered records indicate. However, they are probably never very common. Some birds almost certainly have been overlooked as fall birds are difficult to distinguish from other similar appearing *Sterna*. We know of 18 records.

1904	22 Aug.	1	coll. at Pea Island	Pearson et al. 1942
1937	20 Jan.	1	found dead at Cape Hatteras	Pearson et al. 1942
1938	4, 7 July	1(?)	seen in North Carolina	Grey 1940
1938	26 Aug.	1(?)	seen in North Carolina	Grey 1940

1938	8 Sep.	1(?)	seen in North Carolina	Grey 1940
1939	17 Aug.	1	ad. female coll. at Oregon Inlet	Grey 1940
1939	18 Aug.	1	ad. male coll. at Oregon Inlet	Grey 1940
1939	28 Aug.- 8 Sep.		"fairly common" at Pea Island	Grey 1940
1939	19 Sep.	2	seen at Town Shoal near Beaufort	Simpson 1940
1958	23 May	1	seen on beach near Southport	Chamberlain 1958b
1972	17 July	1	seen at Shackleford Banks	Teulings 1972d
1972	5 Oct.	1	seen at Oregon Inlet	Teulings 1973a
1974	3 June	1	seen at Hatteras Island	Teulings 1974d
1974	28 Oct.	2	seen off Cape Point, Cape Hatteras	Rowlett 1978
1977	29 June	1	seen off Oregon Inlet	LeGrand 1977b
1978	30 Apr.	1	found near Gatesville	Nisbet 1980
1979	19 Aug.	1	seen at Hatteras harbor	LeGrand 1980b
1980	20 May	1	seen at Cape Hatteras Point	LeGrand 1980c

South Carolina In South Carolina, the Roseate Tern is a seldom seen transient that has been reported almost solely during the spring migration. A total of 12 sightings involving about 18 birds were reported through 1979. A specimen reportedly was collected in October about the late 1880's (Wayne 1910). This record was mentioned by Mack (1969), but has since been disregarded because it is believed to be invalid (Burton 1970).

1870	14 May	(1?)	seen at Egg Bank, St. Helena Sound	Sprunt and Chamberlain 1949
1934	19 Apr.	3	seen off Dewees	Sprunt and Chamberlain 1949
1937	29-30 Mar.	1	seen at Cape Romain	Sprunt and Chamberlain 1949
1940	16 Apr.	1	seen near Long Bay Plantation Horry County	Sprunt and Chamberlain 1949
1940	28 July	1	seen near Long Bay Plantation	Sprunt and Chamberlain 1949

1948	5 Apr.	1	seen at Bull's Island	Sprunt and Chamberlain 1949
1967	23 Apr.	2	seen at DeVaux Bank	Burton 1970
1968	28 Apr.	1	seen at the Isle of Palms	Mack 1969
1975	17 Apr.	2	seen at Calibogue Sound, Hilton Head Island	Chapin 1975
1977	21 Apr.	1	seen on the beach, near Singleton's Beach, Hilton Head Island	Cathcart 1977
1979	12 May	several	seen at Huntington Beach State Park	LeGrand 1980b
1979	11 Aug.	2	seen at Huntington Beach State Park	LeGrand 1980b

Georgia Denton et al. (1977) did not include the Roseate Tern in the list of birds known to occur in Georgia. Burleigh (1958) listed the occurrence of this species as hypothetical because the only known specimen (Hebard 1940) had been lost. There are now three records from the state including Hebard's. Hebard (1940) reported that a Roseate Tern was found dead and collected at Mill Creek, western Camden County on 5 November 1940. The second record is for a banded bird found near Everett City in September 1954 (Nisbet 1980), and the third record is of a tern seen at Jekyll Island beach on 10 September 1977 (Bevis 1979).

Florida Roseate Terns are seen rarely in Florida except in the vicinity of breeding colonies. A few migrants and wintering birds have been recorded, although some of these may have been misidentified individuals of other species of terns. Most of the records are of migrants or wintering birds. Most of these birds were seen along the Atlantic coast; few were seen in the Gulf. Some, perhaps most, birds seen in April or May may have been returning to or already at nearby breeding areas. Records of 60-70 Roseate Terns seen 13 September 1972 off Molasses Reef (Stevenson 1973), up to 200 seen 6 August 1974 (Edscorn 1975), and several pairs seen feeding young 14 July 1979 at Key Haven (Ogden 1979b) are excluded from the list below because they were at or near known breeding areas.

1886	24 Sep.	1	coll. at John's Pass	Howell 1932
1887	Mar.	1	coll. at Sombrero Key	Howell 1932
1915	Jan.	1	coll. at Sandy Key	Howell 1932
1919	28 Mar.	11	seen at East Goose Creek, Wakulla County	Howell 1932

1922	1 Jan.	1	seen at East Goose Creek,	Howell 1932
1929	2 May	1	seen at Dunedin Isles	DuMont 1931
1952	14 Sep.	1	found near Pompano Beach	Nisbet 1980
1959	3 May	2	seen at Sigsbee Island, Key West	Hubbard 1959
1959	14 June	3	seen at Marco Island	Stimson 1959
1960	10 Dec.	ca. 6	seen at Biscayne Bay	Abramson 1961
1963	14 Dec.	1	seen at Lake Ingraham, Everglades	Cunningham 1964b
1965	9 Sep.	1	found exhausted on spoil area near Fort Pierce	Pantelidis 1966
1971	3 May	8	seen off Cape Canaveral	Kale 1971
1972	30 Apr.	1	seen at Cocoa	Ogden 1972
1973	24 Apr.	2	seen 20 mi E Cape Canaveral	Kale 1973
1973	3 Sep.	2	seen at Sebastian Inlet	Edscorn 1974
1974	29 Mar.	3	seen at Vero Beach	Stevenson 1974
1974	7 Apr.	1(?)	seen at Mayport	Kale 1974
1974	8 May	2	seen 20 mi E Cape Canaveral	Kale 1974
1975	27-28 June	1(?)	seen off Cape Canaveral	Ogden 1975
1976	29 Mar.	1	seen off Cape Canaveral	Stevenson 1976
1976	5 Jan.	1(?)	seen at Key West	Stevenson 1976
1976	6 Apr.	1	seen at St. Armand's Key, Sarasota	Kale 1976
1976	23 Apr.-4 May	several	seen regularly off Cape Canaveral	Kale 1976
1976	6 Dec.	1	found dead at Key West	Stevenson 1976
1978	18 Mar.	1	seeen at Big Marco Pass near Naples	Kale 1978a
1979	21 Apr.	1	seen at Mullet Key	Kale 1979
1979	29 Apr.	26	seen at Key West	Kale 1979

1979	8, 14 May	2	seen at Longboat Key	Kale 1979
1979	9 May	15	seen off Islamorada	Kale 1979
1979	20 June	2	seen at Port Canaveral	Ogden 1979b
1979	3 Sep.	8	seen between Lantana and Boynton Inlets, Palm Beach County.	Atherton and Atherton 1980
1979	30 Dec.	1	seen at Sebastian Inlet	Stevenson 1980
1980	19 May	14	seen at Big Marco Pass	Kale 1980
1981	14 Jan.	1	seen at Key West	Stevenson 1981

In Florida Roseate Terns breed only in the Keys. Their status there is poorly known because the area has not been surveyed often or completely. Robertson (1978a) considered the Roseate Tern to be threatened in Florida and believes (pers. comm.) that the breeding population consists of no more than 200 pairs. From 1962 to 1973 Roseate Terns were reported breeding in the Keys on islands off Seven-Mile Bridge, at Cocoplum Beach, Crawl Key, on spoil islands in Key West Harbor, and on the Molasses Reef Dry Rocks (authors cited in Robertson 1978a). More recent colonies have been reported at Key Haven, Key West, and near Marathon (Nisbet 1980), and there may be other undiscovered nesting areas (Robertson 1978a).

The primary breeding area in Florida was formerly in the Dry Tortugas, but none have bred there in the last three years (Robertson, pers. comm.). Roseate Terns returned to their colonies in the Dry Tortugas in late April or early May, began nesting in late May or early June, and departed by early September (Robertson 1978a).

Alabama The Roseate Tern occurs casually in Alabama and has only been reported three times. The first record was of 6 birds seen at Bayou La Batre 20 April 1956 (Imhof 1976b), the second was of another six birds in breeding plumage at Gulf Shores 16 April 1969 (Imhof 1969), and the third was of three adults seen at Dauphin Island 10 September 1979 (Purrington 1980).

Louisiana Roseate Terns are rare stragglers to Louisiana. The species has been recorded on four occasions, but all records are sightings and some are not adequately documented. The first record was of a bird or birds seen in the Chandeleur Islands on 8 June 1958 (Lowery 1974). Subsequent reports entail single individuals seen 12 and 20 January 1974 at the Cameron ferry crossing (Lowery 1974, Hamilton 1974), 27-28 December 1974 and 18 January 1975 at the same place (Hamilton 1975), and 11 September 1976 at Barataria Pass at the east end of Grand Isle (Purrington 1977).

Texas Roseate Terns are rare visitors to the Texas coast. Oberholser (1974) indicated that there were approximately nine sight records and three specimens for the state through 1974. Oberholser also reported that Roseate Terns have been recorded along the coast from 25 December through 23 August. We were unable to discover where Oberholser obtained the record for 23 August, but include it in Table 52.

1901	10 Apr.	1	coll. at Corpus Christi	Oberholser 1974
1923	4 Jan.	1	seen near Bahia Grande	Oberholser 1963 ms
1929	7 July	1	coll. on Lydia Ann Island	Oberholser 1974
1937	22 July	1	imm. male coll. on SW Matagorda Island	Oberholser 1974
1938	14, 20 May	2,1	seen at Galveston	Oberholser 1963 ms
1939	15 Apr.	1	seen at Kemah	Oberholser 1963 ms
1946	5 May	1	seen at Corpus Christi	Blacklock 1978 ms
1947	28 June	1	seen at Niggerhead Reef	Oberholser 1963 ms
1961	12 Sep.	1	seen at Austin	Webster 1962a
1966	19 Mar.	1	seen at Rockport	Webster 1966b
1968	8 Apr.	1	seen at Gilchrist, on the E end of the Bolivar Peninsula	Webster 1968b
1968	21 Apr.	1	seen on the Bolivar Peninsula	Webster 1968b
1968	28 Apr.	3	seen on the shore of Galveston Bay, 5 mi from Anahuac	Webster 1968b
1968	25 Dec.	1	seen in Corpus Christi Bay	Webster 1969b
1969	11 Jan.	1	seen at Gilchrist	Webster 1969b
1971	28 Feb.	1	seen off Aransas NWR	Webster 1971a
1971	25 Apr.	2	seen in the Port Lavaca area, Calhoun County	Webster 1971b
1974	27 Apr.	1	seen on the Bolivar Peninsula flats	Webster 1974c
1976	12 Mar.	1	ad. seen at the Texas City Dike	Webster 1976b

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

Breeding In North America Roseate Terns breed primarily in a small area extending from Nova Scotia to New York, although there is occasional scattered breeding in New Jersey, Virginia and North Carolina. There are also a few scattered colonies in southern Florida. Data from Erwin (1979a), Korschgen (1979), and Erwin and Korschgen (1979), summarized by Nisbet (1980), indicate a breeding population of about 4,670 Roseate Terns from Maine to New York in 1977. These birds were found in 22 colonies, most of them in Massachusetts (6) and New York (9). Three colonies, however, held about 90% of the population. These three colonies were on (1) North Monomoy (800 breeding birds); (2) Bird Island, Massachusetts (1,800); and (3) Great Gull Island, New York (1,600 breeding birds). About 5,000 Roseate Terns bred in northeastern North America in 1978. Most of these bred in Massachusetts (64.0%) and Long Island, New York (24.7%), but small populations were also found in three other areas: Maine (2.6%), Connecticut (7.4%), and Nova Scotia (1.3%) (Buckley and Buckley 1981).

Recent information on populations in these areas is limited. In 1979, the breeding population in Masschusetts contained about 3,650 birds, an increase of approximately 400 over the previous year but still about 800 under the peak recorded in 1972. In 1979 at least 440 bred in Connecticut (ca. 340 on Falkner Island and 100 on Tuxis Island [Spendelow, pers. comm.]). In 1980 about 3,740 bred at 9 colonies in Massachusetts, 1,780 bred at two colonies in New York (Nisbet 1981a), and 220-360 bred in Connecticut (Spendelow, in litt.). About 500 bred in Connecticut in 1981 and about 400 bred there in 1982 (Spendelow, in litt.).

Roseate Terns have bred in two other eastern states in recent years. A single pair nested in Rhode Island in 1977 and others possibly bred elsewhere in the state (Erwin 1979a). Two pairs nested in New Jersey in 1978, and one pair was reported nesting there in 1979 (authors cited in Nisbet 1980).

The overall numbers of Roseate Terns breeding in northeastern North America have been declining steadily, so much so that Buckley and Buckley (1981) recommended that these terns be considered an endangered species. Northeastern populations declined from a peak of about 17,000 breeding birds in the early 1930's to less than a third that number in 1978 (Buckley and Buckley 1981, Table 51).

At least 29 major North American Roseate Tern colonies have been lost or nearly extirpated since 1920 (Nisbet 1980), and a linear regression of population trends predicts that the species will disappear from the northeast by the year 2003 (Buckley and Buckley 1981). In at least 13 instances the loss of northeastern Roseate Tern colonies was related to occupation of the colony sites by Herring and Great Black-backed Gulls (Nisbet 1980). Predation by rats, red foxes (*Vulpes vulpes*), and Great Horned Owls (*Bubo virginianus*) was also a significant factor in the loss of these colonies; human disturbance played only a minor role. Almost all colonies lost to predation were found on the mainland in salt marshes or within 1 km (0.6 mi) of the mainland (Nisbet 1980). Although present production of young at northeastern colonies appears adequate to sustain the breeding population (Buckley and Buckley 1981), human

Table 51. Estimated former and present populations of Roseate Terns in northeastern North America (from Nisbet 1980).

Area	Peak breeding population and period		Population 1978-1979
Quebec	10	(1971-1972)	-
Nova Scotia	500	(1971-1972)	60
New Brunswick	2	(1979)	2
Maine	550	(1931-1941)	130
New Hampshire	120	(1941)	0
Massachusetts	13,000	(1931-1935)	3,200
Rhode Island	80	(1941)	-
Connecticut	3,200	(1941)	370
New York	3,800	(1971-1972)	1,240
New Jersey	20	(1931-1935)	-
Maryland	100	(1931-1935)	-
Virginia	20	(1931-1935)	-
TOTAL			5,000

predation on the wintering grounds may be contributing to the continuing decline of North American populations (Nisbet 1980).

Most of the rest of the New World population of Roseate Terns is found in the Caribbean. This species may breed widely in the Bahamas, but recent breeding has been documented only at Little Rock near Hawksbill Bay (about 40 pairs). Other colonies may be present on or near Norman's Key and Guana Key (Sprunt in Nisbet 1980).

The primary breeding area known in the Caribbean is in the Virgin Islands (Nisbet 1980). Dewey and Nellis (1980) reported that there have been at least 11 colonies in the U.S. Virgin Islands. The present status of several of these colonies is not known. Populations in this area are declining primarily as a result of disturbance and predation by man and introduced animals. Five colonies (4 of which were successful in fledging young) contained about 3,000 breeding birds in 1976; 4 of these colonies (only one of which fledged some young) held approximately 1,500 breeding birds in 1979. Several recent estimates for 8 of these colonies and the year of each estimate are as follows: Shark Island (66 breeding birds in 1979); Saba Cay (650 in 1979); Flat Cay (14 in 1979); Dog Island (708 in 1979); Cricket Cay (600 in 1977); Little St. James (300 in 1977); Kalkun (200 in 1978); and Flanagan Island (300 in 1978) (Dewey 1980 in Nisbet 1980). In 1980 about 2,300 breeding birds were found at three colonies: 1,600 at LeDuck Island off St. John, 750 at Kalkun Island, and 28 at Cricket Cay off St. Thomas (Dewey in Nisbet 1981a). In 1981 about 4,480

Roseate Terns bred at four islands in the northern U.S. Virgin Islands. One of the islands observed in 1981 (Shark Island) had about 1,975 breeding birds in early June (Norton 1981), making this the second largest colony under U.S. jurisdiction.

Large numbers of Roseate Terns formerly bred in the British Virgin Islands, but in 1976 the species was found breeding only on Guana Island (about 60 breeding birds), Cooper Island (about 40), and Cockroach Island (about 20) (Cambridge Ornithological Expedition 1976 in Nisbet 1980).

Roseate Terns also have been recorded breeding in other Caribbean areas since 1960, including Cuba (Nisbet 1980), Jamaica (Nisbet 1981a), islands off Puerto Rico, Sombrero Cay northwest of Anguilla, LeBoeuf Islet off St. Barthelemy, York Island at the east end of Antigua, Poirier and Touaou Islets in the Baie des Anglais at Martinique (Nisbet 1980), Castle Rock and Green Cay at St. Maarten, Green Island and Les Tentes near Grenada and the Grenadines (Nisbet 1981a), and Tobago (Nisbet 1980 and authors cited therein). The species also has been reported breeding in the Dominican Republic, Guadeloupe, and Dominica, but Nisbet (1980) found no recent information on these areas. Gochfeld (1983) concluded that the Lesser Antillean population is small compared with that in the Virgin Islands.

Elsewhere, populations of Roseate Terns in the New World probably also nest at Los Roques off Venezuela (Gochfeld 1983); on Aruba, Curacao, and Bonaire in the Netherlands Lesser Antilles and islets off Honduras and Belize (Nisbet 1980, Gochfeld 1983); and possibly on islets off the Yucatan Peninsula (Nisbet 1980). Four colonies with about 220 birds were found off Belize in 1968 (Pelzl 1969 in Gochfeld 1983) and perhaps several hundred pairs nest on Los Roques (Gochfeld 1983).

Old World Roseate Terns primarily occur in the tropical waters of the Atlantic, Indian, and Pacific Oceans. They also breed in temperate waters in northwestern Europe, the Azores, South Africa, the Ryu Kyu Islands, and western Australia. Few birds breed north of 45°N (Nisbet 1980). Numbers breeding in the Old World are poorly known because many of the breeding areas have not been surveyed recently. Earlier observations (summarized by Nisbet 1980) suggest that the species is most numerous in the Indian Ocean, which supported as many as 100,000 breeding birds. The largest colonies in this area presently are found on the coast of East Africa, where Roseate Terns are "certainly the most numerous and widespread [breeding] larid", numbering at least 16,000 breeding birds (Britton and Brown 1974). A single colony at Mlango wa Hindi, an island south of the Kiunga Islands, Kenya, contained at least 10,000 breeding birds (and perhaps as many as 14,000) in 1970 (Britton and Brown 1971). Other colonies at Aride Island in the Seychelles contained between 8,600 and 9,600 breeding birds in 1975 (Todd 1977 in Warman 1979). Elsewhere in the tropical Palearctic, large colonies have been reported in Madagascar (Nisbet 1980), the Mogadishu Islets off southern Somalia (Ash and Karani 1981), Sri Lanka, and western Australia (Nisbet 1980).

Roseate Tern populations peaked at about 17,000 breeding birds in North America, 8,400 in Europe, at least 4,000 in the West Indies, and at least several hundred in the Azores (Nisbet 1980). Gochfeld (1983) estimated the world population as somewhere between 20,000 and 55,000 pairs.

Nisbet (1980) remarked that recently "at least three of the temperate populations (in North America, Europe, and South Africa) have declined precipitously." Most of the breeding Roseate Terns in northwestern Europe in recent decades were found in Great Britain and France. In 1969 breeding populations in Great Britain contained about 4,950 birds, and Brittany in France had about 1,000 (authors cited in Nisbet 1980). Recent populations are much smaller. Some 2,800 Roseate Terns bred in Great Britain in 1974, most of them in Ireland (70.1%) and Wales (17.8%), and about 60 bred in Brittany in France in 1977 (authors cited in Nisbet 1980). In 1979 about 1,950 bred in Great Britain and 240 bred in France (Dunn in Nisbet 1981a). Populations in South Africa have declined from "hundreds" of pairs in the late 1930's to about 220 breeding birds at two localities in Algoa Bay (about 80 breeding birds at Bird Island in 1978 and about 140 breeding birds at St. Croix Island in 1977) (Randall and Randall 1980).

Winter The primary wintering ground for Roseate Terns from northeastern North America is along the northern coasts of South America from the Pacific coast of Columbia east to eastern Brazil. Considerable numbers also winter off Trinidad, but few Roseate Terns winter in the West Indies. Roseate Terns that breed in the West Indies depart in the fall for wintering grounds in South America (Nisbet 1980). Nisbet (1980) discovered a pronounced recent change in the distribution of recoveries of Roseate Terns banded in northeastern North America. Prior to 1966, most of the recoveries were from the West Indies and Trinidad. Since 1966, 96% of the recoveries have been from South America. Nisbet suggested that much of this change is due to birds being killed for food and/or feathers in Guyana.

Roseate Terns breeding in Great Britain winter primarily along the west coast of Africa (Cramp et al. 1974). There is little information on the wintering grounds of other Old World populations (Nisbet 1980), but some Australian populations are believed to be sedentary.

Migration In most of the southeastern United States Roseate Terns are rare migrants or vagrants that are most common in April, May, and September (Table 52), although a few have been reported in winter. Some of these records, as well as some of those obtained during other periods, are poorly documented sight records.

Nisbet (1980) analyzed the migration patterns of North American Roseate Terns, basing his work on a survey of the literature and on 1,185 recoveries of 94,913 birds banded in areas from Nova Scotia to the Virgin Islands and Venezuela. Most of these birds were banded in Massachusetts (86.4%) and New York (12.0%); less than 500 had been banded elsewhere. As a result, little is known about the dispersal of populations from other areas.

Table 52. Approximate number of Roseate Terns recorded by month for the coastal southeastern United States (a).

State/Region	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
North Carolina	1	-	-	1	2	2	2	7	5	3	-	-
South Carolina	-	-	1	13	3	-	1	2	-	-	-	-
Georgia	-	-	-	-	-	-	-	-	2	-	1	-
Florida	4	-	17	34	46	6	-	-	13	-	1	9
Alabama		-	-	12	-	-	-	-	3	-	-	-
Louisiana	2	-	-	-	-	1	-	-	1	-	-	1
Texas	2	1	2	10	3	2	1	1	1	-	-	1
TOTAL	9	1	20	70	54	11	4	10	25	3	2	11

(a) Birds found dead within the first 10 days of a month are arbitrarily assigned to the preceding month; those obviously long-dead are not included in this table. Where the number seen was not specified, we have assumed that one bird was seen. If more than one bird was known to have been seen but the number was not specified, we have assumed that two birds were seen. Birds seen during more than one month are included in the totals for both months. Some records for Florida that were probably birds from nearby breeding areas are not included, and some totals may represent replicate sightings.

Adult and juvenile Roseate Tern disperse from their breeding colonies in New England from mid-July through mid-September. Most remain in the general area of their breeding colony and depart south in late August and early September. Others may disperse as far as 500 km (310 mi) north or south along the Atlantic coast (Nisbet 1980).

The southward migration is apparently overwater on the western North Atlantic Ocean (Nisbet 1980) and few birds are seen inshore. Roseate Terns begin to arrive in the West Indies in mid-August, with peak occurrence in September and October, and a few recoveries have been obtained there in November and December. Roseate Terns are widely distributed along the northern coast of South America by early October, but they do not reach Brazil before November. Most birds spend their second summer on the wintering grounds. Some may move north during their third summer, but few return to their natal colonies to breed. Most young Roseate Terns return north during their fourth summer when many breed for the first time as three-year-old birds (Nisbet 1981a).

Migration of British Roseate Terns is similar to that of birds from the northeastern United States. Departure from the breeding colonies is followed by some movement north and south in August although subsequent recoveries have all been from areas to the south (Langham 1971). Like North American birds, most young remain on the wintering grounds during their first year with some movement north in their second summer. Some Roseate Terns return to northern European waters during their third summer. Langham (1971) believed that many of these birds do not breed until the following summer.

HABITAT

Nesting Nisbet (1981a) reported that Roseate Terns in northeastern North America characteristically use two types of sites: (1) sandy islands or barrier beaches and islands sparsely vegetated with grass and herbaceous plants, and (2) rocky or clay islands that, except in areas of rock outcrop or on sandy margins, are more densely vegetated and have taller plants than sites on sandy islands. Roseate Terns nest less frequently on mainland sites or in marshes on top of mats of tide-strewn wrack. Nisbet (1981a) remarked that optimum habitat in North America is apparently "an area with about 80 percent cover of herbaceous plants, growing to about 75 cm [30 in] in height." He described typical sites as those "adjacent to the base of clumps of beach grass [*Ammophila* spp.], or seaside goldenrod [*Solidago sempervirens*], under sprawling stems of beach pea [*Lathyrus japonicus*] or bindweed [*Calystegia sepium*], and among stands of ragweed [*Ambrosia artemisiifolia*], orache [*Atriplex patula*], or bouncing bet [*Saponaria officinalis*]."

Roseate Terns typically nest in colonies with other larids, almost invariably with Common Terns in northeastern North America, usually with this same species in Europe, and with other *Sterna* in other areas (van der Werf et al. 1958, Voous 1960, Nisbet 1981a). They usually nest in discrete subcolonies, often with a high nest density. Between 0.7-4.0 nests/sq m (6.5-37.2 nests/100 sq ft) were found in Roseate Tern colonies in Massachusetts (Nisbet 1981a). At Aride Island in the Seychelles, nest density ranged from 0.31 nests/sq m (2.9 nests/100 sq ft) under a tall canopy of *Pisonia grandis* to 0.97 nests/sq m (9.0 nests/100 sq ft) in an open grassy area (Todd in Warman 1979). Roseate Tern nests at a very large colony on Mlango wa Hindi off Kenya occurred at densities ranging from 0.2 nests/sq m (1.9-2.3 nests/100 sq ft) minimum to 3-4 nests/sq m (27.9-37.2 nests/100 sq ft) maximum; the average density of nests in this colony was about 0.6 nests/sq m (6.2 nests/100 sq ft) (Britton and Brown 1971). Roseate Terns at one site on St. Croix Island, South Africa, nested at a density of 0.2 nests/sq m (1.9 nests/100 sq ft) (Randall and Randall 1981).

In colonies in the northeastern United States, nests are usually placed among or under cover (dense vegetation, boulders, or driftwood) and are only rarely found in the open (Nisbet 1981a, Spendelow 1982). Nisbet detected no clear geographical pattern in the use of vegetated or unvegetated sites, or in the amount of cover around the nest. His report shows that Roseate Terns breeding elsewhere use a variety of sites ranging from ones similar to those used in North America to sparsely or unvegetated sites in areas of sand, broken coral, or limestone in the Caribbean. Nesting habitats reported elsewhere include sand dunes; small rocky, coral, or limestone islands; flat-topped sandstone islands; shingle along the coast; saltpans; and islets in lagoons and coral reefs.

Nests sites reported include those under rock slabs, in crevices and natural hollows in rocks, rabbit (Oryctolagus cuniculus) burrows, puffin (Fratercula arctica) burrows, a vegetated sandy breakwater, large rocks or boulders, rock ledges, bare rocky slopes, and the ground under a canopy of tall trees (Nisbet 1981a). Human artifacts also may provide cover attractive to nesting Roseate Terns. Some of the more exotic sites used in colonies in Massachusetts, Connecticut, and New York included the inside of bushel baskets, paint cans, tires, horseshoe crab shells, buckets, and lobster pots, and underneath snow fence and piles of stakes (Nisbet 1981a, Spendelow 1982). Roseate Terns nesting under boards, driftwood and old tires provided by researchers had greater reproductive success at Falkner Island, Connecticut, than did terns nesting at natural, unmodified sites (Spendelow 1982).

The nest substrate is usually sand but may also be shingle, cobble, pebbles, bare rock or ground, turf, peat, dry vegetation, litter or soil under trees, rock or marl fill, and ridges of broken coral (Nisbet 1981a).

Feeding In Massachusetts feeding habitat consists mostly of "inlets, sheltered bays, tide rips and open coastal waters up to 2-3 km [1-2 mi] offshore" (Nisbet 1981a). Roseate Terns feed in deeper and usually clearer water than do Common Terns, and they rarely forage in the shallow water over sandbars as Common Terns do (Nisbet 1981a).

Breeding Roseate Terns usually feed in waters near their colonies, but may also travel considerable distances in search of food. Birds breeding at Bird Island, Massachusetts regularly feed as far away as 19 km (12 mi), but birds at Monomoy, Massachusetts obtained most of their food within 5 km (3 mi) of the colony (Nisbet 1981a). Roseate Terns breeding at Coquet Island, England, feed up to 22 km (13.7 mi) away (Dunn 1972b in Nisbet 1981a) and most evidently feed well offshore (Langham 1968, Dunn 1972b in Nisbet 1981a). At St. Croix Island, Algoa Bay, South Africa, Roseate Terns usually feed within 300 m (1000 ft) of the colony in water ca. 20 m (65 ft) deep (Randall and Randall 1978). Off the Kenya coast Roseate Terns, primarily birds in nonbreeding plumage, feed by the thousands in water 6-10 km (4-6 mi) offshore (Britton and Brown 1974).

Nonbreeding and Offshore Roseate Terns wintering in Guyana roost on mudbanks and are believed to feed in clear water 10 km (6 mi) or more offshore (Trull in Nisbet 1981a). Several adults were seen 10-12 mi (16-19 km) off Ocean City, Maryland in mid-August 1972 (DuMont and DuMont 1973a).

FOOD AND FEEDING BEHAVIOR

Roseate Terns obtain their food primarily by (1) feeding solitarily over widely dispersed shoaling fish; (2) feeding in flocks with other terns, often Common Terns, over schools of fish; and (3) kleptoparasitizing other species (Dunn 1973b, Nisbet 1981a). Most food is obtained by plunging into the water to seize the fish with the bill, but this species has also been observed seizing prey at the surface of the water and hawking insects from the air (Hulsman 1974 in Nisbet 1981a).

Roseate Terns in England usually dive from heights of 1.5 to 6 m (5-20 ft) and remain submerged for an average of 1.2 sec (Dunn 1972b in Nisbet 1981a). Similar immersion times have been recorded on Long Island (Duffy 1978 ms in Nisbet 1981a) and in Massachusetts (Nisbet 1981a). Nisbet remarked that Roseate Terns feeding in flocks in Massachusetts dive from heights similar to those reported by Dunn, but pointed out that solitary Roseate Terns usually dive from greater heights (5-12 m [16-39 ft]) and submerge longer (1.5-2.5 sec). He also remarked that Roseate Terns can dive deeper (75 cm [30 in] or more) than other medium-sized terns, but do not do so when fish can be obtained more easily near the surface.

Other species of terns are the primary objects of kleptoparasitism by Roseate Terns. When attempting to rob other terns of fish, Roseate Terns fly high (10-20 m [30-70 ft]) above the colony, dive on an incoming bird, and attempt to seize fish from the victim's' bill (Dunn 1973b). Roseate Terns at Coquet Island, England, obtained fish from Common Terns on 7.5% of their attempts, but success rate varied widely from day to day, ranging from 1.9% to 18.0% (Dunn 1973b). Roseate Terns at One Tree Island, Australia, succeeded in robbing members of their own species in only 2% of their attempts and successfully robbed Black-naped Terns (Sterna sumatrana) in only 2 of 420 attempts (0.5%). Stolen fish were 2-6 cm (0.8-2.4 in) long. Seven attempts to seize fish from Crested Terns (Sterna bergii) returning to the colony were unsuccessful, but two out of three attempts to rob Crested Terns in a foraging flock succeeded (Hulsman 1976).

Kleptoparasitic Roseate Terns in England are most successful when they attempt to seize the shortest fish (up to 2.5 cm [1 in]), and least successful when they attempt to seize the longest fish (10 cm [3.9 in]) (Dunn 1973b). Dunn pointed out that Roseate Terns that capture large fish obtain more food than those seizing small fish, but noted that terns concentrate their attacks on Common Terns carrying intermediate sized (ca. 5 cm [2 in]) fish.

The species that Roseate Terns kleptoparasitize depends upon the breeding cycle of the victims. In May at Coquet Island, Roseate Terns made most of their attempts to steal fish from Sandwich Terns, the only species at that time that was regularly bringing food back to the colony. By mid-July, when many of the young Sandwich Terns have fledged, Roseate Terns concentrate their efforts on their own species and on Common and Arctic Terns (Dunn 1973b).

Roseate Terns are specialists in diet. They feed almost entirely on small marine fish (Nisbet 1981a), although the major prey species differ from area to area. Dunn (1973b) noted that fish taken by plunge-diving at sea averaged about 4.5 cm (1.8 in) long and cited Langham's (1968) suggestion that the optimal size of prey for this species is between 5 and 7.5 cm (2-3 in) long. Little detailed information is available on specific foods eaten by Roseate Terns. Assembled below are scattered comments on foods eaten in different portions of the range:

Massachusetts Roseate Terns in Massachusetts eat mainly American sand lance (or sand-eel) (Ammodytes americanus) (Nisbet 1981a). These fish make up 80-100% of the diet during the first half of the breeding season (early May to mid-July), but clupeioids form part of the diet in late June and July. Adults feed mostly on juvenile sand lance 6-9 cm (2.4-3.5 in) long; newly hatched young are fed primarily on sand lance and herring 4-7.5 cm (1.6-3.0 in) long. Young are fed fish 6-9 cm (2.4-3.5 in) long when they grow older, and are occasionally fed fish weighing up to 15 gm (0.53 oz) that are 10-15 cm (4-6 in) long.

Fish eaten most frequently are Atlantic herring (Clupea harengus), blueback herring (Alosa aestivalis), round herring (Etrumeus teres), and Atlantic mackerel (Scomber scombrus). Other fish eaten in Massachusetts colonies, but which make up only a very small part of the diet, included butterfish (Peprilus triacanthus), pollock (Pollachius virens), Atlantic silverside (Menidia menidia), and cunner (Tautogolabrus adspersus) (Nisbet 1981a).

New York Roseate Terns at Great Gull Island in 1966 fed almost entirely on American sand lance. This fish was fed both to young and to partners in courtship-feeding. Both this species and butterfish were found in or near Roseate Tern nests (Cooper et al. 1970). From 2 to 14 August 1971, however, all fish brought to this colony by Roseate Terns were small Atlantic menhaden (Brevoortia tyrannus) up to about an inch (2.5 cm) long (Hays et al. 1973).

Florida Roseate Terns at the Dry Tortugas are reported (Robertson 1978a) to feed solely on fish 3-4 in (8-10 cm) long.

England Roseate Terns at Coquet Island, Northumberland, feed mostly (98%) on sprat (Clupea sprattus) and sand lance (Ammodytes marinus), and only occasionally on gadid fish and crustacea. The size of fish stolen by kleptoparasitic Roseate Terns ranges from 2.5 to 7.5 cm (1-3 in) for sprat and from 5 to 10 cm (2-4 in) for sand lance. The estimated weight of these fish ranges from approximately 0.2 to 2.5 g (0.007-0.90 oz) for sprat and 0.25 to 3.0 g (0.009-0.11 oz) for sand lance (Dunn 1973b).

South Africa Roseate Terns at St. Croix Island fed on 11 species of fish. Ratfish (Gonorhynchus gonorhynchus), averaging about 8.4 cm (3.3 in) long, were the most important food, comprising 20 of 43 food items examined. Most of the rest of the diet was made up of cheilodactylid and clupeid fish (3.9-8.3 cm [1.5-3.3 in] long) (Randall and Randall 1978).

SUSCEPTIBILITY TO OIL POLLUTION

There is little available information on the effect of oil on Roseate Terns or on the degree to which oiling occurs in the wild. Gochfeld (1979a) saw no oiled birds in a small population on western Long Island, but one of 76 birds examined in the hand was lightly oiled. Because Roseate Terns rarely occur in most southeastern states, and usually only as offshore migrants, it is unlikely that development of oil resources in this area will affect this species. Because Roseate Terns are threatened and declining in numbers in many parts of their range, including the United States, we recommend a careful survey of the populations in Florida to obtain needed information on their status and occurrence in the state and to determine which areas need protection.

BIBLIOGRAPHY

1983

Gochfeld, M. 1983. The Roseate Tern: world distribution and status of a threatened species. Biol. Conserv. 25: 103-125.

1982

Buckley, P. A. and F. G. Buckley. 1982. Population success and site-tenacity in saltmarsh-nesting Common and Roseate Terns. (Abstract only.) Colonial Waterbirds 5: 57.

Kemp, J. B. 1982. Identification of juvenile Common, Arctic and Roseate Terns. Brit. Birds 75: 129.

Spendelow, J. A. 1982. An analysis of temporal variation in, and the effects of habitat modification on, the reproductive success of Roseate Terns. Colonial Waterbirds 5: 19-31.

1981

Ash, J. S. and A. A. Karani. 1981. Roseate and Sooty Terns *Sterna dougallii* and *fuscata* breeding on islets in southern Somalia. Scopus 5: 22-27.

Buckley, P. A. and F. G. Buckley. 1981. The endangered status of North American Roseate Terns. Colonial Waterbirds 4: 166-173.

Hamilton, J. 1981. Recoveries of wintering Roseate Terns. J. Field Ornithol. 52: 36-42.

Nisbet, I. C. T. 1981a. Biological characteristics of the Roseate Tern *Sterna dougallii*. Unpubl. rep. U.S. Fish Wildl. Serv., Office of Endangered Species, Massachusetts, USA. i-viii, 1-112 and A1-A24 pp.

_____. 1981b. Behavior of Common and Roseate Terns after trapping. Colonial Waterbirds 4: 44-46.

Randall, R. M. and B. M. Randall. 1981. Roseate Tern breeding biology and factors responsible for low chick production in Algoa Bay, South Africa. Ostrich 52: 17-24.

Randall, R. M., B. M. Randall, A. L. Batchelor and G. J. B. Ross. 1981. The status of seabirds associated with islands in Algoa Bay, South Africa, 1973-1981. Cormorant 9: 85-104.

1980

Buckley, P. A. and F. G. Buckley. 1980b. Population and colony-site trends of Long Island waterbirds for five years in the mid 1970s. Trans. Linn. Soc. N.Y. 9: 23-56.

Dewey, R. A. 1980. Summary of studies of Roseate Terns in the U.S. Virgin Islands, 1975-1979. Unpubl. rep. Bur. Fish Wildl. Gov. of the Virgin Islands, St. Thomas, V.I.

Hulsman, K. 1980. Feeding and breeding strategies of sympatric terns on tropical islands. Proc. Internatl. Ornithol. Congr. 17: 984-988.

Nisbet, I. C. T. 1980. Status and trends of the Roseate Tern Sterna dougallii in North America and the Caribbean. Unpubl. rep. U.S. Fish Wild. Serv., Office of Endangered Species, Massachusetts, USA. 131 pp.

Randall, R. M. and B. M. Randall. 1980. Status and distribution of the Roseate Tern in South Africa. Ostrich 51: 14-20.

Tucker, V. R. 1980. Autumn Roseate Terns without tail streamers. Brit. Birds 73: 264.

1979

Bevis, J. H. 1979. Roseate Tern sighted on Jekyll Island. Oriole 44: 52-53.

Eigenhuis, K. J. 1979. Meer over de Dougalls Stern Sterna dougallii in Het Zwin in 1979. [More about the Roseate Tern Sterna dougallii in Het Zwin in 1979.] Dutch Birding 1: 59-60. [In Dutch with English summary.]

Forster, R. A. 1979. Roseate Terns in Massachusetts. Mass. Aububon 18(5): 10-11.

Gochfeld, M. 1979a. Prevalence of oiled plumage of terns and skimmers on western Long Island, New York: baseline data prior to petroleum exploration. Environ. Pollut. 20: 123-130.

Sibley, F. C. and J. A. Spendelow. 1979 ms. Falkner's Island tern project--1979. Peabody Mus., Yale Univ./New Haven, CT. 4 pp.

Smith, A. D. 1979. Roseate Terns in Atlantic Canada. Unpubl. rep. Can. Wildl. Serv., Environ. Canada, Sackville, NB.

van den Berg, A. B. 1979. Dougalls Stern Sterna dougallii broedend een kilometer buiten Nederland. [Roseate Tern Sterna dougallii breeding one kilometer outside the Netherlands.] Dutch Birding 1: 21.

Vanderbulcke, P. 1979. Velddeterminatie van Visdief, Noordse en Dougall's Stern. Veldornitol. Tijdschr. 2: 93-98.

Warman, S. R. 1979. The Roseate Tern *Sterna dougallii arideensis* on Aride Island, Seychelles. Bull. Br. Ornithol. Club 99: 124-128.

1978

Duffy, D. C. 1978. Terns and skimmers in Connecticut and eastern Long Island, N.Y., 1972-76. (Abstract only.) Ibis 120: 131.

_____. 1978 ms. The feeding ecology of Common and Roseate Terns during the breeding season at Great Gull Island, New York.

Erwin, R. M. 1978a. Population and colony site dynamics in selected Massachusetts waterbirds. Proc. 1977 Conf. Colonial Waterbird Group 1: 19-25.

_____. 1978b. Coloniality in terns: the role of social feeding. Condor 80: 211-215.

Evans, P. G. H. and W. R. P. Bourne. 1978. Auks on Inishtearaght, 1968-1973, and the occurrence of disease in terns. Irish Birds 1: 239-243.

Fisk, E. J. 1978a. Roof-nesting terns, skimmers and plovers in Florida. Fla. Field Nat. 6: 1-8.

_____. 1978c. The growing use of roofs by nesting birds. Bird-Banding 49: 134-141.

Gosper, D. G., W. D. Watson and G. C. Fraser. 1978. Sightings of the Roseate Tern on the north coast of New South Wales. Austr. Birds 13: 36-38.

Kepler, C. B. and A. K. Kepler. 1978. The seabirds of Culebra and its adjacent islands, Puerto Rico. Living Bird 16: 21-50.

Mead, C. J. 1978. Tern mortality in West Africa as shown by British and Dutch ringing results. (Abstract only.) Ibis 120: 110.

Nisbet, I. C. T. 1978b. Dependence of fledging success on egg-size, parental performance and egg-composition among Common and Roseate Terns, *Sterna hirundo* and *S. dougallii*. Ibis 120: 207-215.

Randall, R. M. and B. M. Randall. 1978. Diet of Roseate Terns during the breeding season at St. Croix Is., Algoa Bay. Cormorant 5: 4-10.

Robertson, W. B., Jr. 1978a. Roseate Tern. Pp. 39-40 *in* H. W. Kale, II (ed.). Rare and endangered biota of Florida. Vol. 2. Birds. Univ. Presses of Florida, Gainesville, FL. xix and 121 pp.

Rowlett, R. A. 1978. A massive flight of Cory's Shearwaters at Cape Hatteras. Chat 42: 45-46.

Sibley, F. C. and J. A. Spendelow. 1978 ms. Falkner's Island tern project-1978. Peabody Mus., Yale Univ./New Haven, CT. 4 pp.

Thomas, G. 1978. Roseate future? Birds (Lond.) 7: 30-31.

<u>1977</u>

Becker, P. 1977. Rosenseeschwalbe (<u>Sterna</u> <u>dougallii</u>) an der niedersachsischen Nordseekuste. Vogelkd. Ber. Nieders. 9: 12-13.

Behrends, O. 1977. Dougalls Tern (<u>Sterna</u> <u>dougallii</u>) i Vadehavet. Dan. Fugle 29: 81.

Britton, P. L. 1977a. Status and identification of East African terns. Scopus 1: 29-34.

Burggraeve, G. 1977. Waarnemingen bij een vermoedelijk gemengd broedpaar Dougalls Stern, <u>Sterna</u> <u>dougallii</u>, X Visdief, <u>Sterna</u> <u>hirundo</u>, te Knokke. [Observations on a probably mixed pair Roseate Tern, <u>Sterna</u> <u>dougallii</u>, new record, X Common Tern, <u>Sterna</u> <u>hirundo</u>, at Knokke.] Gerfaut 67: 75-80. [In Dutch with French and English summaries.]

Cathcart, N. 1977. Hilton Head Island, S.C. [Spring Count]. Chat 41: 88.

Cox, J. B. 1977. White-fronted Terns in South Australia and notes on the identification of similar terns. S. Austr. Ornithol. 27: 179-184.

Duffy, D. 1977b. Breeding populations of terns and skimmers on Long Island Sound and eastern Long Island: 1972-1975. Proc. Linn. Soc. N.Y. 73: 1-48.

Houde, P. 1977a. Low productivity of terns on Hicks Island, 1975. Proc. Linn. Soc. N.Y. 73: 49-57.

_____. 1977b. Gull-tern interactions on Hicks Island, 1975. Proc. Linn. Soc. N.Y. 73: 58-64.

Hulsman, K. 1977a. Breeding success and mortality of terns at One Tree Island, Great Barrier Reef. Emu 77: 49-60.

_____. 1977b. Daily attendance of terns and gulls at One Tree Island. Sunbird 8: 9-19.

Lloyd, C. S. and D. Cabot. 1977. Roseate Tern decline. Brit. Trust Ornithol. News 84: 5.

1976

Converse, J. D., H. Hoogstraal, M. I. Moussa, M. N. Kaiser, J. Casals and C. J. Feare. 1976. Aride virus, a new ungrouped arbovirus infecting *Amblyomna loculosum* ticks from Roseate Terns in the Seychelles. Arch. Virol. 50: 237-240.

Cormons, G. D. 1976. Roseate Tern bill color change in relation to nesting status and food supply. Wilson Bull. 88: 377-389.

Dexter, R. W. 1976. Marine banding and nesting studies at Cape Ann, Massachusetts. N. Am. Bird Bander 1: 165-167.

Gochfeld, M. 1976. Waterbird colonies of Long Island, New York. 3. Cedar Beach ternery. Kingbird 26: 62-80.

Hansen, J. 1976. Notes on the field identification of terns in Papua New Guinea. New Guinea Bird Soc. Newsl. 124: 5-15.

Hulsman, K. 1976. The robbing behavior of gulls and terns. Emu 76: 143-149.

Nisbet, I. C. T. 1976c. Returns from terns. Mass. Audubon Newsl. 15: 3-5.

1975

Anon. 1975. Welsh terns in peril. Newsl. N. Wales Nat. Trust 34: 4-5.

Chapin, C. S. 1975. Hilton Head Island, S.C. [Spring Count]. Chat 39: 84.

de Jonckheere, T. and Y. de Jonckheere. 1975. Dougall's Stern, *Sterna dougallii*. Wielewaal 41: 59.

Dunn, E. K. 1975. The role of environmental factors in the growth of tern chicks. J. Anim. Ecol. 44: 743-754.

Every, B. 1975. The Roseate Tern at Cape Recife. Bokmakierie 27: 59-60.

Hays, H. 1975. Probable Common X Roseate Tern hybrids. Auk 92: 219-234.

Hulsman, K. 1975. The skimming behaviour of terns. Sunbird 6: 41-43.

Lloyd, C. S., C. J. Bibby and M. J. Everett. 1975. Breeding terns in Britain and Ireland in 1969-74. Brit. Birds 68: 221-237.

Nisbet, I. C. T. 1975. Selective effects of predation in a tern colony. Condor 77: 221-226.

Nisbet, I. C. T. and M. E. Cohen. 1975. Asynchronous hatching in Common and Roseate Terns, *Sterna hirundo* and *S. dougallii*. Ibis 117: 374-379.

Soots, R. F. and J. F. Parnell. 1975b. First record of the Roseate Tern nesting in North Carolina. Chat 39: 20-21.

1974

Bibby, C. J., W. R. P. Bourne and O. J. Merne. 1974. Roseate Terns in trouble. Brit. Trust Ornithol. News 63: 8-9.

Britton, P. L. and L. H. Brown. 1974. The status and breeding behaviour of East African Lari. Ostrich 45: 63-82.

Cruickshank, A. D. 1974. Field identification of difficult birds: II. Four similar terns. Fla. Field Nat. 2: 1-3.

Gochfeld, M. 1974b. Prevalence of subcutaneous emphysema in young terns, skimmers and gulls. J. Wildl. Dis. 10: 115-120.

Hulsman, K. 1974. Notes on the behaviour of terns at One Tree Island. Sunbird 5: 44-49.

Langham, N. P. E. 1974. Comparative breeding biology of the Sandwich Tern. Auk 91: 255-277.

Leijs, H. N. and A. Vink. 1974. Een waarneming van dougals stern Sterna dougallii op de Maasulakte bij Oostuoorne Z.H. Limosa 47: 57-59. [In Dutch with English summary.]

Nisbet, I. C. T. 1974b. Further observations of terns' eggs enclosed by hatched eggshells. Blue Jay 32: 164-165.

Oreel, G. J. 1974a. Identification of Roseate Terns. Brit. Birds 67: 167-168.

Robbins, C. S. 1974. Probable interbreeding of Common and Roseate Terns. Brit. Birds 67: 168-170.

1973

Domm, S. and H. F. Recher. 1973. Birds of One Tree Island with notes on their yearly cycle and feeding ecology. Sunbird 4: 63-86.

Drury, W. H. 1973-74. Population changes in New England seabirds. Bird-Banding 44: 267-313; 45: 1-15.

Duffy, D. C. and C. La Farge. 1973. The birds of Great Gull Island 1966-1972. Linn. Soc. N.Y. vii and 44 pp.

Dunn, E. K. 1973b. Robbing behavior of Roseate Terns. Auk 90: 641-651.

Hays, H., E. Dunn and A. Poole. 1973. Common, Arctic, Roseate, and Sandwich Terns carrying multiple fish. Wilson Bull. 85: 233-236.

Nisbet, I. C. T. 1973b. Terns in Massachusetts: present numbers and historical changes. Bird-Banding 44: 27-55.

Thomas, R. D. and H. F. I. Elliott. 1973. Nesting of the Roseate Tern (Sterna dougallii) near Dar es Salaam. Bull. Br. Ornithol. Club 93: 21-23.

Udvardy, M. D. F., C. S. de Beausset and M. Ruby. 1973. New tern records from Caribbean Honduras. Auk 90: 440-442.

1972

Collins, C. T. and M. LeCroy. 1972. Analysis of measurements, weights, and composition of Common and Roseate Tern eggs. Wilson Bull. 84: 187-192.

Cramp, S. 1972. A new pollution threat? Brit. Trust Ornithol. News 49: 2.

Dunn, E. K. 1972b. Studies on terns with particular refererce to feeding ecology. Ph.D. thesis, Univ. Durham/Durham, England.

Hays, H. and R. W. Risebrough. 1972. Pollutant concentrations in abnormal young terns from Long Island Sound. Auk 89: 19-35.

Langham, N. P. E. 1972. Chick survival in terns (Sterna spp.) with particular reference to the Common Tern. J. Anim. Ecol. 41: 385-395.

Lazell, J. D., Jr. and I. C. T. Nisbet. 1972. The tern-eating Garter Snakes of Nomans Land. Man Nat., June 1972: 27-29.

LeCroy, M. 1972. Young Common and Roseate Terns learning to fish. Wilson Bull. 84: 201-202.

LeCroy, M. and C. T. Collins. 1972. Growth and survival of Roseate and Common Tern chicks. Auk 89: 595-611.

Nisbet, I. C. T. 1972. Disaster year for terns. Man Nat., Dec. 1972: 16-21.

Nisbet, I. C. T. and W. H. Drury. 1972. Measuring breeding success in Common and Roseate Terns. Bird-Banding 43: 97-106.

1971

Britton, P. L. and L. H. Brown. 1971. Breeding sea-birds at the Kiunga Islands, Kenya. Ibis 113: 364-366.

Donaldson, G. 1971. Roseate Tern breeds during its second year. Bird-Banding 42: 300.

Filonov, K. P. and V. I. Lysenko. 1971. [The biology of the Sea Pigeon Cepphus columba and Roseate Tern Sterna dougallii on the Milk estuary.] Biol. Nauki (Mosc.) 7: 31-33. [In Russian.]

Gochfeld, M. 1971. Premature feather loss--a "new" disease of terns on Long Island, N.Y. Kingbird 21: 206-211.

Harlow, R. A., Jr. 1971. Roseate Tern breeds during its third year. Bird-Banding 42: 50.

Hays, H. 1971. Roseate Tern, Sterna dougallii, banded on Atlantic coast recovered on Pacific. Bird-Banding 42: 295.

Hays, H. and R. W. Risebrough. 1971. The early warning of the terns. Nat. Hist. 80(9): 38-47.

Langham, N. P. E. 1971. Seasonal movements of British terns in the Atlantic Ocean. Bird Study 18: 155-175.

Nisbet, I. C. T. 1971c. Downward turn for terns? Mass. Audubon Newsl. 11: 8.

Parkes, K. C., A. Poole and H. Lapham. 1971. The Ruddy Turnstone as an egg predator. Wilson Bull. 83: 306-308.

1970

Collins, C. T. 1970. The Black-crowned Night Heron as a predator of tern chicks. Auk 87: 584-586.

Cooper, D., H. Hays and C. Pessino. 1970. Breeding of the Common and Roseate Terns on Great Gull Island [New York]. Proc. Linn. Soc. N.Y. 71: 83-104.

Hays, H. 1970b. Great Gull Island Report on nesting species, 1967-1968. Proc. Linn. Soc. N.Y. 71: 105-119.

Heilbrun, L. H. 1970. Great Gull Island, its history and biology. Proc. Linn. Soc. N.Y. 71: 55-79.

Pessino, C. 1970. Great Gull Island visits 1962-1966. Proc. Linn. Soc. N.Y. 71: 80-82.

1969

Avilova, K. V. 1969. [On the structure of the eye retina in gulls and Roseate Terns.] Vestn. Mosk. Gos. Univ. 1969: 121-123. [In Russian.]

Donaldson, G. and H. Hays. 1969. Roseate Tern in unusual plumage. Bird-Banding 40: 255.

Grant, P. J. and R. E. Scott. 1969. Field identification of juvenile Common, Arctic and Roseate Terns. Brit. Birds 62: 297-299.

Mack, B. 1969. The Roseate Tern in the Carolinas. Chat 33: 85-87.

1968

Black, R. 1968. Roseate Terns. Bokmakierie 20: 49.

Donaldson, G. 1968. Bill color changes in adult Roseate Terns. Auk 85: 662-668.

Langham, N. P. E. 1968. The comparative biology of terns, *Sterna* spp. Ph.D. thesis, Univ. Durham/Durham, England.

Pessino, C. M. 1968. Red-winged Blackbird destroys eggs of Common and Roseate Terns. Auk 85: 513.

1967

Armistead, H. T. 1967. Roseate Tern new for Dorchester County. Md. Birdlife 23: 10.

Clancy, P. A. 1967. The Roseate Tern *Sterna dougallii* in Natal. Ostrich 38: 288-289.

Clement, R. C. and R. E. Woodruff. 1967. A history of the nesting gulls and terns of Rhode Island, 1889-1961. Narragansett Nat. 5: 108-111, 125-128.

Nichol, W. 1967. An appeal for the protection of the Roseate Tern. Bokmakierie 19: 74.

Parslow, J. L. F. 1967. Changes in status among breeding birds in Britain and Ireland. Part 3. Brit. Birds 60: 177-202.

1966

Pantelidis, [V.] 1966. Roseate Tern at Fort Pierce. Fla. Nat. 39: 30.

1965

Drury, W. H., Jr. 1965b. Gulls vs. terns: clash of coastal nesters. Mass. Audubon 64: 207-211.

Voous, K. H. 1965. Nesting and nest-sites of Common Terns and Dougall's Terns in the Netherlands Antilles. Ibis 107: 430-431.

1964

Bonney, C. and L. Johnston. 1964. The nesting of Roseate Terns at Cocoa Plum Beach--Crawl Key, Florida. Fla. Nat. 37: 57-58.

Cunningham, R. L. 1964. Recent records from Everglades National Park. Fla. Nat. 37: 91-92.

Robertson, W. B., Jr. 1964. The terns of the Dry Torgugas. Bull. Fla. State Mus. 8: 1-94.

1963

Sandeman, G. L. 1963. Roseate and Sandwich Tern colonies in the Forth and neighboring areas. Scott. Birds 2: 286-293.

Voous, K. H. 1963. Tern colonies in Aruba, Curacao, and Bonaire, South Caribbean Sea. Proc. Internatl. Ornithol. Congr. 13: 1214-1216.

1962

Harrison, R. E. 1962. A note on the Roseate Tern. Linn. Newsl. 16: 2.

Mylne, C. K. 1962. Roseate Terns breeding on the mainland of Fife in 1956. Scott. Birds 2: 239.

1960

Cullen, J. M. 1960a. Some adaptations in the nesting behaviour of terns. Proc. Internatl. Ornithol. Congr. 12: 153-157.

1959

Hubbard, L. S. 1959. Observations at Key West. Fla. Nat. 32: 202, 211.

Stimson, L. A. 1959. Roseate Terns (Sterna dougallii). Fla. Nat. 32: 202.

1958

Tabor, A. R. 1958. Roseate Tern. Miss. Ornithol. Soc. Newsl. 3: 2.

van der Werf, P. A., J. S. Zaneveld and K. H. Voous. 1958. Field observations on the birds of the Islas Las Aves in the southern Caribbean Sea. Ardea 46: 37-58.

1957

Henry, D. and M. Henry. 1957. Roseate Tern nesting in Nova Scotia. Bird-Banding 28: 41.

Ridley, M. W. 1957. Terns of the Seychelles Islands. J. Bombay Nat. Hist. Soc. 54: 920-924.

1955

Bauer, K. and H. Freundl. 1955. Verschlagene Rosenseeschwalbe, Sterna dougallii, am Neusiedlersee. Vogelwelt 76: 13-15.

Dorn, J. L. 1955. Birding trips to Mississippi. La. Ornithol Soc. News 3: 3.

Gross, A. O. 1955. Changes of certain seabird populations along the New England coast of North America. Proc. Internatl. Ornithol. Congr. 11: 446-449.

Guichard, G. 1955. Notes sur la biologie de la Sterne de Dougall (Sterna d. dougallii). Oiseau Rev. Fr. Ornithol. 25: 75-86. [In French.]

Konig, D. 1955a Feldornithologische Kennzeichen der Rosenseeschwalbe (Sterna d. dougallii Mont.). Ornithol. Mitt. 7: 7.

_____. 1955b. Nachtrag zu: Feldornithologische Kennzeichen der Rosenseeschwalbe, (Sterna d. dougallii Mont.). Ornithol. Mitt. 7: 111.

1950

Adams, R. G. 1950. Roseate Terns in Devon. Brit. Birds 43: 381.

Serventy, V. N. and S. R. White. 1950. The Roseate Tern: notes on the nesting behavior. Emu 50: 145-151.

1949

King, B. 1949. Bill colour of Roseate Tern. Brit. Birds 42: 162.

Nyquist, E. and G. Otterlind. 1949. Dougalls tarna (Sterna dougallii Montagu) en for Sverige ny fagelart. [The first record of the Roseate Tern (Sterna dougallii Montagu) in Sweden.] Var Fagelvarld 8: 132-133. [In Swedish with English summary.]

Onslow, G. H. 1949. Bill colour of Roseate Tern. Brit. Birds 42: 159.

Sprunt, A., Jr. 1949b. Status of Roseate Tern as a breeding species in southern United States. Auk 66: 206-207.

1948

Austin, O. L. 1948. Predation by the Common Rat (Rattus norvegicus) in the Cape Cod colonies of nesting terns. Bird-Banding 19: 60-65.

1947

Campbell, B. 1947. Field notes on the breeding of the Roseate Tern (Sterna d. dougallii Mont.) in Scotland. North West. Nat. 22: 174.

1946

Austin, O. L. 1946a. The status of the Cape Cod terns in 1944: a behavior study. Bird-Banding 17: 10-27.

Crowell, E. M. and S. Crowell. 1946. The displacement of terns by Herring Gulls at the Weepecket Islands. Bird-Banding 17: 1-10.

1944

Austin, O. L. 1944. The status of Tern Island and Cape Cod terns in 1943. Bird-Banding 15: 133-139.

1943

Dathe, H. 1943. Eine Rosenseeschwalbe, Sterna d. dougallii Montague, von Busum. Zool. Anz. 142: 104-105. [In German.]

Williamson, K., M. N. Rankin and D. H. Rankin. 1943. Field notes on the breeding of the Roseate Tern (Sterna d. dougallii Mont.). North West. Nat. 18: 29-32.

1940

Austin, O. L. 1940. Some aspects of individual distribution in the Cape Cod tern colonies. Bird-Banding 11: 155-169.

Grey, J. 1940. Unusual birds in 1939. Chat 4: 1-5.

Hebard, F. V. 1940. Roseate Tern in Western Camden County. Oriole 5: 48, 53.

1939

de Beaufort, L. F. 1939. Een exemplaar van Sterna dougallii dougallii Mont. aan onze kust. Ardea 28: 58-59. [In Dutch.]

1938

Austin, O. L. 1938. Some results from adult tern trapping in the Cape Cod colonies. Bird-Banding 9: 12-25.

Floyd, C. B. 1938. Experiments with terns at Tern Island, Chatham, Massachusetts. Bull. Mass. Audubon Soc. 21: 2-4.

Palmer, R. S. 1938. Tern mortality along the Maine coast. Bird-Banding 9: 117-123.

1936

Latham, R. 1936. The rise and fall of a tern colony. Univ. State N.Y. Bull. Schools 22: 135-136.

1934

Austin, O. L. 1934. The status of Cape Cod terns in 1934. Bird-Banding 5: 155-171.

1933

Austin, O. L., Jr. 1933. The status of Cape Cod terns in 1933. Bird-Banding 4: 190-198.

1932

Austin, O. L. [Sr.]. 1932a. The status of Cape Cod terns in 1932. Bird-Banding 3: 143-156.

_____. 1932c. Duration of life of the Roseate Tern. Bird-Banding 3: 34.

Austin, O. L., Jr. 1932b. Further contributions to the knowledge of the Cape Cod Sterninae. Bird-Banding 3: 123-139.

Crowell, E. M. 1932. Two Common Tern returns and a Roseate Tern recovery. Bird-Banding 3: 33-34.

Floyd, C. B. 1932a. Strange disappearance of nesting Penikese Island terns. Bird-Banding 3: 173-174.

_____. 1932b. Report on tern banding on Cape Cod during 1931. Bird-Banding 3: 63-65.

Humphreys, G. R. 1932. [Letter on] Roseate Terns with three eggs. Brit. Birds 26: 204.

Marples, G. 1932a. Roseate Terns with three eggs. Brit. Birds 26: 168-169.

_____. 1932b. [Letter on] Roseate Terns with three eggs. Brit. Birds 26: 233-234.

Saunders, A. A. 1932. Increase of the Roseate Tern in Connecticut. Auk 49: 84-85.

Whittle, C. L. 1932. The Roseate Tern, a new recorded species for Newfoundland. Bird-Banding 3: 75.

1930

Floyd, C. B. 1930. Further banding notes from Tern Island, Massachusetts. Bird-Banding 1: 181-184.

Stoney, C. V. 1930. Erythristic egg of Roseate Tern. Brit. Birds 23: 226.

1929

Austin, O. L., Jr. 1929. Contributions to the knowledge of the Cape Cod Sterninae. Bull. N.E. Bird-Banding Assoc. 5: 123-140.

Floyd, C. B. 1929b. Notes on banding terns at Chatham, Massachusetts, for 1929. Bull. N.E. Bird-Banding Assoc. 5: 144-148.

1928

Floyd, C. B. 1928. Notes on banding terns at Chatham. Massachusetts, for 1928. Bull. N.E. Bird-Banding Assoc. 4: 125-132.

1927

Floyd, C. B. 1927. Notes on the development of young Common and Roseate Terns. Bull. N.E. Bird-Banding Assoc. 3: 95-101.

1926

Floyd, C. B. 1926. Additional experiences in banding terns at Tern Island, Chatham, Mass. Bull. N.E. Bird-Banding Assoc. 2: 68-72.

1925

Floyd, C. B. 1925. Six days in a Massachusetts tern colony. Bull. N.E. Bird-Banding Assoc. 1: 58-60.

1924

Forbush, E. H. 1924. Gulls and terns feeding on the Seventeen-year Cicada. Auk 41: 468-470.

1923

Phillips, W. W. A. 1923. An account of a visit to the breeding islet of Sterna dougallii korustes and Sterna bergii cristatus in Ceylon waters. Ibis (11th Ser.) 5: 604-606.

1921

Carroll, C. J. 1921. Notes for seasons 1918-19-20 on the Irish colonies of Sandwich and Roseate Terns discovered in 1917. Brit. Birds 14: 253-256.

1920

Bales, B. 1920. Roseate Tern (Sterna dougallii) breeding in Virginia. Auk 37: 579.

1917

Carroll, C. J. 1917. On newly discovered Irish colonies of Roseate and Sandwich Terns. Brit. Birds 11: 122-214.

Stoddard, H. L. 1917. The Roseate Tern (Sterna dougalli) on Lake Michigan. Auk 34: 86.

1916

Cahn, A. R. 1916. The terns of Weepecket Islands, Massachusetts. Wilson Bull. 28: 11-18.

1914

Humphreys, G. R. 1914. The Roseate Tern breeding in Ireland. Irish Nat. 23: 17-20, 227.

1913

Humphreys, G. R. 1913. Breeding of the Roseate Tern in Ireland. Brit. Birds 7: 186-187.

1906

Jones, L. 1906. A contribution to the life history of the Common (Sterna hirundo) and Roseate (S. dougallii) Terns. Wilson Bull. 18: 35-47.

1905

Bureau, L. 1905. Monographie de la Sterne de Dougall (Sterna dougallii). Proc. Internatl. Ornithol. Congr. 4: 289-346. [In French.]

1903

Jones, L. 1903a. The terns of the Weepecket Islands, Massachusetts. Wilson Bull. 15: 94-100.

1902

Blathwayt, F. L. 1902. The Roseate Tern on the Farne Islands. Zoologist 1902: 53-54.

Dutcher, W. 1902. Results of special protection to gulls and terns obtained through the Thayer Fund. Auk 19: 34-64.

Wells, J. G. 1902. Birds of the Island of Larriacou. Part I. Auk 19: 237-246.

1901

Dutcher, W. 1901. Results of special protection to gulls and terns obtained through the Thayer Fund. Auk 18: 76-104.

Strong, R. M. 1901. Notes on terns. Sterna hirundo, S. dougalli and S. antillarum. Wilson Bull. 13: 69-70.

1899

MacKay, G. H. 1899. The terns of Muskeget and Penikese Islands, Massachusetts. Auk 16: 259-266.

1898

MacKay, G. H. 1898. The terns of Muskeget Island, Massachusetts. Part IV. Auk 15: 168-172.

Reed, J. H. 1898. The terns of Great Gull Island, N.Y., during 1897. Auk 15: 40-43.

1897

Howe, R. H., Jr. 1897a. The terns of Dyer's and the Weepecket Islands. Auk 14: 203-205.

MacKay, G. H. 1897a. The terns of Penikese Island, Massachusetts. Auk 14: 278-284.

_____. 1897b. The terns of Muskeget Island, Massachusetts. Part III. Auk 14: 383-390.

1896

MacKay, G. H. 1896. The terns of Muskeget Island, Masschusetts. Part II. Auk 13: 47-55.

1895

MacKay, G. H. 1895. The terns of Muskeget Island, Massachusetts. Auk 12: 32-48, 178.

1889

Dutcher, B. H. 1889. Bird notes from Little Gull Island, Suffolk Co., New York. Auk 6: 124-131.

1879

Brewster, W. 1879. The terns of the New England coast. Bull. Nuttall Ornithol. Club 4: 13-27.

COMMON TERN

(Sterna hirundo)

[DA: Fjordterne, DU: Visdiefje, FI: Kalatiira, FR: Sterne Pierre-Garin, GE: Flussseeschwalbe, IC: Siladerna; IT: Rondine di mare, JA: Ajisashi; NW: Makrellterne, PO: Rybitwa zwyczajna, Rybitwa pospolita; PR: Andorinha do mar, RU: (River Tern), SP: Charran comun, SW: Fisktarna]

GENERAL DISTRIBUTION

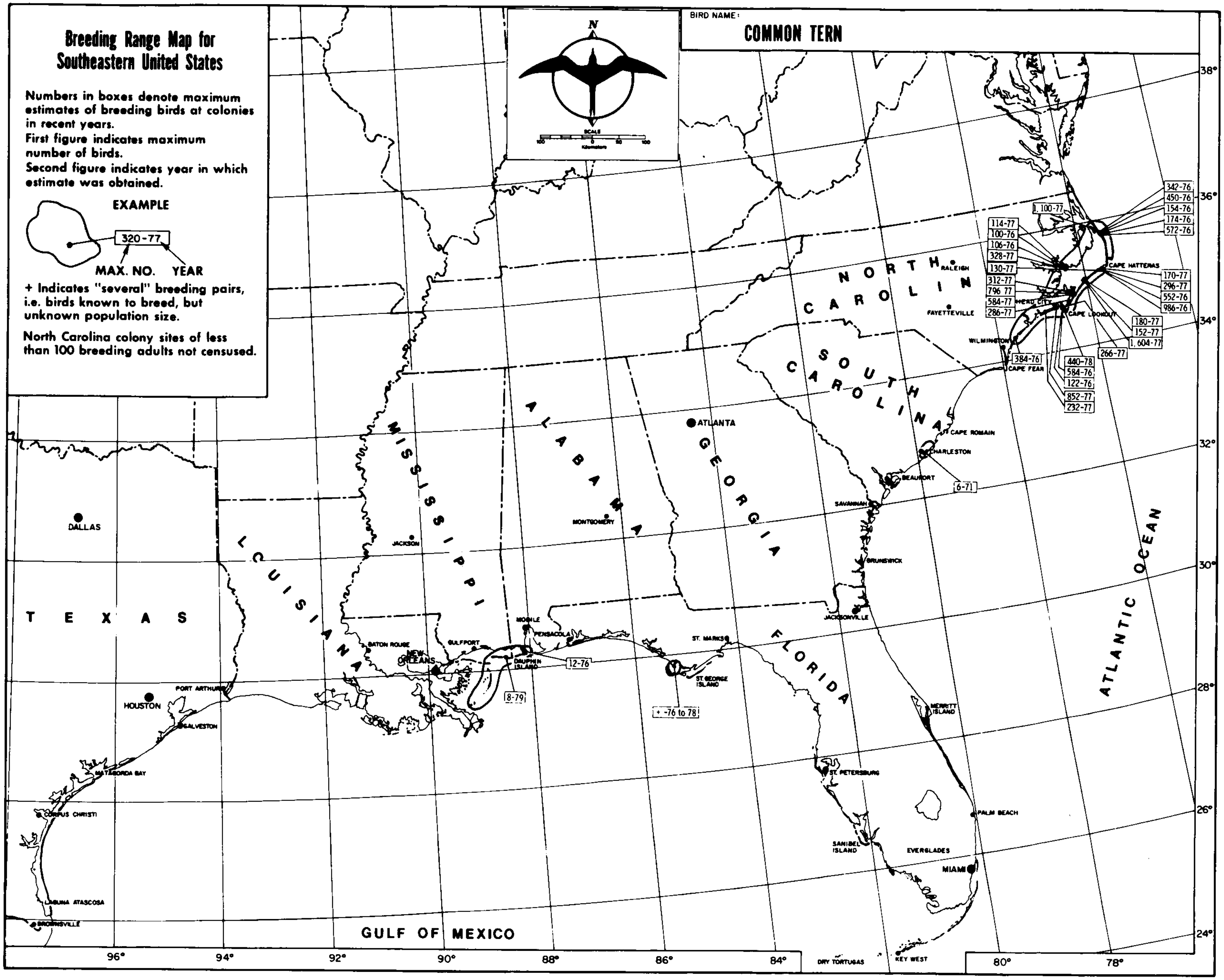
North America Common Terns nest primarily in the north-central and northeastern portions of North America. Only a very small proportion of the New World population breeds south of the northern half of the Atlantic coast in the Gulf of Mexico (rarely), the Caribbean, and on islands off South America (extralimitally). In Canada, these terns breed from southern Mackenzie and northwestern Alberta south to southern Alberta, thence east through Saskatchewan, north-central to southern Manitoba, and central and southern Ontario to southern Quebec and southern Labrador, and south to the United States (Godfrey 1966).

In the central and northeastern United States, Common Terns breed south to northeastern Montana, North Dakota, central Minnesota, northeastern Illinois, northwestern Indiana, southern Michigan, northern Ohio, northwestern Pennsylvania, and northwestern Vermont (AOU 1957). From there, they breed regularly, but locally, south along the Atlantic coast to North Carolina. Small numbers occasionally breed in South Carolina and the Florida Keys. Nesting has been recorded in Florida, Mississippi, Louisiana, and Texas, but this species breeds only occasionally to rarely along the northern Gulf of Mexico (Map 18).

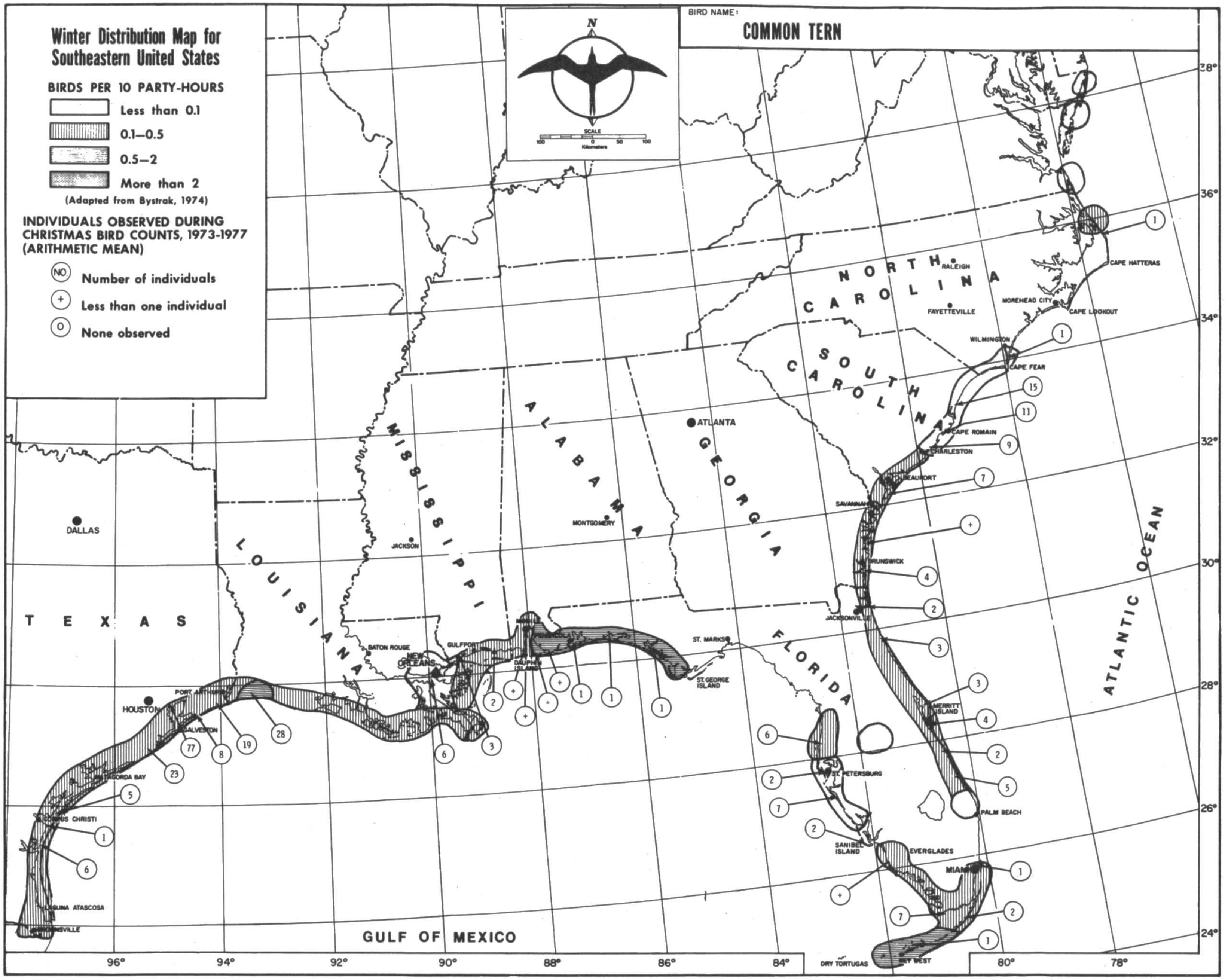
To the east and south of the United States, Common Terns breed in Bermuda (AOU 1957) and have been reported breeding in the Bahamas and Virgin Islands (Bond 1971, 1978). Robertson (1964) pointed out that some of these breeding records may have been of Roseate Terns.

North American Common Terns winter along both coasts. On the Pacific coast, they winter primarily from Baja California south to central Peru. In the Atlantic/Caribbean area they winter primarily from South Carolina south through the Caribbean to the coasts of northern South America, and south to southern Argentina (AOU 1957, Blake 1977, Map 19).

Stragglers from the Great Lakes population have been found in the Atlantic Ocean east of the Azores (Haymes and Blokpoel 1978c) and in Hawaii (Houston 1962, Ludwig 1962b, Haymes and Blokpoel 1978c). A tern banded in Saskatchewan straggled to Aitutaki Island in the Cook Islands, Central Pacific (Houston 1962, 1963), another wandered from Long Island, New York, to the Gulf of Guinea off the Ivory Coast (Raynor 1970), and another bird from New York straggled south


Breeding Range Map for Southeastern United States
Numbers in boxes denote maximum estimates of breeding birds at colonies in recent years.
First figure indicates maximum number of birds.
Second figure indicates year in which estimate was obtained.
EXAMPLE
320-77
MAX. NO.
YEAR
+ Indicates "several" breeding pairs, i.e. birds known to breed, but unknown population size.
North Carolina colony sites of less than 100 breeding adults not censused.
BIRD NAME:
COMMON TERN
N
SCALE
1,100-77
342-76
450-76
154-76
174-76
572-76
114-77
100-76
106-76
328-77
130-77
312-77
796 77
584-77
286-77
CAPE HATTERAS
170-77
296-77
552-76
986-76
CAPE LOOKOUT
180-77
152-77
1,604-77
266-77
384-76
CAPE FEAR
440-78
584-76
122-76
852-77
232-77
RALEIGH
FAYETTEVILLE
WILMINGTON
NORTH CAROLINA
SOUTH CAROLINA
CAPE ROMAIN
CHARLESTON
BEAUFORT
6-71
SAVANNAH
BRUNSWICK
JACKSONVILLE
ATLANTA
GEORGIA
ALABAMA
MONTGOMERY
MISSISSIPPI
JACKSON
LOUISIANA
BATON ROUGE
NEW ORLEANS
GULFPORT
MOBILE
PENSACOLA
DAUPHIN ISLAND
12-76
8-79
ST. MARKS
ST GEORGE ISLAND
+ -76 to 78
FLORIDA
MERRITT ISLAND
ST. PETERSBURG
PALM BEACH
SANIBEL ISLAND
EVERGLADES
MIAMI
KEY WEST
DRY TORTUGAS
ATLANTIC OCEAN
GULF OF MEXICO
TEXAS
DALLAS
HOUSTON
PORT ARTHUR
GALVESTON
MATAGORDA BAY
CORPUS CHRISTI
LAGUNA ATASCOSA
BROWNSVILLE
96°
94°
92°
90°
88°
86°
84°
80°
78°
38°
36°
34°
32°
30°
28°
26°
24°

Map 18



Winter Distribution Map for Southeastern United States
BIRDS PER 10 PARTY-HOURS
Less than 0.1
0.1–0.5
0.5–2
More than 2
(Adapted from Bystrak, 1974)
INDIVIDUALS OBSERVED DURING CHRISTMAS BIRD COUNTS, 1973-1977 (ARITHMETIC MEAN)
NO. Number of individuals
+ Less than one individual
O None observed
N
SCALE
Kilometers
BIRD NAME:
COMMON TERN
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI
LOUISIANA
TEXAS
FLORIDA
ATLANTIC OCEAN
GULF OF MEXICO
RALEIGH
FAYETTEVILLE
CAPE HATTERAS
MOREHEAD CITY
CAPE LOOKOUT
WILMINGTON
CAPE FEAR
CAPE ROMAIN
CHARLESTON
BEAUFORT
SAVANNAH
BRUNSWICK
JACKSONVILLE
MERRITT ISLAND
PALM BEACH
ST. PETERSBURG
SANIBEL ISLAND
EVERGLADES
MIAMI
KEY WEST
DRY TORTUGAS
ST. MARKS
ST. GEORGE ISLAND
ATLANTA
MONTGOMERY
JACKSON
BATON ROUGE
NEW ORLEANS
GULFPORT
DAUPHIN ISLAND
DALLAS
HOUSTON
PORT ARTHUR
GALVESTON
MATAGORDA BAY
CORPUS CHRISTI
LAGUNA ATASCOSA
BROWNSVILLE
96° 94° 92° 90° 88° 86° 84° 80° 78°
24° 26° 28° 30° 32° 34° 36° 38°

Map 19

to Valdivia (40° S) on the coast of Chile (DiConstanzo 1978).

World Distribution Common Terns have a wide Holarctic distribution from 6° to 70° N, and also breed, but to a very limited extent, in tropical areas (Voous 1960, BOU 1971). In the eastern Atlantic, they nest in the Azores and Madeira, and throughout Eurasia, where they occur north to about 70° N on the Atlantic coast of Norway and to about 67°30' N in Siberia (Cramp et al. 1974). From Norway they breed east through Sweden, Finland, and Russia to the coasts of the White Sea, and through Siberia north to the valley of the Anadyr and nearly to the Arctic Circle. They breed south to Portugal, Spain, France, northern Italy and Sardinia, Greece, Russian Turkestan, Iran, Iraq, Afghanistan, Tibet, Mongolia, Manchuria, the Kamchatka Peninsula, and the northern Kurile Islands (Voous 1960, Vaurie 1965, Etchecopar and Hue 1978).

Common Terns have few breeding areas in Africa. They have been reported nesting on the Banc d'Arguin, on the coasts of Tunisia and Libya, and in the Niger delta (Etchecopar and Hue 1964, Cramp et al. 1974). Off the northern coast of South America, Common Terns breed in the Netherlands Antilles and on Las Aves and Los Roques Islands off Venezuela (Blake 1977).

Birds breeding in Great Britain winter primarily along the west coast of Africa from the equator to about 20° N (Cramp et al. 1974); Scandinavian populations winter primarily off South Africa (Radford 1961). Stragglers from Europe have wandered from Sweden (Dunnet 1956a, Austin 1958) and Ireland (Rogers 1969a) to Australia. Other birds, probably those from the central Eurasian populations, winter south along the east coast of Africa, in Malagasy, the Red Sea, and in the Persian Gulf (Vaurie 1965). Common Terns from eastern Eurasian populations winter off the coasts of India and Ceylon, and from Malaya and Indonesia to eastern and southeastern Australia, New Guinea, the Louisiade Archipelago, and the Solomon Islands (Vaurie 1965, Serventy et al. 1971, Condon 1975).

DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

North Carolina Common Terns occur along the North Carolina coast primarily from April through September (Wray and Davis 1959) and are abundant there during the spring and fall migrations. They are rarely seen in winter (Map 19) and some winter records may have been of misidentified Forster's Terns. Common Terns nest commonly along the North Carolina coast. Egg laying begins by mid-May and may continue into mid-July. Dependent young are often present well into August (Parnell and Soots 1979 ms).

Pearson et al. (1919) regarded Common Terns as the most abundant tern along the coast and thought that the population had been even larger before it was reduced by plume hunters. By 1939 "a few thousand" birds (Pearson et al. 1942) were breeding along a 100 mi (160 km) portion of the northern coast of North Carolina.

Common Terns now breed along the coast of North Carolina south to Monks Island near the Shallotte River (Parnell and Soots 1979 ms) but are more abundant in the northern half of the Outer Banks (Map 18). Present populations are in the low thousands but are evidently increasing (Parnell and Soots 1979 ms). At least 6,640 bred in North Carolina in 1973 (Soots and Parnell 1975a), and about 8,890 were found in 50 colonies in 1976 (Portnoy et al. 1981). About 9,790 birds were found in 51 colonies in 1977 (Parnell and Soots 1979 ms). Colonies ranged in size from 2 to 986 birds in 1976 (mean = 161.8, mode = 79) (Portnoy et al. 1981), and 50 colonies in 1977 ranged from 2 to 1,602 birds (mean = 197.8, mode = 66) (Parnell and Soots 1979 ms) (1). Important colonies include one on a barrier beach at Ocracoke Flats and several at Hatteras Inlet. The former colony held about 9% and 16% of the state's nesting Common Terns in 1976 and 1977, respectively (Parnell and Soots 1979 ms, Portnoy et al. 1981). Three colonies on dredged islands at Hatteras Inlet held about 18% of the 1976 nesting population (Portnoy et al. 1981).

South Carolina Common Terns are numerous migrants along the South Carolina coast with peak numbers present from early May to late June, and from August until about the third week of September. A few winter, but sporadically and in small numbers (Sprunt and Chamberlain 1949). Few are present in summer. Common Terns breed uncommonly in the state and reach their southern limits of breeding distribution along the U.S. Atlantic coast in the vicinity of Charleston (Potter et al. 1980).

Georgia Burleigh (1958) considered Common Terns common transients in spring and fall along the coast and uncommon transients in the interior. Their status in Georgia is poorly known.

Florida - Atlantic Coast A few Common Terns winter on the Florida Atlantic coast (Map 19), but the species is most abundant as a fall migrant in October and November, when several hundred are occasionally seen well offshore. They are rarely seen inshore during spring migration, but occur regularly in small numbers off the coast (Kale 1979 ms a).

Florida - Keys Common Terns formerly bred on Bush Key in the Dry Tortugas (Howell 1932), but Robertson (1964) pointed out that the few breeding records from the Tortugas are not entirely satisfactory because this species may have been confused with the Roseate Tern. Robertson (1964) analyzed most previous observations and concluded that "breeding of the Common Tern at the Dry Tortugas is not proved."

(1) Colonies in North Carolina are large compared to colonies found in the more northern breeding localities. Mean size of colonies in Saskatchewan in 1973 and 1974 was 16 and 23 nests, respectively, and ranged in size from 4 nests to 40 nests (n = 21) (Stelfox and Brewster 1979). Colonies in the Old World are also small. Those in Orkney and Shetland in 1980 averaged 16 and 24 birds per colony, respectively, and 83.5% of the 115 colonies censused held less than 40 breeding birds (Bullock and Gomersall 1981). In southern Finland about 18% of the breeding sites are occupied by single pairs; most sites have 2 to 10 pairs (Bergman 1980).

Florida - Gulf Coast Common Terns winter in small numbers along the Florida Gulf coast and are occasionally seen in large numbers well offshore during migration (Kale 1979 ms b). Reports of breeding in this area are doubted by Kale, who stated that "the only known, or believable nesting of this species in Florida is on St. Joe Island where a few birds nested in the 1960s and early 1970s."

Alabama Common Terns occur along the Alabama coast throughout the year. They are most abundant during migration and least abundant in winter. Their status in Alabama is poorly known, due to confusion with the similar-appearing Forster's Tern. Imhof (1976b) knew of no certain breeding records but thought that this species occasionally nested along the coast. During the summer of 1976, about 12 birds were found nesting near beach dunes on Dauphin Island (Portnoy 1977). This poorly documented record is the first report of nesting in Alabama.

Mississippi Burleigh (1944) reported that Common Terns occur along the Mississippi coast in spring, but had no records for the fall. He thought that they may occur regularly in summer and early fall. Jackson et al. (1980) summarized information on the status of Common Terns as breeding birds in Mississippi. They reported that the first nest was found on 14 July 1962, when a single pair was found on 2 eggs in a mixed skimmer/tern colony between the mouths of the Pascagoula River. Nesting has subsequently been recorded three times. A nest with two eggs was found 13 July 1964 on spoil banks in the Pascagoula ship channel, at least two nests were present on 28 June 1977 on a spoil island in Horn Island Pass, and four nests with eggs were found there on 7 July 1979.

Louisiana Lowery (1974) considered Common Terns to be common to locally common in winter and on migration. Fall migrants begin arriving in Louisiana in late August and some individuals may be found along the coast until late spring (Lowery 1974). There are only two breeding records for the state. On 11 June 1971 an adult and a nest with two eggs were found on Monkey Island in the Chandeleurs (Myers 1971, Stewart 1971). On 21 June 1973 three adults with several young were in the same place (Kennedy 1973, Lowery 1974). Three Common Terns were present on Monkey Island in late June 1975, but no nest was found although the birds behaved as if they were nesting (J. Stewart 1975).

Texas Common Terns are common migrants along the Texas coast in spring from early March to mid- or late May and in fall from mid-August to mid-November, but are uncommon to scarce in winter (Oberholser 1974). The status of this species as a breeder in the state is in doubt. Records summarized by Oberholser (1974) indicate that populations of up to several thousand birds nested along the coast during the early part of the 20th century. Kincaid (in Oberholser 1974) suggested that at least some of these reports dealt with the similar-appearing Forster's Tern and stated that "authenticated Common Tern nestings within Texas seem to be lacking since 1930." Chaney et al. (1978) indicated (Tables 2 and 3 on pp. 134 and 135) that 25 pairs of Common Terns nested on a dredged site in 1977, but this may have been in error because these authors failed to list this species in an appendix giving information on birds nesting on these sites. Censuses of birds nesting along the Texas coast from 1976 through 1978 (Blacklock et al. 1978, Blacklock et al. 1978 ms) do not mention this species.

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

Breeding Common Terns breed only in the Northern Hemisphere, primarily in temperate waters from Alberta east to southern Labrador in Canada, south to North Carolina, and east across Eurasia from Scandinavia, the Azores, and Madeira in the Atlantic Ocean to Siberia.

We lack recent information for all Canadian populations, but in 1976 and 1977 about 5,000 bred in the U.S. Great Lakes area (Scharf 1978). During this period, the total breeding population in the lower Great Lakes basin (including Canadian colonies) was about 7,600 birds (Blokpoel and Fetterolf 1978) with many (ca. 40%) in the Toronto Outer Harbour, Ontario. Populations of Common Terns in this area have been declining in recent years (Scharf 1979, Morris et al. 1980) due to loss of nesting habitat to floods, succession of vegetation on nesting sites, competition for sites with Ring-billed Gulls, and occasionally because of predation by canids, snakes, and humans (Scharf 1979).

Most of the North American population of Common Terns breeds along the North Atlantic coast of the United States. A survey conducted in 1977 (Erwin 1979a, Korschgen 1979) revealed about 56,000 birds nesting from Maine to Virginia--about 4,190 in Maine; 8,950 in Massachusetts; 1,180 in Rhode Island; 2,960 in Connecticut; 20,030 on Long Island, New York; 8,920 in New Jersey; 900 in Delaware; 3,360 in Maryland; and 7,110 in Virginia. In the southeastern United States only North Carolina contains a significant number of breeding Common Terns. Some 8,900 to 9,800, about 10% of the population nesting in the eastern United States, bred there in 1976-1977. Elsewhere in the southeast, this tern is a common to abundant transient and has been recorded breeding in all the states except Georgia. The total number breeding in these states is small and was probably less than a hundred birds in the 1970's.

Nesting in the Caribbean and off northern South America is poorly documented but is probably not substantial. LeCroy (1976) reported that about 84 bred on Los Roques off Venezuela in 1973, and Voous (1963) suggested a breeding population of under 200 birds in the Netherlands Antilles.

Data on Old World populations is scattered and incomplete. A minimum of about 29,400 birds bred in Britain and Ireland in 1969-70 (Cramp et al. 1974); about 1,800 bred in Denmark in 1970-72 (Salomonsen 1979); over 1,800 breed in Finland (Fig. 2 in Bergman 1980); and at least 26,000 bred along the Norwegian coast in 1970-1974 (Brun 1979). There is little information on populations breeding elsewhere, but the species is numerous in the U.S.S.R. (Borodulina 1960).

Winter Over 850,000 Common Terns have been banded in North America; about 56,000 recoveries have been made (Clapp et al. 1982a). Consequently, more is known about the dispersal and wintering grounds of this species than is known about most other species discussed in this volume. Juveniles of both Old World (Cramp et al. 1974) and New World (Haymes and Blokpoel 1978c) populations may spend their first summer on the wintering grounds. Austin (1953a) studied 709 recoveries and reported that the wintering grounds for Common Terns breeding along the U.S. Atlantic coast encompass the entire coastline of the Gulf of Mexico, all of the Caribbean, and both coasts of Central and South America. The winter range of those breeding in the Great Lakes overlaps that of the Atlantic population to some extent, but is centered farther west. Birds from Great Lakes populations winter along the Gulf of Mexico, on both coasts of Central America, and on the west coast of South America. The majority of the recoveries from the Caribbean (9 of 13) were from Cuba; 14 of 18 recoveries from North America south of the United States were from Mexico (8) and Panama (6). All seven of the South American recoveries were from Ecuador and Peru. Birds breeding northwest of U.S. populations apparently winter principally along the west coast of the Americas.

Haymes and Blokpoel (1978c) analyzed more recent information for the Great Lakes population (about 1,700 recoveries) and confirmed Austin's (1953a) conclusion that more than 80% of the South American recoveries were along the west coast of that continent. Wintering two-year-old and older Common Terns were primarily recovered in Florida and Central and South America, but younger birds were also found frequently along the Gulf Coast and in the Caribbean.

Most Common Terns breeding in Great Britain and the Netherlands winter along the west coast of Africa from about 20° N latitude to the equator (Radford 1961, Langham 1971, Cramp et al. 1974), but those from Scandinavia and Germany winter farther south along the South African coast (Elliott 1971, Salomonsen 1955 in Langham 1971). Wintering populations from Germany and Scandinavia consist of a series of overlapping wintering populations along the African coast; Finnish birds predominate among terns wintering in South Africa (Elliott 1971).

Common Terns from the southern U.S.S.R. winter principally in Africa and southern Asia (Borodulina 1960), but those from the eastern U.S.S.R. are believed to winter primarily in the Gulf of Papua, the Louisiade and Bismarck Archipelagos, and the Solomon Islands. Small numbers winter in the Philippines, Halmahera, the Moloccas, and on the Aru Islands (Hitchcock and Favaloro 1951).

<u>Migration</u> Common Terns disperse widely after fledging and before migration (Nisbet 1976a). Young have been found as far as 400 km (250 mi) from their natal colonies in various directions (authors cited in Nisbet 1976a) within six weeks after fledging, but even so they usually remain in family groups (Nisbet 1976a). After fledging juveniles may remain as long as three weeks in the colony, but most remain there for only about 10-15 days after fledging (Nisbet 1976a).

Fall migration of North American Common Terns is fairly slow (Austin 1953a). Terns are seldom seen in large aggregations and they frequently rest along the shoreline. The return migration in spring is more rapid; large aggregations are often seen, but they seldom rest en route. Austin (1953a) suggested that part of the migration may be directly overwater from the wintering grounds. Large concentrations recorded along the southeastern Atlantic coast in recent years (Table 53) support Austin's conjecture, but also indicate that large numbers migrate close to the coast of Florida.

Several different routes are used in migration. Most birds that breed along the North Atlantic coast move south along the coast to Cape May or Cape Hatteras, and thence overwater through the Caribbean from eastern Cuba west to the north coast of South America. Most of 301 recoveries in the West Indies reported by Austin (1953a) came from Trinidad (112), Puerto Rico (86), and Hispaniola (59). The 179 recoveries reported from South America were fairly evenly distributed (56 from Guyana, 36 from Venezuela, 35 from Brazil, and 32 from French Guiana).

Most Common Terns that breed on the Great Lakes fly east, mostly through New York and the Hudson River Valley, to the Atlantic coast and thence south. Some birds follow the coastline of the Gulf of Mexico and others fly overwater off Florida and western Cuba to Central America. Austin (1953a) had little data from populations west and northwest of the Great Lakes, but the few recoveries available suggested that these birds migrate across the Rocky Mountains and then south along the California coast to Peru. Recent recoveries of terns banded in Saskatchewan (Houston 1972) were made along the Pacific coast from California to Central America and tend to confirm Austin's hypothesis.

Austin's (1953a) analysis of band recoveries led him to conclude that fall migration of birds breeding along the northern U.S. Atlantic coast occurs from early July through the first week of September. Migration starts about a week later in the southern portion of this area. Migrants in the northern West Indies are present from roughly the first week of August through the first week of December. Migrants (and wintering birds) are present in the southern West Indies from November through April, and in southern South America from late November to March. Peak periods of migration for the eastern North Atlantic population are August along the North Atlantic coast, September along the southern North Atlantic coast, and October in the northern West Indies.

The timing of fall movement in the Old World is similar to the timing in North America. Young Common Terns in Britain may disperse widely after fledging but move south in August, September, and October (Langham 1971). Terns from Great Britain follow the western coasts of Europe and Africa south; those from Scandinavia migrate southwest to the Atlantic (Lemmetyinen 1968).

Populations of Common Terns (S. h. longipennis) breeding in the eastern U.S.S.R. (evidently largely in Kamchatka and Sakhalin) are believed to move south along the Asiatic coast in fall. They arrive at Osaka Bay, Japan, from late July to early September, and most move south in October (Kobayashi 1953). Some move east to the Bismarck Archipelago, and then south to northern and eastern Australia (Hitchcock and Favaloro 1951). Hitchcock and Favaloro suggested that there may be an alternate fall migration route through Micronesia.

Table 53. Peak concentrations of migrant Common Terns in the coastal southeastern United States (a).

Date	Seen	Number seen	Locality	Source
			NORTH CAROLINA	
1977	20 May	15+	40 mi off Oregon Inlet	Teulings 1977b
1972	21 Sep.	ca. 900	on sandbar at Lockwood Folly Inlet near Wilmington	Teulings 1973a
1973	22 Sep.	9,000	Bird Shoal, Morehead City	Teulings 1974a
1974	25 Sep.	5,000+	Bird Shoal, Morehead City	Tuelings 1975a
			FLORIDA	
1974	30 Mar.	500	Mullet Key	Stevenson 1974
1973	16 May	150	in Gulf off St James	Kale 1973
1973	20 May	45	18-45 mi off Mayport	Kale 1973
1976	25 Sep.	1,000 +	25 mi off Clearwater	Buhrman and Hopkins 1978
1971	2-3 Nov.	6,000	offshore (Johnson)	Robertson 1972
			ALABAMA	
1958	16 May	1,100	Sand and Dauphin Islands	Imhof 1976b
			MISSISSIPPI	
1978	1 July	50	East Ship Island	Jackson and Cooley 1978a
1960	22 Sep.	100	Gulfport, Harrison Co.	Gandy and Turcotte 1970
			TEXAS	
1973	3 May	2,500	Bolivar Peninsula	Webster 1973c
1974	20 Sep.	10,000	N. Padre Island beaches	Webster 1975a
1973	22 Sep.	1,500	Bolivar flats	Webster 1974a
1976	17 Oct.	5,000	S. Padre Island beaches	Webster 1976a

(a) Within states records are arranged chronologically by time of year. A few records of smaller numbers seen offshore indicate the distances at which migrants may be seen at sea.

HABITAT

Nesting Common Terns nest in a variety of habitats, but mostly near water, often on islets, and usually in areas with little or no vegetation. Nesting habitats are often highly susceptible to floods, tides, storms, or rapid growth of weedy vegetation. In the southeastern United States, the principal habitats used are sparsely vegetated sandy islands (often man-made or man-altered), barrier beaches, and marshy islands.

Palmer (1941a) indicated that the primary requirements for a tern colony were isolation from disturbance and predation, close proximity to a source of food, and nesting areas with scant vegetation. Several studies have described nesting requirements in more detail; we briefly summarize some of these below.

Burger and Lesser (1978a, 1978b) examined colony sites chosen by Common Terns in Ocean County, New Jersey in 1976. All 34 colonies were found on small ([mean = 17.7 ac (7.2 ha)] [Burger and Lesser 1978a] or [21 ac (8.5 ha)] [Burger and Lesser 1978b]) islands in salt marshes. The islands were usually sparsely vegetated (less than 50% shrub cover) with a low growth of Spartina alterniflora. Two-thirds of the sites chosen also contained S. patens, and 44% had higher, drier areas with Iva frutescens, Baccharis, and Phragmites (Burger and Lesser 1978b). The average nesting island contained about 70% S. alterniflora, 19% S. patens, ca. 5% windrow or wrack (largely eelgrass, Zostera marina), and 7% other vegetation. Most of the terns (80%) placed their nests on windrow, and another 18% nested in S. alterniflora (Burger and Lesser 1978a). All nesting islands faced an expanse of at least 2 mi of open water from at least one direction and the terns nesting on these islands usually chose that portion of the island that was most exposed to open water (Burger and Lesser 1978b).

Common Terns in North Carolina nest mostly on coastal islands, although smaller numbers also nest in marshes and on barrier beaches. In 1976, 80% of the population was found on islands, and 7% and 13% nested on marshes and barrier beaches, respectively (Portnoy et al. 1981). A high proportion of the population breeds on man-made or man-modified islands. About 67% nested on on dredged material in 1977 (Parnell and Soots 1979 ms). In North Carolina, Common Terns prefer sparse (about 20%) cover around their nests, but they occasionally nest on bare sand. The usual nesting substrate is mixed sand and shell, but nests have also been found on shell or dead plant material (wrack). Plants most frequently associated with nest sites were saltmeadow cordgrass (Spartina patens), sea rocket (Cakile edentula harperi), American beachgrass (Ammophila breviligulata), and seaside goldenrod (Solidago sempervirens) (Parnell and Soots 1979 ms).

Preferred nesting sites in Saskatchewan in 1973 and 1974 were small, rocky islands (less than 1000 sq m [10760 sq ft] in area) in lakes and rivers (Stelfox and Brewster 1979). These islands were low (less than 3 m [10 ft] above water level) and were usually less than half-covered with vegetation. The vegetation usually consisted of grasses, forbs, mosses, and lichens growing on the higher parts of the islands. Nests were situtated near the lower portions of the vegetated areas and averaged 0.7 m (2.3 ft) above water level. Those nesting in 1977 on the peninsula in Toronto Outer Harbor, Ontario, also nested in sparsely vegetated areas; cover there averaged 16% (Blokpoel et al. 1978). Blokpoel et al. (1978) reported, however, that Common Terns avoided nesting in areas with little or no vegetation and that more than 90% of the nests sampled were in more than 20% vegetative cover (mean = 44%). These authors suggested that the Common Terns prefer to nest near vegetation because of the protection it affords from inclement weather and predators, and because it allows adults and chicks to recognize their own nests more easily.

Occasionally, Common Terns use roofs as nest sites. One pair nested on the roof of an old army building at Gull Island, New York (MacFarlane 1977), and another pair nested on the top of a small cabin cruiser on Long Island (Gill 1953). Another reported instance of roof-nesting in Florida (McGowan 1969) may have been an observation of the similar-appearing Roseate Tern (Fisk 1978a).

Old World Common Terns use a variety of nesting habitats such as shingle beaches; sandy beaches and dunes; freshwater marshes; small islands in coastal, marine, and inland waters (Cramp et al. 1974); and silted, sandy, and coquine spits (Borodulina 1960). Nesting inland along rivers and in other freshwater areas is more common in the Old World than in North America (Dement'ev and Gladkov 1951a, Voous 1960).

More than 80% of the Common Terns breeding in Orkney and Shetland in 1980 were within 100 m (330 ft) of the sea coast. Colonies in Shetland were typically on rocky coasts, rock sea holms, or shingle, whereas the majority of those in Orkney nested in rough pasture and heath; a smaller proportion were on shingle or sand, or on holms (Bullock and Gomersall 1981).

Small, low islets and rocky reefs are used as nest sites along the Adriatic coast. In Croatia Common Terns regularly nest in swamps, fishponds, and rivers, most often on floating logs, water-lily leaves, and beds of cut swamp plants (Stromar 1972). A considerable proportion (36.1%) of the terns nesting in Poland use floating vegetation for nest sites, but the majority (54.2%) of the nests are found on bare ground or on ground overgrown with low vegetation (Bochenski 1966). Colonies in Poland are primarily found on islets in reservoirs, lakes, and fishponds. Use of floating vegetation (mats of cattail [_Typha_ spp.]) as a nesting substrate in the New World has been noted at Point Pelee, Ontario (Nickell 1966). Muskrat (_Ondatra zibethicus_) lodges are also used as nest sites in this area and in Michigan (Nickell 1966), and small marl islands were used in areas of freshwater marsh in upstate New York (Alexander 1955).

Feeding Common Terns are more flexible in their choice of feeding habitat than are many other terns. They feed in terrestrial situations, either near their colonies or in distant areas (Erwin 1978b). In Virginia, summering Common Terns fed mostly near beaches and inlets but were frequently seen more than 20 km (12 mi) from their colonies (Erwin 1978b).

Nisbet (1977) reported observations from two colonies in Massachusetts that suggest that feeding habitats used by breeding Common Terns vary depending on the topography of the breeding area. Those breeding at Bird Island fed frequently along the highly convoluted shoreline. During rising and falling tides, many terns from this colony fed in shallow waters within 1 km (0.6 mi) of shore, where they usually picked shrimp and other invertebrates from the surface of the water. Those breeding at Monomoy Island (where most of the shoreline is straight, open, and sandy) usually fed in flocks on schools of small fish shoaling over shallow sand bars.

Common Terns nesting on a small island in an oligotrophic reservoir inland in North Dakota often foraged in a highly eutrophic lake some 2-3 km (1-2 mi) away (Pinkowski 1980). They usually fed along the margins of the lake where emergent sedges (Carex sp.) and smartweeds (Polygonum amphibium) were the dominant vegetation. Sometimes the terns fed in the reservoir but fed there less frequently when the water was especially muddy.

Feeding habitats in the Old World are as varied as in North America. In southern Finland, this species prefers to feed in shallow eutrophic bays "with limited water area and low transparency..." (Lemmetyinen 1976), but they also feed along rocky and stony shores (Lemmetyinen 1973a). Common Terns do not nest in Australia, but those visiting there apparently prefer to feed in rivers and estuaries (Hitchcock and Favaloro 1951). Hitchcock and Favaloro (1951) also stated that Australian Common Terns are "sedentary, favoring a single 'fishing perch' (stake, pipe, etc.)." They are evidently territorial, as they are "aggressive, especially towards other terns."

Nonbreeding and Offshore Following their departure from the nesting ground, Common Terns are typically found along shorelines (Nisbet 1976a) and on exposed rocks and old pilings (LeCroy 1972). Observations in the northern Chesapeake Bight (Rowlett 1980) suggest that migrants are most common inshore over shallow coastal waters; only a few Common Terns occur more than 30 km (20 mi) offshore. Observations farther south off Florida (Table 53) suggest that large concentrations may occur even farther out at sea.

FOOD AND FEEDING BEHAVIOR

Common Terns capture their prey in a variety of ways. Most of their diet consists of small fish captured by diving from heights of about 1-7 m (3-23 ft) above the water (Gochfeld 1978b). Common Terns also hawk insects from the air or pick them or small crustaceans from the surface of the water (Lemmetyinen 1973a). One walked on mud-shingle and waded in a shallow pool while picking up food in its bill (Christie 1982). This type of feeding behavior is rare, but Borodulina (1960) noted that flocks in the southern U.S.S.R. occasionally stand on exposed spits picking prey from the surface. Common Terns only occasionally eat offal or refuse (Palmer 1941a).

Common Terns occasionally steal fish from other Common Terns (Hays 1970a, Hopkins and Wiley 1972) or from other species such as Arctic Terns (Hopkins and Wiley 1972). Fish may be stolen from them by other species such as Roseate Terns (Dunn 1973b) and Parasitic Jaegers (Stercorarius parasiticus) (I. R. Taylor 1979a).

Common Terns breeding on Great Gull Island, NY, routinely forage as far as 20 km (12 mi) from the colony, but much of their foraging is done closer to the colony (Duffy 1977a). Similar observations were reported in Virginia by Erwin (1978b) and in Massachusetts by Austin (1946a), who indicated that most birds fed within 1-4 mi (1.6-6 km) of their colony sites. Pearson (1968) calculated that Common Terns breeding in the Farne Islands have a maximum foraging range of 13.6 mi (22 km). He based his estimate on a foraging flight lasting 54.5 minutes at an estimated flight speed of 30 mi/h (48.3 km/h).

These terns feed solitarily, in small groups, or in large flocks. Summering birds in Virginia were seen feeding most often (12 of 32 observations) in groups of 2-10 birds, but fed almost as frequently alone or with another bird (9 observations), or in flocks of 10 to more than 50 birds (11 observations) (Erwin 1978b). The largest groups (mean = 10.4 birds) fed along beaches and at inlets; the smallest groups (mean = 3.19 birds) fed over marsh and tidal pools. Groups feeding in the mouth of the Chesapeake Bay and along tidal creeks were medium sized (mean = 5.5 and 7.4 birds, respectively) (Erwin 1977a). Common Terns on Long Island often fed in large flocks over schools of shoaling fish (Gochfeld 1978b).

Common Terns in Virginia captured and fed small fish (estimated mean weight of 2.4 g [0.8 oz]) to their young at an average interval of 16.6 min (Erwin 1977a). Foraging flights to feed young in the lower Great Lakes are similar in length (mean = 17.2 min), but foraging flights used in courtship are shorter (mean = 11.2 min) (Courtney and Blokpoel 1980b). At the Toronto Outer Harbour, Common Terns with one chick foraged for 7.1 h (45% of daylight hours) and those with broods of four chicks foraged for 10.2 h (64% of daylight hours) (Courtney and Blokpoel 1980b). Pearson (1968) estimated that those breeding on the Farne Islands spent 40-94% of the day foraging. Common Terns in Virginia caught prey at a rate of 0.34 fish/min (Erwin 1977a). Terns at Northumberland, England, captured fish in moderate seas at a greater rate (ca. 30 fish/h) and on a higher proportion of attempts than in calm seas (ca. 14 fish/h) (Dunn 1973a); Dunn suggested that success increased in moderate seas because the combination of increased wind and rougher seas allowed the terns to hover more easily and rendered them less conspicuous to their prey.

Food caught by breeding male Common Terns at Sands of Forvie, Scotland, are not the same size or of the same species as the food actually eaten; the kind of food taken also varies with the stage of the tide (I. R. Taylor 1979b). At low tide foraging males primarily caught common shrimp (*Crangon vulgaris* - 61.3% of all items) and viviparous blenny (*Zoarces viviparus* - 18.6%), but fed mainly (97.6%) on small unidentified items and the shrimp. The blennies, about twice as long and heavy as the shrimp, were presented to females in courtship feeding. At high tide, foraging males caught marine Ammodytidae (70.7%) and Clupeidae (29.3%). As at low tide, the males ate a high proportion (82.7%) of the smaller ammodytids and fed a greater proportion (77.5%) of the larger clupeids (believed to be largely young herring, *Clupea harengus*) to females.

Fish of both families that were fed to females were significantly larger than those eaten by the males. Judging from the estimated mean length of fish eaten and presented by males, I. Taylor (1979b) calculated that the average fresh weight of fish fed to females was 2.29 g (0.08 oz), and those eaten by the males was only 0.29 g (0.01 oz). Nisbet (1977) reported that fish brought to female Common Terns during courtship in Massachusetts had an estimated median weight of about 2 g (0.07 oz), but that food items (largely shrimp) brought to nesting females had an estimated median weight of about 0.5-0.6 g (0.017-0.021 oz).

Nisbet (1977) also estimated that the food consumption at Marion, Massachusetts by females fed during courtship was about 6-7 g/h (0.21-0.25 oz/h), but less than 2 g/h (0.07 oz/h) during egg laying. At another colony at Chatham, Massachusetts, food consumption by females during courtship was only about 3 g/h (0.11 oz/h). Nisbet (1977) suggested that the larger amounts of food eaten by females during courtship at Marion led to earlier egg laying, larger clutches, and larger eggs than at Chatham.

The kind of food fed young may vary with the size of the chick. Small chicks in the southwestern Archipelago of Finland were fed a wide variety of foods during the early part of the 1969-1970 breeding season, but by their third week the diet was 80% threespine sticklebacks (Gasterosteus aculeatus) (Lemmetyinen 1973a). The mean sizes of fish eaten by chicks 0-5 days old and 6-8 days old were 6.08 cm (2.4 in) and 8.15 cm (3.2 in), respectively. Fish captured in June at Jones Inlet, Long Island, were about 4-8 cm (1.6-3.1 in) long (Gochfeld 1980b); those brought to young at Oneida Lake, New York, varied from 2 to 11 cm (0.8-4.3 in) long, but averaged ca. 4.6 cm (1.8 in) (Miller and Confer 1982).

Common Terns feed throughout their range on a wide variety of foods, but they feed mostly on small fish. Crustaceans (particularly shrimp) (Collinge 1926, Borodulina 1960, Lemmetyinen 1973a) and insects are also important at times (Collinge 1926, Borodulina 1960, Hitchcock 1965, Lemmetyinen 1973a). Other foods eaten include molluscs (Collinge 1926 Borodulina 1960, Lemmetyinen 1973a), marine annelids (Collinge 1926) and, less frequently, spiders and tadpoles or lizards (Borodulina 1960).

Some of the extensive literature on the diet of the Common Tern in North America is summarized by area below. More detailed information is provided by McAtee and Beal (1912), Palmer (1941a), and other papers listed in the terminal bibliography at the end of this species account.

Lake Winnipeg, Manitoba Vermeer (1973a) examined 316 pellets regurgitated by Common Terns at Little George Island in June and July 1971. He reported that 92.4% of the pellets contained insects and 35.4% contained fish.

Great Lakes region, western Lake Ontario Alewives (Alosa pseudoharengus) and smelt (Osmerus mordax) made up over 90% of the diet of birds breeding at the Eastern Headland of the Toronto Outer Harbour (Courtney and Blokpoel 1980b). Emerald shiners (Notropis atherinoides) and fathead minnows (Pimephales promelas) were also eaten, but the latter was eaten only by chicks.

Great Lakes region, Niagara River Common Terns breeding at Tower Island in late May and late June fed mostly on smelt (Courtney and Blokpoel 1980b). Emerald and common shiner (Notropis cornutus) were next in importance early in the breeding season, but were later replaced by bluntnose minnow (Pimephales notatus) and spottail shiner (Notropis hudsonius).

Great Lakes region, eastern Lake Erie Smelt and emerald shiner were important constitutents of the diet early in the season. Trout-perch (Percopsis omiscomaycus) became important later (Courtney and Blokpoel 1980b).

Great Lakes region, western Lake Erie Young at Lost Ballast and Rattles Islands in 1950 were mostly fed emerald shiners. A small proportion of the food consisted of gizzard shad (Dorosoma cepedianum) and insects (grasshoppers, mayflies, and dragonfly nymphs) (Ligas 1952). Other foods fed to young in this area included trout-perch, yellow perch (Perca flavescens), freshwater drum (Aplodinotus grunniens), and Storer's chub (= silver chub, Hybopsis storeriana). Three stomachs from terns collected at the Bass Islands contained both emerald shiners and gizzard shad, but predominantly the former. Marshall (1942) had noted earlier that fish brought to the Starve Island colony were largely cyprinids, most of them lake (emerald) shiners.

Great Lakes region, Lake Michigan Manuel (1931a in Ligas 1952) reported that trout-perch and emerald shiners were the principal foods in this area. Carpenter ants, mayflies, and dragonfly nymphs were among the most frequently eaten insect prey.

Maine Stomachs of birds collected at the Sugarloaf Islands held mostly young herring and sand lance (Ammodytes americanus) (Palmer 1941a). Specimens collected in 1933 and 1934 at a number of localities contained a variety of foods with fish (primarily herring [Clupea harengus] and mackerel [Scomber scombrus]) the principal item of diet (Mendall 1935). Shrimp were found in 40% of the stomachs and other small crustaceans, molluscs, and insects were also eaten regularly, but not nearly as commonly as fish and shrimp. Birds breeding at Petit Manan Island in 1968 and 1969 fed largely on small herring, but also fed on other fish and crustacea (Hopkins and Wiley 1972).

Massachusetts Foods eaten by Common Terns in Massachusetts are similar to those eaten in Maine. Fish found in a colony at Chatham by Floyd (1930) included silversides (Menidia), herring, butterfish (Peprilus triacanthus), sand lance, red hake (Urophycis chuss), and killifish (= common mummichog) (Fundulus heteroclitus).

Different foods were fed to courted females at different colonies in Massachusetts (Nisbet 1977). Females at Bird Island primarily were fed small herring, whereas those at Monomoy Island were fed larger fish, with estimated weights of 3-12 g (0.10-0.42 oz). About half the fish at the latter locality were mature silversides (Menidia menidia); other fish eaten included sand lance, common mummichog, and cunners (Tautogolabrus adspersus). Nisbet (1974a) also reported an unusual item that was brought to chicks at Monomoy in July 1973--swim-bladders of the northern searobin (Prionotus carolinus). The young were unable to swallow these, however, and Nisbet suggested that the bladders were discarded fishing offal that were taken only because other food was scarce.

New York, Great Gull Island Hays et al. (1973) noted Common Terns bringing small mackerel to chicks at Great Gull Island. These authors also reported one of the few instances in which this species has been noted carrying more than one fish at a time.

New York, Long Island Fish dropped near the nests of terns breeding on Long Island included killifish (*Fundulus* spp.), silversides (*Menidia* spp.), and sand lance (Gochfeld 1980b). Fish are the primary food item on Long Island, but when fish are scarce, Common Terns feed extensively on crustaceans such as shrimp and mole crabs (*Emerita talpoida*) (Gochfeld 1978b).

Virginia Erwin (1977a) found eight species of fish near Common Tern nests in Virginia and reported that most of the diet consisted of small, inshore silversides (*Menidia* sp.) and killifish (*Fundulus* sp.).

North Carolina Mueller (1976) noted about 70 Common Terns feeding exclusively on small (1.5-2.5 cm [0.6-1.0 in]) mole crabs on the ocean beach at Ocracoke Inlet in July. Subsequently, he observed these terns feeding mainly on mole crabs at Bogue Bank. He remarked that such feeding habits were unusual, and suggested that the terns were concentrating on the crabs only because the latter were unusually abundant.

IMPORTANT BIOLOGICAL PARAMETERS

Egg Laying The peak egg-laying period in most parts of the range of the Common Tern occurs in May and June. Laying tends to begin later at more northern breeding localities. About 50% of the clutches had been laid by 22-25 May at five colonies in the lower Canadian Great Lakes in 1972 (Morris and Hunter 1976), and the median dates of laying at two colonies in Massachusetts in 1973 and 1975 were 25 and 28 May, respectively (Nisbet 1977). The median date of laying along the mid-Atlantic coast in 1980 varied from 20-21 May in Rhode Island and 24-25 May in New Jersey to 18-19 May in Virginia and 12-13 May in North Carolina (Smith et al. 1981). Smith et al. attributed the 12-16 day difference between northern and southern colonies primarily to differences in the ambient temperature between the areas.

Mean Clutch Size Common Terns lay from one to five eggs but usually lay two or three. As many as six eggs (Jones 1906, Helminen 1959, Borodulina 1960) or seven eggs (Warburton 1947, Fry 1948) have been found in one nest, but most authors believed that such "clutches" were the product of two females. Jones (1906) suggested that even the five-egg clutches in Massachusetts were laid by two females.

Judging from data compiled in Table 54, Common Terns lay larger clutches at more northern latitudes. Most of the nests at northern localities contain three eggs while two-egg clutches predominate in more southern areas. At one of the southernmost breeding localities for this species (in southern Curacao, Netherlands Antilles), clutches of two eggs are "by far the commonest" (Ansingh and Koelers 1957).

Clutch size may also vary in relation to a number of other factors such as age and experience of individual females, nest site, colony size, period of the breeding season during which the clutch is laid, and whether or not the clutch is the first or is a replacement clutch. Burger and Lesser (1978a) reported that mean clutch size (2.86) of Common Terns nesting on wrack in New Jersey in 1976 was significantly greater than that of birds nesting in Spartina (mean = 2.63). These authors found only a weak correlation ($r = \pm 0.335$) between mean clutch size and size of the colony, but clutches believed to be replacement clutches were significantly smaller (mean = 2.43) than initial clutches.

Table 54. Mean clutch sizes reported for the Common Tern (a).

Mean clutch size	Number of clutches	Locality and year of observation (b)	Source
2.87	62	Ontario, Toronto Outer Harbor, 1977 (3-87%)	Haymes and Blokpoel 1978a
2.49	113	Ontario, S. Limestone Island, 1972	Morris and Hunter 1976
2.61	348	Ontario, near Port Colborne, 1972 (3-70%)	Morris et al. 1976
2.59	98	Ontario, Hamilton Harbor, 1972 (3-67%)	Morris et al. 1976
2.65	212	Ontario, Muggs Islands, 1972 (3-71%)	Morris et al. 1976
2.25		Alberta, Chip Lake, 1969	Switzer et al. 1971
2.9		southern Finland, Kustavi, 1965	Lemmetyinen 1973b
2.9		southern Finland, Kustavi, 1966	Lemmetyinen 1973b
2.9		southern Finland, Kustavi, 1967	Lemmetyinen 1973b
2.8		southern Finland, Kustavi, 1968	Lemmetyinen 1973b
2.65	950	USSR, Estonia, Matsalu Bay, 1957-64 (3-69%)	Onno 1968
2.71	1588	USSR, Smalenyi Island, 1957 (3-77%)	Borodulina 1960
2.55	143	Scotland, Shetland, 1980 (3-68%)	Bullock and Gomersall 1981
2.54	265	England, Northumberland, 1965	Langham 1974
2.31	118	England, Northumberland, 1966	Langham 1974
2.38	115	England, Northumberland, 1967	Langham 1974
2.28	102	Massachusetts, Plymouth, 1970	Nisbet and Drury 1972
2.27	61	Massachusetts, Plymouth, 1971	Nisbet and Drury 1972
2.80	117	Massachusetts, Marion, 1970	Nisbet and Drury 1972
2.96	28	Massachusetts, Marion, 1971	Nisbet and Drury 1972
2.95	37	Massachusetts, Mattapoisett, 1971	Nisbet and Drury 1972
2.78	250	Massachusetts, Chatham, 1975	Nisbet 1977
2.87	183	Rhode Island, four colonies, 1980	Smith et al. 1981

Table 54. Concluded.

Mean clutch size	Number of clutches	Locality and year of observation (b)	Source
2.16	2650	Connecticut, Falkner Island, 1978	Sibley and Spendelow 1978 ms
2.13	706	New York, Great Gull Island, 1967 (2-56%)	Hays 1970b
2.16	953	New York, Great Gull Island, 1968 (2-61%)	Hays 1970b
1.85	193	New York, Hicks Island, 1975 (3-48%)	Houde 1977a
2.78		New Jersey, 1977	Burger and Lesser 1978a
2.30	258	New Jersey, five colonies, 1980	Smith et al. 1981
2.64	495	Virginia, four colonies, 1980	Smith et al. 1981
2.87	519	North Carolina, 3 colonies, 1980	Smith et al. 1981
		Early nests (c)	
2.09	347	New York, Great Gull Island, 1966 (2-41%)	Cooper et al. 1970
1.94	265	New York, Great Gull Island, 1967 (2-49%)	Hays 1970b
2.38	426	New York, Great Gull Island, 1968 (2-52%)	Hays 1970b
		Late nests (d)	
1.81	616	New York, Great Gull Island, 1966 (2-67%)	Cooper et al. 1970
2.24	441	New York, Great Gull Island, 1967 (2-60%)	Hays 1970b
1.98	527	New York, Great Gull Island, 1968 (2-69%)	Hays 1970b

(a) In some instances we calculated the mean clutch sizes given in this table from data presented in the sources listed. We took our data from Table 3 of Hays (1970b), Table 3 of Morris et al. (1976), Table 1 of Smith et al. (1981), and from data given by Nisbet and Drury (1972) for both their control and detailed study plots.

(b) When possible, we listed in parentheses the most frequently observed clutch size and the percentage of the nests that contained this number of eggs.

(c) Nests marked in May (Hays 1970b), or nesting 21-31 May (Cooper et al. 1970).

(d) Nests marked in June (Hays 1970b), or nesting 11 June-10 July (Cooper et al. 1970).

Incubation Period The incubation period of the Common Tern is slightly over three weeks. Some variation in incubation times within the clutch and with breeding season has been reported (see below); mean incubation periods also vary (Table 55). The modal incubation period in one study in Massachusetts (Austin 1932b) was 26 days for 33.7% of 95 nests.

Table 55. Incubation periods (in days) reported for the Common Tern.

Mean incubation period	Range	Number of eggs	Locality	Source
ca. 23	21-36	-	Maine, Sugarloaf Island	Palmer 1941a
25.5 (a)	21-30	95	Massachusetts, Chatham	Austin 1932b
21.5	21-22	2	New York, Great Gull Island	Cooper et al. 1970

(a) Figure recalculated from data given in the cited source, which gave mean incubation period as 25.7 days.

Courtney (1979a) documented the laying-to-hatching interval of first eggs in three-egg clutches laid by Common Terns nesting in Lake Erie in 1976 and 1977. The incubation period for these eggs decreased during the breeding season in both years. In 1976, eggs laid in early, mid, and late season, respectively, took an average of 24.0 (n = 29), 23.0 (n = 18), and 22.1 (n = 17) days to hatch. The following year first eggs took an average of 27.0 (n = 8), 26.3 (n = 7), and 24.0 (n = 6) days to hatch from early to late in the laying season. Nisbet and Cohen (1975) pointed out that a difference in mean incubation period of six days between two colonies in Massachusetts was almost certainly the result of night desertions by incubating terns at one of these colonies.

Hatching Success Hatching success in Common Terns varies considerably (Table 56) because of the frequency with which eggs are lost to disturbance and environmental variables. Presumably, the rate of physiological hatching failure is low and significant only in areas having heavy burdens of pesticides or other environmental contaminants that affect development. Hatching success may vary with the period of the season at which eggs are laid and with clutch size. At Gull Island, Lake Ontario, hatching success for most clutches was higher for clutches laid early (13 May-4 June) than for those laid later (5 June-28 July) (Morris et al. 1980). Three-egg clutches had a higher hatching success than smaller clutches in a number of studies (Table 56).

Age at Fledging Several authors (Nisbet and Drury 1972, LeCroy and LeCroy 1974, Nisbet 1976a) reported that most Common Terns fledge at 23-27 days of age. Pearson (1968) reported a mean fledging period of 22 days for Common Terns nesting at the Farne Islands in Northumberland. Fledging periods during two years at Great Gull Island, New York, were 23-29 days in 1969 (n = 32) and 23-30 days in 1970 (n = 36). The fledging period was bimodal in 1969 (23 and 25 days), and unimodal in 1970 (25 days) (calculated from data in LeCroy and LeCroy 1974).

Fledging Success Fledging success varies widely from colony to colony and from year to year. At five colonies in New Jersey, fledging success for nests begun in May 1980 ranged from 0.13 to 0.54 (n = 232, mean = 0.43); for the same period at four colonies in Virginia, the range was from 0.34 to 0.66 (n = 198,

Table 56. Rates of hatching success reported for the Common Tern.

Percent of eggs laid that hatched	Number of eggs	Locality and year of observation	Source
		All clutches	
87.6	178	Ontario, Toronto Outer Harbor, 1977	Haymes and Blokpoel 1978a
80.5	910	Ontario, near Port Colborne, 1972	Morris et al. 1976
35.0	254	Ontario, Hamilton Harbor, 1972	Morris et al. 1976
37.8	561	Ontario, Muggs Islands, 1972	Morris et al. 1976
67	79	Lake Ontario, Gull Island, 1975	Morris et al. 1980
53	53	Lake Ontario, Gull Island, 1976	Morris et al. 1980
84.4	45	New York, Great Gull Island, 1967	LeCroy and Collins 1972
62.9	89	New York, Great Gull Island, 1968	LeCroy and Collins 1972
88.8	107	New York, Great Gull Island, 1969	LeCroy and LeCroy 1974
88.2	93	New York, Great Gull Island, 1970	LeCroy and LeCroy 1974
96.6	232	Massachusetts, Plymouth, 1970	Nisbet and Drury 1972
94.6	112	Massachusetts, Marion, 1970	Nisbet and Drury 1972
97.6	83	Massachusetts, Marion, 1971	Nisbet and Drury 1972
97.2	109	Massachusetts, Mattapoisett, 1971	Nisbet and Drury 1972
49.3	5,723	Connecticut, Falkner Island, 1978	Sibley and Spendelow 1978 ms
84.2		southern Finland, Kustavi, 1965	Lemmetyinen 1973b
80.0		southern Finland, Kustavi, 1966	Lemmetyinen 1973b
67.8		southern Finland, Kustavi, 1967	Lemmetyinen 1973b
86.5		southern Finland, Kustavi, 1968	Lemmetyinen 1973b
73.7	1,002	England, Northumberland, 1965-66	Langham 1974
81.2	303	England, Northumberland, 1967	Langham 1974
		One-egg clutches	
54.1	37	Ontario, near Port Colborne, 1972	Morris et al. 1976
3.2	31	New York, Hicks Island, 1975	Houde 1977a
41.5	41	England, Northumberland, 1965-66	Langham 1974
		Two-egg clutches	
61.1	126	Ontario, near Port Colborne, 1972	Morris et al. 1976
9.4	138	New York, Hicks Island, 1975	Houde 1977a
75.0	12	southern Finland, Kustavi, 1965-69	Lemmetyinen 1973b
64.4	368	England, Northumberland, 1965-66	Langham 1974

Table 56. Concluded.

Percent of eggs laid that hatched	Number of eggs	Locality and year of observation	Source
		Three-egg clutches	
87.9	735	Ontario, near Port Colborne, 1965-69	Morris et al. 1976
22.2	279	New York, Hicks Island, 1975	Houde 1977a
81.6	141	southern Finland, Kustavi, 1965-66	Lemmetyinen 1973b
81.6	593	England, Northumberland, 1972	Langham 1974
		Four-egg clutches	
66.7	12	Ontario, near Port Colborne, 1972	Morris et al. 1976

mean = 0.48) (Smith et al. 1981). Figures for fledging success (i.e., the number of young fledged divided by the number of eggs laid) are given in Table 57. At a managed habitat at Gull Island, Ontario, in 1976, proportionately more young fledged from clutches laid early in the nesting season than from ones laid later (Morris et al. 1980). Early clutches had greater fledging success than did early clutches from the year before when the habitat was not managed. Overall, 0.18 chicks fledged per egg laid in 1975, and 0.26 fledged per egg laid in 1976.

Estimates of the number of young produced per pair or per nest (e.g., productivity) are freqently given in some papers that do not report how many eggs were laid. Such figures, sometimes also referred to as nesting success or reproductive success, are not good measures of fledging success as more usually defined (see above), but they do allow estimates of the potential recruitment in future years and provide a means to assess the "health" of a breeding population.

Productivity (Table 58), like fledging success, varies widely from year to year and area to area between and among colonies. Smith et al. (1981) tested for the source of differences in reproductive success among colonies surveyed and monitored from Rhode Island to North Carolina in 1980. They found no significant differences in success between (1) colonies of different sizes; (2) colonies with varying amounts of relaying; and (3) colonies on salt-marsh islands and those on barrier beaches.

Table 57. Fledging success in Common Tern colonies (a).

Fledging success (percent)	Number of eggs laid	Locality and year of observation	Source
5	360	Alberta, Chip Lake, 1969	Switzer et al. 1971
0.6	178	Ontario, Toronto Outer Harbor, 1977	Haymes and Blokpoel 1978a
36.2	910	Ontario, near Port Colborne, 1972	Morris et al. 1976
5.1	254	Ontario, Hamilton Harbor, 1972	Morris et al. 1976
25.9	232	Massachusetts, Plymouth, 1970	Nisbet and Drury 1972
2.8	141	Massachusetts, Plymouth, 1971	Nisbet and Drury 1972
55.4	112	Massachusetts, Marion, 1970	Nisbet and Drury 1972
69.9	83	Massachusetts, Marion, 1971	Nisbet and Drury 1972
63.3	109	Massachusetts, Mattapoisett, 1971	Nisbet and Drury 1972
0.7	142	Massachusetts, Chatham, 1971	Nisbet and Drury 1972
33.2	5,723	Connecticut, Falkner Island, 1978	Sibley and Spendelow 1978 ms
48.6	---	England, Northumberland, 1965	Langham 1974
39.9	---	England, Northumberland, 1966	Langham 1974
71.3	---	England, Northumberland, 1967	Langham 1974

(a) These figures have sometimes been recalculated from data presented in the original papers. Data from Nisbet and Drury (1972) are from their Table 1. The figures for Marion, 1970 are derived from the detailed study plot, those for Marion, 1971 are from the control plot, and those for Plymouth, 1970 are from both plots combined. Figures for the Hamilton Harbor area are derived from two colonies.

Mortality of Eggs and Young A wide variety of factors is responsible for mortality of eggs and young of Common Terns. Perhaps the most important causes are inclement weather, disturbance by man, and predation. Common Terns frequently lose nests to storms and floods or storm tides. Parnell and Soots (1979 ms) reported that flooding due to storm tides was a major factor in the loss of Common Tern colonies in North Carolina. About half of the nests lost in 1978 on Falkner Island, Connecticut were destroyed by heavy rains and storm tides (Sibley and Spendelow 1978 ms). High tides and floods following Hurricane Agnes in 1972 destroyed about 80% of the nests at the Wantagh Parkway, Long Island, colony (Gochfeld and Ford 1974).

Parnell and Soots (1979 ms) considered human disturbance an important source of mortality in North Carolina, particularly in colonies on barrier beaches where most nest loss is related to the use of recreational vehicles and to predation by Laughing Gulls, Herring Gulls, and Norway rats (*Rattus norvegicus*). Visits by humans to nesting colonies may also result in death of

Table 58. Productivity in Common Tern colonies.

Number of young produced per pair or per nest	Locality and year of observation	Source
0.11	Alberta, Chip Lake, 1969	Switzer et al. 1971
0.95	Ontario, near Port Colborne, 1972	Morris et al. 1976
0.32-1.4 (a)	Ontario, near Port Colborne, 1973	Morris and Hunter 1976
0.13 (b)	Ontario, Hamilton Harbor, 1972	Morris et al. 1976
0.20-0.21 (b)	Ontario, Hamilton Harbor	Morris and Hunter 1976
0.49	Lake Ontario, Gull Island	Morris et al. 1980
0.55	Lake Ontario, Gull Island	Morris et al. 1980
0.36 (c)	Michigan, St. Mary's River	Scharf 1981
0.59	Massachusetts, Plymouth, 1970	Nisbet and Drury 1972
0.06	Massachusetts, Plymouth, 1971	Nisbet and Drury 1972
1.59	Massachusetts, Marion, 1970	Nisbet and Drury 1972
2.07	Massachusetts, Marion, 1971	Nisbet and Drury 1972
0.99	Massachusetts, Mattapoisett, 1970	Nisbet and Drury 1972
1.86	Massachusetts, Mattapoisett, 1971	Nisbet and Drury 1972
0.02-0.00 (d)	Massachusetts, Chatham, 1971	Nisbet and Drury 1972
0.40	Massachusetts, 1972	Nisbet 1972 in Gochfeld and Ford 1974
0.72	Connecticut, Falkner Island, 1978	Sibley and Spendelow 1978 ms
ca. 0.89-1.07	New York, Long Island, 1972	Gochfeld and Ford 1974
ca. 0.05-0.9	New York, Long Island, 1978	Post and Gochfeld 1979
0.97 (e)	New Jersey, 1980	Smith et al. 1981
1.28 (f)	Virginia, 1980	Smith et al. 1981
1.22, 1.36 (g)	England, Northumberland, 1965	Langham 1974
0.88	England, Northumberland, 1966	Langham 1974

(a) Extremes from eight colonies.
(b) Data subsumes two colonies.
(c) Data for 12 colonies that produced from 0.0 to 1.3 young per nest.
(d) Data for two colonies.
(e) Data for five colonies that produced from 0.22 to 1.29 young per nest.
(f) Data for four colonies that produced from 0.81 to 1.81 young per nest.
(g) These figures are respectively from Tables 10 and 11 of the cited source.

the young from exposure, either from the sun (Robinson 1933, 1934a), or from inclement weather (Power 1964). Other forms of human disturbance which may decimate or eliminate colonies include vandalism (shooting birds [Robinson 1934a]) and collection of eggs for food (Crowell 1935, Palmer 1938).

Two recent studies examined the effect of disturbance on nesting Common Terns and their young. Nisbet (1981b) reported that only two of 320 adult Common Terns captured with a wire drop-trap in Massachusetts deserted their nests. Gochfeld (1981a) noted that chicks on Long Island were more likely to run about if touched than were those not manipulated. He suggested that increased wandering by disturbed chicks may have four adverse affects: (1) young may be eaten by predators or conspecifics; (2) young may be subject to aggressive attacks by neighboring adults; (3) separation of young from parents may result in starvation; and (4) young may be adversely affected by weather conditions such as overheating in the sun or chilling in the rain.

Avian predators are occasionally a major cause of a nesting failure. Herring Gulls were particularly important predators at several tern colonies in New Jersey during 1978 (Burger and Lesser 1978b). Herring Gulls were also considered the major factor in nest failure at Hicks Island, New York, in 1975 (Houde 1977b). Hatch (1970) suggested that Herring Gulls at a colony in Maine caused a mortality of as much as 0.48 to 1.2 young per pair (1). In other areas gulls may not be important predators. Ring-billed Gulls have been observed taking both eggs and young in the Great Lakes (authors cited in Courtney and Blokpoel 1980a), but some studies (Morris et al. 1976, Courtney and Blokpoel 1980a) made in that area reported that these gulls cause no significant nesting mortality. However, competition between Common Terns and Ring-billed Gulls for nest sites in the Great Lakes may have an adverse affect on the terns (Morris and Hunter 1976, Morris et al. 1976).

Another species often implicated in the loss of eggs and chicks is the Black-crowned Night-Heron (<u>Nycticorax nycticorax</u>). Morris et al. (1980) suggested that nocturnal predation of eggs and chicks by this species was the primary cause of an almost complete failure of late-nesting terns at Gull Island in Lake Ontario in 1976. In 1973, observations of predation on eggs and chicks by night-herons led Hunter and Morris (1976) to conclude that this heron and other avian predators can cause substantial mortality not only through predation but also by causing the adults to leave the colony and thereby increasing the exposure of eggs and chicks. Other areas in which night-heron predation is known include Connecticut (Sibley and Spendelow 1978 ms), Ohio (Marshall 1942), and New York (Collins 1970).

Palmer (1941a) suggested that a wave of deaths of young at Upper Sugarloaf Island in 1939 was due to nocturnal disturbance by Great Horned Owls (<u>Bubo virginianus</u>), and Nisbet (1975) suggested that this owl was the primary nocturnal predator at a colony in Massachusetts. Other reported avian predators of eggs include Canada Geese (<u>Branta canadensis</u>) (Courtney and Blokpoel 1980c) and Red-winged Blackbirds (<u>Agelaius phoeniceus</u>) (Cooper et al. 1970).

Several mammalian predators also may cause a nesting failure. Rats (<u>Rattus</u>) have been known to take eggs, young, and adults in such numbers that Palmer (1941a) considered these animals the most significant non-human mammal-

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(1) Hatch did not distinguish between young Common and Arctic Terns in his study, so this mortality rate subsumes predation on both species.

ian predators of Common Terns. Norway Rats evidently were a major factor in chick loss at West End Beach, Long Island, in 1972 (Gochfeld and Ford 1974). Other mammalian predators listed by Palmer are weasels (Mustela), skunks (Mephitis), and cats (Felis). Foxes (Vulpes) are also known predators (Latham 1936), as are dogs (Canis) (Austin 1932a). Mammals also may cause nest failure by trampling on nests, or by causing nests to be abandoned by attending adults.

Snakes also occasionally eat eggs and young. Both fox snakes (Elaphe vulpina) (Lyon 1927) and garter snakes (Thamnophis sirtalis) (Floyd 1932a) have been reported taking eggs; both garter snakes (Floyd 1927) and a "black snake" (Coluber constrictor?) are known to prey on chicks (Austin 1932a). There is little evidence, however, that snakes are often serious predators of Common Terns.

Renesting The extent to which Common Terns renest is not well known. Smith et al. (1981) indicated that both late nesting and renesting were rare in most colonies observed along the U.S. North Atlantic coast in 1980, but their methods of study did not allow them to distinguish between these phenomena. Burger and Lesser (1978a) reported that replacement clutches were laid 7-10 days after eggs were lost to predation in New Jersey. They reported no observations of individually marked birds and evidently assumed that new eggs found in previously used sites were laid by the same females. H. Hays (in DiCostanzo 1980) indicated that the approximate minimum interval for renesting is ten days at Great Gull Island, New York. Figures provided by DiCostanzo indicate that 28.1% and 30.7% of the population at Great Gull Island renested in 1977 and 1978, respectively.

Age at First Breeding A considerable amount of information is available on the demographics of Common Tern populations. Common Terns studied in Massachusetts (Austin 1932b) usually bred for the first time at three years of age. A few bred at two years, but only very rarely did any breed in their first year. Most young Common Terns in Britain also breed for the first time at three years (Langham 1971).

Almost 90% of the breeding population at Cape Cod was made up of birds 3-10 years old and 56.1% of the breeding population was less than five years old (Austin and Austin 1956). Post and Gochfeld (1979) estimated that about 53.3% of the population breeding at Breezy Point, Long Island, was less than five years old.

Maximum Natural Longevity One young tern banded in Massachusetts reached an estimated minimum age of 24 years (Clapp et al. 1982a). Another banded in the Old World reached an estimated minimum age of 25 years (Rydzewski 1978).

Weights Information on the weights of Common Terns is presented in Table 59. The reader should consult the original papers for more detailed analyses of these data. Multiple entries for the same locality show some of the variation obtained at different colonies in the same area (Courtney and Blokpoel 1980b), from year to year at the same colony (LeCroy and Collins 1972, LeCroy and LeCroy 1974) or colonies (Nisbet 1977), and from early to late in incubation (Courtney and Blokpoel 1980b, Nisbet 1977).

Table 59. Weights (in grams) of Common Terns (a).

Mean weight	Range	Number weighed	Area	Period	Source
			Adults		
143.4	139-148	19	Ontario	early incubation	Courtney and Blokpoel 1980b
129.2	126-132	18	Ontario	early incubation	Courtney and Blokpoel 1980b
141.2	138-145	25	Ontario	late incubation	Courtney and Blokpoel 1980b
126.4	122-131	16	Ontario	late incubation	Courtney and Blokpoel 1980b
116.1	103-129	56	New York	June-July	LeCroy and Collins 1972
120.4	103-145	265	New York		LeCroy and LeCroy 1974
122.7	106-145	34	Massachusetts		Nisbet 1977
126.7	108-147	82	Massachusetts		Nisbet 1977
125	117-133	11	England		Pearson 1968
			Males		
122.1	108-141	29	Maine		Palmer 1941a
108	---	7	Florida		Hartman 1955
122.4	101-147	55	southern USSR		Borodulina 1960
126.4	112-140	5	Australia	Dec.-Jan.	Hitchcock 1965
			Females		
122.1	103-138	20	Maine	breeding	Palmer 1941a
161	149-172	12	Massachusetts	after laying 1 of 3 eggs	Nisbet 1977
143	126-155	7	Massachusetts	after laying 1 of 2 eggs	Nisbet 1977
123	109-134	21	Massachusetts	late incubation	Nisbet 1977
102	---	5	Florida		Hartman 1955

Table 59. Continued.

Mean weight	Range	Number weighed	Area	Period	Source
			Females (concluded)		
128.1	97-175	37	southern USSR		Borodulina 1960
105	---	2	Papua	August	Hitchcock 1965
124.3	124-125	4	Australia	Dec.-Jan.	Hitchcock 1965
			Young		
14.8	12.0-17.7	13	New York	newly hatched	LeCroy and Collins 1972
14.9	13.0-16.5	6	New York	newly hatched	LeCroy and Collins 1972
123.1	108-142	32	New York	maximum weight	LeCroy and LeCroy 1974
131.4	114-148	36	New York	maximum weight	LeCroy and LeCroy 1974
109.8	108-112	2	Massachusetts	near fledging	Nisbet 1976a
111.2	101-125	32	New York	fledging	LeCroy and LeCroy 1974
113.2	95-128	36	New York	fledging	LeCroy and LeCroy 1974
			Eggs		
18.3	---	--	----	fresh	Palmer 1941a
21.0	18.7-23.8	20	New York	fresh	Collins and LeCroy 1972

Weights of individual eggs from 3-egg clutches

Mean weight	Number weighed	Sequence in clutch	Area in Massachusetts and year	Source
21.5	76	1st egg	Bird Island, 1971-72	Nisbet and Cohen 1975
20.4	70	1st egg	Yarmouth, 1973	Nisbet and Cohen 1975
20.3	26	1st egg (b)	Bird Island, 1972	Nisbet and Cohen 1975
21.3	75	2nd egg	Bird Island, 1971-72	Nisbet and Cohen 1975

Table 59. Concluded.

Mean weight	Number weighed	Sequence in clutch	Area in Massachusetts and year	Source
		Weights of individual eggs from 3-egg clutches (concluded)		
19.8	61	2nd egg	Yarmouth, 1973	Nisbet and Cohen 1975
19.8	23	2nd egg (b)	Bird Island, 1972	Nisbet and Cohen 1975
20.8	64	3rd egg	Bird Island, 1971-72	Nisbet and Cohen 1975
19.3	33	3rd egg	Yarmouth, 1973	Nisbet and Cohen 1975
19.4	5	3rd egg (b)	Bird Island, 1972	Nisbet and Cohen 1975

(a) Published weights over 100 grams are rounded to the nearest gram. Figures given for range from Pearson (1968) and Courtney and Blokpoel (1980b) are the mean $\pm$ 2 SD.
(b) Eggs from relaid clutches.

SUSCEPTIBILITY TO OIL POLLUTION

Although terns usually show little direct effect from oiling, they are often stained with oil. This oil may then be transmitted to eggs. In at least one instance, this has caused reduced nesting success (Rittinghaus 1956), but until recently few studies have documented the degree to which such staining occurs in wild populations. Duffy (1977a) examined the degree to which breeding Common Terns at Great Gull Island, New York, were contaminated with oil. He examined about 1,200 to 1,450 birds per year from 1973 to 1976 and found that 0.74% to 1.60% had oiled plumage. Most birds had only small (1-2 mm) oil spots, but a few were more extensively oiled. One had a 39 x 19 mm tar mass on its belly. More recently Gochfeld (1979a) reported the prevalence of oiling in adult Common Terns from colonies on Long Island's south shore. For the period 1969-1978, the prevalence varied from 0.04% at the West End Beach colony in 1971 to 0.25% at the Cedar Beach colony in 1969. Nearly one-third of the contaminated birds were moderately to heavily oiled (i.e., about one-third to two-thirds covered or stained with oil). These figures were based on field observations and perhaps underestimated the degree of oiling found in the colonies. Gochfeld also trapped and examined a number of individuals. For this smaller, but more thoroughly examined sample, the prevalence ranged from none to 1.22%. The overall incidence of oiling was 0.86% (n = 2,093).

Aside from these two studies, there are few published accounts of oiled

Common Terns. Records in the Bird Banding Laboratory, Laurel, Maryland, suggest that this species does occasionally die as the result of oiling. Records attribute oil as the cause of death of Common Terns in areas as diverse as Michigan, New York, New Jersey, Florida, Venezuela, Brazil, and the Caribbean. Many oiled terns were seen on the wintering grounds in Trinidad in 1982 and oiling there may be a signficant source of mortality (H. Blokpoel, pers. comm.)

Only a small proportion of the North American and world population nests in the southeastern United States, primarily in North Carolina. The status of transient populations in southeastern waters is poorly known, but the populations are large. These populations apparently occur mostly off the Atlantic coast for few months of the year. Consequently, we do not believe that the development of oil resources in the southeast will cause any pronounced threat to this species.

BIBLIOGRAPHY

1982

Blokpoel, H. and P. A. Courtney. 1982. Immigration and recruitment of Ring-billed Gulls and Common Terns on the lower Great Lakes. Can. Wildl. Serv. Prog. Notes 133. 12 pp.

Blokpoel, H., R. D. Morris and P. Trull. 1982. Winter observations of Common Terns in Trinidad, Guyana and Suriname. Colonial Waterbirds 5: 144-147.

Braune, B. M. and D. E. Gaskin. 1982a. Feeding ecology of nonbreeding populations of larids off Deer Island, New Brunswick. Auk 99: 67-76.

______. 1982b. Feeding methods and diving rates of migrating larids off Deer Island, New Brunswick. Can. J. Zool. 60: 2190-2197.

Buckley, F. G. and P. A. Buckley. 1982. Microenvironmental determinants of survival in saltmarsh-nesting Common Terns. Colonial Waterbirds 5: 39-48.

Buckley, P. A. and F. G. Buckley. 1982. Population success and site-tenacity in saltmarsh-nesting Common and Roseate Terns. (Abstract only.) Colonial Waterbirds 5: 57.

Burger, J. 1982b. Jamaica Bay Studies: I. Environmental determinants of abundance and distribution of Common Terns (*Sterna hirundo*) and Black Skimmers (*Rynchops niger*) at an east coast estuary. Colonial Waterbirds 5: 148-160.

Christie, D. A. 1982. Common Tern feeding by wading. Brit. Birds 75: 129.

Coulter, M. C. 1982a. Development of a runt Common Tern chick. J. Field. Ornithol. 53: 276-279.

Coulter, M. C. 1982b. Assortative mating in Common Terns, Sterna hirundo, on Great Gull Island, New York. (Abstract only.) Pac. Seabird Group Bull. 9: 80.

Erwin, R. M. and T. W. Custer. 1982. Estimating reproductive success in colonial waterbirds: an evaluation. Colonial Waterbirds 5: 49-56.

Gochfeld, M. and J. Burger. 1982. Biological concentration of cadmium in estuarine birds of the New York Bight. Colonial Waterbirds 5: 116-123.

Houston, C. S. and P. W. Brown. 1982. Cowbird egg in Common Tern nest. J. Field Ornithol. 53: 57.

Kasparek, M. 1982. Zur Zuggeschwindigket der Flussseeschwalbe, Sterna hirundo. [The speed of migration of the Common Tern Sterna hirundo.] J. Ornithol. 123: 297-305.

Kemp, J. B. 1982. Identification of juvenile Common, Arctic and Roseate Terns. Brit. Birds 75: 129.

Miller, L. and J. Confer. 1982. A study of the feeding of young Common Terns at one site in Oneida Lake during 1980. Kingbird 32: 167-172.

Nisbet, I. C. T. 1982. Eggshell characteristics and organochlorine residues in Common Terns: variation with egg sequence. Colonial Waterbirds 5: 139-143.

Reed, J. M., H. E. Hays and D. A. Zegers. 1982. Feeding behaviors and efficiencies of Common and Forster's Terns. Wilson Bull. 94: 567-569.

Severinghaus, L. L. 1982. Nest site selection by the Common Tern Sterna hirundo on Oneida Lake, New York. Colonial Waterbirds 5: 11-18.

1981

Baron, S. 1981. Whitenecked Raven Corvus albicollis attacking a Common Tern Sterna hirundo. Cormorant 9: 135.

Bullock, I. D. and C. H. Gomersall. 1981. The breeding populations of terns in Orkney and Shetland in 1980. Bird Study 28: 187-200.

Erwin, R. M., J. Galli and J. Burger. 1981. Colony site dynamics and habitat use in Atlantic coast seabirds. Auk 98: 550-561.

Gochfeld, M. 1981a. Differences in behavioral responses of young Common Terns and Black Skimmers to intrusion and handling. Colonial Waterbirds 4: 47-53.

Grant, G. S. 1981. Belly-soaking by incubating Common, Sandwich, and Royal Terns. J. Field Ornithol. 52: 244.

Lee, D. A. and M. K. Clark. 1981. Common Terns foraging over land. Chat 45: 73.

Lehtonen, L. 1981. Kalatiiran Sterna hirundo poikavaiheen saalistuksesta ja ravintobiologiasta jarvi-suomessa. [Prey and feeding biology of Common Terns Sterna hirundo during development of young in the Finnish Lake District.] Ornis Fenn. 58: 29-40. [In Finnish with English summary.]

Nisbet, I. C. T. 1981b. Behavior of Common and Roseate Terns after trapping. Colonial Waterbirds 4: 44-46.

Oreel, G. J. 1981. On field identification of Common and Arctic Tern. Dutch Birding 3: 18.

Ricklefs, R. E. and S. C. White. 1981. Growth and energetics of chicks of the Sooty Tern (Sterna fuscata) and Common Tern (S. hirundo). Auk 98: 361-378.

Scharf, W. C. 1981. The significance of deteriorating man-made island habitats to Common Terns and Ring-billed Gulls in the St. Mary's River, Michigan. Colonial Waterbirds 4: 155-159.

Shugart, G. W. and W. C. Scharf. 1981. Great Lakes Common Terns (Sterna hirundo): status of Michigan colonies. (Abstract only.) Colonial Waterbirds 4: 201.

Sibley, F. C. 1981. Common Terns in Connecticut. A progress report. Conn. Warbler 1: 18-24.

Smith, D. C., R. M. Erwin, T. W. Custer and J. O. Fussell, III. 1981. Common Tern colonies along the mid-Atlantic coast. I. Nesting chronology. Colonial Waterbirds 4: 160-165.

1980

Bell, D. G. 1980. Terns perching on wire. Brit. Birds 73: 316.

Bergman, G. 1980. Single-breeding versus colonial breeding in the Caspian Tern Hydroprogne caspia, the Common Tern Sterna hirundo and the Arctic Tern Sterna paradisaea. Ornis Fenn. 57: 141-152. [In English with Finnish summary.]

Buckley, P. A. and F. G. Buckley. 1980b. Population and colony-site trends of Long Island waterbirds for five years in the mid 1970s. Trans. Linn. Soc. N.Y. 9: 23-56.

Burton, J. and J. Chalifour. 1980. Trapping nesting terns: a modified method. Inl. Bird Banding 52: 36.

Coulter, M. C. 1980. Stones: an important incubation stimulus for gulls and terns. Auk 97: 898-899.

Courtney, P. A. and H. Blokpoel. 1980a. Behavior of Common Terns nesting near Ring-billed Gulls. Can. Field-Nat. 94: 336-338.

_____. 1980b. Food and indicators of food availability for Common Terns on the lower Great Lakes. Can. J. Zool. 58: 1318-1323.

_____. 1980c. Canada Goose predation on eggs of Common Terns. Ont. Field. Biol. 34: 40-42.

DiCostanzo, J. 1980. Population dynamics of a Common Tern colony. J. Field Ornithol. 51: 229-243.

Erwin, R. M. 1980b. Breeding habitat use by colonially nesting waterbirds in two mid-Atlantic U.S. regions under different regimes of human disturbance. Biol. Conserv. 18: 39-51.

Gloe, P. 1980. Flussseeschwalbe (Sterna hirundo) fischt aus dem Stand. Ornithol. Mitt. 32: 24.

Gochfeld, M. 1980a. Tissue distribution of mercury in normal and abnormal young Common Terns. Mar. Pollut. Bull. 11: 362-366.

_____. 1980b. Learning to eat by young Common Terns: consistency of presentation as an early cue. Proc. 1979 Conf. Colonial Waterbird Group 3: 108-118.

Mand, R. 1980. Jogitijru poegade kasvu seos koorumisjajekorraga. [The dependence of the growth of Common Tern nestlings on their hatching sequence.] Loodusvaatlusi 1978: 38-44. [In Estonian with Russian and English summaries.]

Mikkola, E., M. Ojanen and M. Orell. 1980. Lapin- ja kalatiirat pyydystavat kuoriutuvia surviassaaskia (Diptera, Chironomidae). [Emerging chironomids (Diptera) eaten by Sterna paradisaea and S. hirundo.] Ornis Fenn. 57: 42. [In Finnish with English summary.]

Morris, R. D., I. R. Kirkham and J. W. Chardine. 1980. Management of a declining Common Tern colony. J. Wildl. Manage. 44: 241-245.

Pinkowski, B. C. 1980. Adaptations of Common Terns nesting on an inland reservoir. Prairie Nat. 12: 111-113.

Taylor, P. B. 1980. Common Tern Sterna hirundo at Luanshya, Zambia. Scopus 4: 70.

Turrian, F. 1980. Nidification de la Sterna Pierregarin sur un radeau pres de Geneve. [Nesting of the Common Tern on a raft near Geneva.] Nos Oiseaux 35: 341-343.

1979

Burger, J. and F. Lesser. 1979. Breeding behavior and success in salt marsh Common Tern colonies. Bird-Banding 50: 322-337.

Courtney, P. 1979a. Seasonal variation in intra-clutch hatching intervals among Common Terns Sterna hirundo. Ibis 121: 207-211.

_____. 1979b. Effects of a rabbit on nesting Common Terns. Can. J. Zool. 57: 2457-2460.

Erwin, R. M. 1979b. Species interactions in a mixed colony of Common Terns (Sterna hirundo) and Black Skimmers (Rynchops niger). Anim. Behav. 27: 1054-1062.

Gochfeld, M. 1979a. Prevalence of oiled plumage of terns and skimmers on western Long Island, New York: baseline data prior to petroleum exploration. Environ. Pollut. 20: 123-130.

_____. 1979b. Group adherence in emigration of Common Terns. Bird-Banding 50: 365-366.

Hanssen, O. J. 1979. Forekomsten av Makrellterns Sterna hirundo pa Ostfldkysten. [The occurrence of Common Tern Sterna hirundo in Ostfold County.] Fauna 32: 19-22. [In Norwegian with English summary.]

Jensen, H. 1979. Mere angaende fodetraek hos Fjordternen (Sterna hirundo). Dan. Fugle 31: 31-32.

Kiss, J. B. 1979. Verhaltensunterschiede zwischen Brandseeschwalbe (Sterna sandvicensis Lath.) und Fluss-Seeschwalben (S. hirundo Linne) wahrend der gegenseitigen Ablosungs-Rituale am Nest. Tibiscus 1979: 201-210. [In Romanian with German summary.]

Pearce, P. A., D. B. Peakall and L. M. Reynolds. 1979. Shell thinning and residues of organochlorines and mercury in seabird eggs, Eastern Canada, 1970-76. Pestic. Monit. J. 13: 61-68.

Post, P. W. and M. Gochfeld. 1979. Recolonization by Common Terns at Breezy Point, New York. Proc. 1978 Conf. Colonial Waterbird Group 2: 128-136.

Rasmussen, S. A. 1979a. Angaende fodetraek hos Fjordterne (Sterna hirundo). Dan. Fugle 31: 85-86.

_____. 1979b. Fjordternens Sterna hirundo L. status som ynglefugl i Danmark 1970-1976. [The breeding status of the Common Tern Sterna hirundo L. in Denmark 1970-1976.] Dan. Ornithol. Foren. Tidsskr. 73: 271-279.

Ricklefs, R. E. 1979. Patterns of growth in birds. V. A comparative study of development in the Starling, Common Tern, and Japanese Quail. Auk 96: 10-30.

Rittinghaus, H. 1979. Beitrage zur okologischen Potenz einiger Seeschwalbenarten (Sterna albifrons, Sterna hirundo, Sterna paradisaea, Sterna sandvicensis). Ornithol. Mitt. 31: 73-85, 99-119. [In German.]

Scharf, W. C. 1979. Nesting and migration areas of birds of the U.S. Great Lakes (30 April to 25 August 1976). U.S. Fish Wildl. Serv. Off. Biol. Serv. FWS/OBS-77/2. 113 pp.

Sibley, F. C. and J. A. Spendelow. 1979 ms. Falkner's Island tern project--1979. Peabody Mus., Yale Univ./New Haven, CT. 4 pp.

Stelfox, H. A. and G. J. Brewster. 1979. Colonial-nesting Herring Gulls and Common Terns in northeastern Saskatchewan. Can. Field-Nat. 93: 132-138.

Taylor, I. R. 1979a. The kleptoparasitic behaviour of the Arctic Skua Stercorarius parasiticus with three species of terns. Ibis 121: 274-282.

_____. 1979b. Prey selection during courtship feeding in the Common Tern. Ornis Scand. 10: 142-144.

Tofft, J. 1979. Iagttagelser af Fjordternens (Sterna hirundo) fodetraek. Dan. Fugle 31: 86-87.

1978

Blokpoel, H. and P. M. Fetterolf. 1978. Colonization by gulls and terns of the Eastern Headland, Toronto Outer Harbour. Bird-Banding 49: 59-65.

Blokpoel, H. and G. B. McKeating. 1978. Fish-eating birds nesting in Canadian Lake Erie and adjacent waters. Can. Wildl. Serv. Prog. Notes 87. 12 pp.

Blokpoel, H., P. M. Catling and G. T. Haymes. 1978. Relationship between nest sites of Common Terns and vegetation on the Eastern Headland, Toronto Outer Harbour. Can. J. Zool. 56: 2057-2061.

Bogdanov, L. V. and L. M. Shelobod. 1978. [Genetic analysis of Common Tern (Sterna hirundo) eggs.] Genetika 14: 609-613. [In Russian with English summary.]

Buckley, P. A., M. Gochfeld and F. G. Buckley. 1978b. Efficacy and timing of helicopter censuses of Black Skimmers and Common Terns on Long Island, N.Y.: a preliminary analysis. Proc. 1977 Conf. Colonial Waterbird Group 1: 48-61.

Burger, J. and F. Lesser. 1978a. Selection of colony sites and nest sites by Common Terns Sterna hirundo in Ocean County, New Jersey. Ibis 120: 433-449.

_____. 1978b. Determinants of colony site selection in Common Terns (Sterna hirundo). Proc. 1977 Conf. Colonial Waterbird Group 1: 118-127.

Devillers, P. 1978. Illustration du plumage Juvenile des Sternes Arctique (Sterna paradisaea) et Pierregarin (S. hirundo). [Identification of juvenal plumage of Arctic Tern (Sterna paradisaea) and Common Tern (S. hirundo).] Gerfaut 68: 91-96. [In French with Dutch and English summaries.]

DiCostanzo, J. 1978. Occurrences of the Common Tern in the interior of South America. Bird-Banding 49: 248-251.

Duffy, D. C. 1978. Terns and skimmers in Connecticut and eastern Long Island, N.Y., 1972-76. (Abstract only.) Ibis 120: 131.

_____. 1978 ms. The feeding ecology of Common and Roseate Terns during the breeding season at Great Gull Island, New York.

Erwin, R. M. 1978a. Population and colony site dynamics in selected Massachusetts waterbirds. Proc. 1977 Conf. Colonial Waterbird Group 1: 19-25.

_____. 1978b. Coloniality in terns: the role of social feeding. Condor 80: 211-215.

Fisk, E. J. 1978a. Roof-nesting terns, skimmers, and plovers in Florida. Fla. Field Nat. 6: 1-8.

_____. 1978c. The growing use of roofs by nesting birds. Bird-Banding 49: 134-141.

Gochfeld, M. 1978b. Observations on feeding ecology and behavior of Common Terns. Kingbird 28: 84-90.

_____. 1978c. Behavioral adjustments to flightlessness by meadowlarks and terns. Condor 80: 251-252.

_____. 1978d. Incubation behaviour in Common Terns: influence of wind speed and direction on orientation of incubating adults. Anim. Behav. 26: 848-851.

_____. 1978e. Terns in traffic. Nat. Hist. 87: 54-61.

Haymes, G. T. and H. Blokpoel. 1978a. Reproductive success of larids nesting on the Eastern Headland of the Toronto Outer Harbour in 1977. Ont. Field Biol. 32: 1-17.

_____. 1978c. Seasonal distribution and site tenacity of the Great Lakes Common Tern. Bird-Banding 49: 142-151.

Hays, H. 1978. Timing and breeding success in three- to seven-year-old Common Terns. (Abstract only.) Ibis 120: 127-128.

Kiss, J. B. 1978. [Lachmowen-angriffe in Seeschwalben-Kolonien.] Stud. Comunicari Muz. Brukenthal St. Nat. 22: 367-371. [In Romanian with German summary.]

Lilleleht, V. and J. Kestpaik. 1978. Meriski (Haemotopus ostralegus) ja sinikaelpart (Anas platyrhynchos) toitumas kalakajaka (Larus canus) ja jogitiiru (Sterna hirundo). [The Oystercatcher (Haemotopus ostralegus) and the Mallard (Anas platyrhynchos) feeding in the nesting colonies of the Common Gull (Larus canus) and the Common Tern (Sterna hirundo).] Ornitol. Kogumik 8: 235-238. [In Estonian.]

Lobkov, E. G. and N. M. Golovina. 1978. [A comparative analysis of the biology of Sterna hirundo and Sterna kamtschatica in Kamchatka.] Byull. Mosk. Ova. Ispyt. Prir. Otd. Biol. 83: 27-37. [In Russian with English summary.]

Mead, C. J. 1978. Tern mortality in West Africa as shown by British and Dutch ringing results. (Abstract only.) Ibis 120: 110.

Mes, R., R. Schuckard and J. Wattel. 1978. Visdieven Sterna hirundo zoeken koelte. [Cooling behavior in Common Terns Sterna hirundo.] Limosa 51: 64-68. [In Dutch with English summary.]

Neubauer, W. 1978. Experimentelle Untersuchungen zur akustischen und visuellen Kommunikation an der Flussseeschwalbe (Sterna hirundo L.) unter besonderer Berucksichtigung der Jungenaufzucht. Beitr. Vogelkd. 24: 1-71.

Nisbet, I. C. T. 1978a. Population models for Common Terns in Massachusetts. Bird-Banding 49: 50-58.

_____. 1978b. Dependence of fledging success on egg-size, parental performance and egg-composition among Common and Roseate Terns, Sterna hirundo and S. dougallii. Ibis 120: 207-215.

Nisbet, I. C. T., K. J. Wilson and W. A. Broad. 1978. Common Terns raise young after death of their mates. Condor 80: 106-109.

Rasmussen, L. W. 1978a. Angaende fodetraek hos Fjordterne (Sterna hirundo). Dan Fugle 30: 162-163.

_____. 1978b. Troskab mod fodekolonien hos ungerne, sammenlignet med de gamle fugles flytninger, i en dansk bestand af Fjordternen. Feltornithologen 20: 104-106.

Sibley, F. C. and J. A. Spendelow. 1978 ms. Falkner's Island tern project--1978. Peabody Mus., Yale Univ./New Haven, CT. 4 pp.

Siokhin, V. D. and G. S. Skripko. 1978. [On some relations between Sterna hirundo L. colonies and plant associations of islands.] Vestn. Zool. 1978: 77-79. [In Russian.]

Spaans, A. L. 1978. Status of terns along the Surinam coast. Bird-Banding 49: 66-76.

Storey, A. E. 1978. Adaptations in Common Terns and Forster's Terns for nesting in the salt marsh. Ph.D. thesis, Rutgers Univ./Newark, NJ. 194 pp.

Zettel, J. 1978. Erste Untersuchungen zum Problem der Brutmisserfolge der flussseeschwalbe am Fanel. Vogel Heimat 48: 148-154.

1977

Alsem, K. J. 1977. [Strange behavior in Common Terns.] Vogeljaar 25: 141.

Bainbridge, I. P. 1977a. Biometrics and moult of Common Terns at Seaforth Dock, Liverpool. Bird Ringing in S.W. Lancashire 7: 34-40.

_____. 1977b. Controls and recoveries of Common Terns caught at Seaforth Dock, Liverpool. Bird Ringing in S.W. Lancashire 7: 40-42.

Blokpoel, H. 1977. Gulls and terns nesting in northern Lake Ontario and the upper St. Lawrence River. Can. Wildl. Serv. Prog. Notes 75. 12 pp.

Burggraeve, G. 1977. Waarnemingen bij een vermoedelijk gemengd broedpaar Dougalls Stern, Sterna dougallii, X Visdief, Sterna hirundo, te Knokke. [Observations on a probably mixed pair Roseate Tern, Sterna dougallii, new record, X Common Tern, Sterna hirundo, at Knokke.] Gerfaut 67: 75-80. [In Dutch with French and English summaries.]

Busse, K. 1977. Pragungsbedingte akustische Arterkennungsfahigkeit der Kuken der Flussesseeschwalben und Kustenseeschwalben Sterna hirundo L. and S. paradisaea Pont. Z. Tierpsychol. 44: 154-161. [In German with English summary.]

Clancy, P. A. 1977a. Notes on recent tern "wrecks" on the Natal coast. Bokmakierie 29: 17.

Cox, J. B. 1977. White-fronted Terns in South Australia and notes on the identification of similar terns. S. Austr. Ornithol. 27: 179-184.

Duffy, D. 1977a. Incidence of oil contamination on breeding Common Terns. Bird-Banding 48: 370-371.

_____. 1977b. Breeding populations of terns and skimmers on Long Island Sound and eastern Long Island: 1972-1975. Proc. Linn. Soc. N.Y. 73: 1-48.

Erwin, R. M. 1977a. Foraging and breeding adaptations to different food regimes in three seabirds: the Common Tern, Sterna hirundo, Royal Tern, Sterna maxima, and Black Skimmer, Rynchops niger. Ecology 58: 389-397.

Fetterolf, P. M. and H. Blokpoel. 1977. Terns and gulls nesting on Toronto's eastern headland. Ont. Field Biol. 31: 51-52.

Gochfeld, M. 1977a. Intraclutch egg variation: the uniqueness of the Common Tern's third egg. Bird-Banding 48: 325-332.

Houde, P. 1977a. Low productivity of terns on Hicks Island, 1975. Proc. Linn. Soc. N.Y. 73: 49-57.

_____. 1977b. Gull-tern interactions on Hicks Island, 1975. Proc. Linn. Soc. N.Y. 73: 58-64.

Jensen, H. 1977. Fjordternen (Sterna hirundo) i Kagsmosen 1976. Dan. Fugle 29: 27.

King, B. 1977. 'Alarms', 'dreads' and 'panics' at terneries. Brit. Birds 70: 81-82.

MacFarlane, A. E. 1977. Roof-nesting by Common Terns. Wilson Bull. 89: 475-476.

Mand, R. 1977. [Terns migrate.] Eesti Loodus 20: 607-609. [In Estonian with English and Russian summaries.]

Mannaert, P. 1977. [Common Tern--Sterna hirundo.] Wielewaal 43: 250. [In Flemish.]

Nisbet, I. C. T. 1977. Courtship-feeding and clutch size in Common Terns. Pp. 101-109 in B. Stonehouse and C. Perrins (eds.). Evolutionary ecology. (Vol. 2. Biology and environment.) 310 pp.

1976

Clancy, P. A. 1976. Further on the characters and status of Sterna hirundo tibetana Saunders in southern Africa. Ostrich 47: 228.

Dexter, R. W. 1976. Marine banding and nesting studies at Cape Ann, Massachusetts. N. Am. Bird Bander 1: 165-167.

Fox, G. A. 1976. Eggshell quality: its ecological and physiological significance in a DDE-contaminated Common Tern population. Wilson Bull. 88: 459-477.

Gochfeld, M. 1976. Waterbird colonies of Long Island, New York. 3. Cedar Beach ternery. Kingbird 26: 62-80.

Hunter, R. A. 1976. A study of selected factors influencing the reproductive success of the Common Tern (Sterna hirundo) at Port Colborne, Ontario, in 1973 and 1974. M.S. thesis, Brock Univ./St. Catherine's, ON. 132 pp.

Hunter, R. A. and R. D. Morris. 1976. Nocturnal predation by a Black-crowned Night Heron at a Common Tern colony. Auk 93: 629-633.

Lemmetyinen, R. 1976. Feeding segregation in the Arctic and Common Terns in southern Finland. Auk 93: 636-640.

Lobkov, E. G. 1976. Quantitative estimate of the biotopic isolation of birds of a single genus under conditions of sympatry. Sov. J. Ecol. 7: 550-552.

Merrie, D. 1976. Behaviour of injured Common Tern. Brit. Birds 69: 272.

Mes, R. and R. Schuckard. 1976. Een onderzoek naar verschillen in fourageer-activiteit tussen Visdief _Sterna hirundo_ en Noordse Stern _Sterna paradisaea_ op de Engelsmanplant (NL). _Versl. Tech. Gegevens Inst. Taxon. Zool. Amst._ 11: 1-36. [In Dutch with English summary.]

Morris, R. D. and R. A. Hunter. 1976. Factors influencing desertion of colony sites by Common Terns (_Sterna hirundo_). Can. Field-Nat. 90: 137-143.

Morris, R. D., R. A. Hunter and J. F. McElman. 1976. Factors affecting the reproductive success of Common Tern (_Sterna hirundo_) colonies on the lower Great Lakes during the summer of 1972. Can. J. Zool. 54: 1850-1862.

Mueller, H. C. 1976. Common Terns feed on mole crabs. Wilson Bull. 88: 675-676.

Newton, R. 1976. Establishment of a Common Tern colony in the Lee Valley 1962-75. Birds Lee Valley 1975: 33-35.

Nilsson, I. and S. Nilsson. 1976. Kanadagass _Branta canadensis_ trampar sonder agg av fisktarna _Sterna hirundo_. [Canada Goose, _Branta canadensis_, crushing eggs of Common Tern, _Sterna hirundo_.] Var Fagelvarld 35: 157. [In Swedish.]

Nisbet, I. C. T. 1976a. Early stages in postfledging dispersal of Common Terns. Bird-Banding 47: 163-164.

_____. 1976c. Returns from terns. Mass. Audubon Newsl. 15: 3-5.

Rasmussen, L. U. and E. H. Jensen. 1976. En undersogelse af biotopvalget hos ynglende Fjordterner. Feltornithologen 18: 212.

Vermylen, M. 1976. Visdiefje-_Sterna hirundo_. Wielewaal 42: 347.

1975

Cantelo, J. and P. A. Gregory. 1975. Feeding association between Common Terns and Razorbill. Brit. Birds 68: 296-297.

Connors, P. G., V. C. Anderlini, R. W. Risebrough, M. Gilbertson and H. Hays. 1975. Investigations of heavy metals in Common Tern populations. Can. Field-Nat. 89: 157-162.

Dunn, E. K. 1975. The role of environmental factors in the growth of tern chicks. J. Anim. Ecol. 44: 743-754.

Gochfeld, M. 1975a. Developmental defects in Common Terns of western Long Island, New York. Auk 92: 58-65.

_____. 1975b. Hazards of tail-first fish-swallowing by young terns. Condor 77: 345-346.

Greenhalgh, M. E. 1975. Food of an estuarine Common Tern colony. Naturalist (Leeds) 95: 145.

Harris, J. T. and S. W. Matteson. 1975. Gulls and terns as indicators of man's impact upon Lake Superior. Univ. Wis. Sea Grant Progr. Tech. Rep. 227. v and 45 pp.

Hays, H. 1975. Probable Common x Roseate Tern hybrids. Auk 92: 219-234.

Hohlt, G. and M. Kaniss. 1975. Erfolg einer kunstlichen Brutinsel fur Flussseeschwalbe (Sterna hirundo) im Inn. Anz. Ornithol. Ges. Bayern 14: 311-313.

Keleman, A. and Z. Szambath. 1975. Osszehasonlito meg figyeleseka Kuszvago esa kis cser Koltesi Magatartasarol. [Comparative observations of the breeding behavior of Common Tern and Little Tern.] Aquila 82: 211-228. [In Hungarian and German.]

Kiss, J. B. 1975. Brutbeobachtungen an der Flussseeschwalbe auf Sahalin. Vogel Heimat 45: 136-142.

Kruger, S. and K.-H. Schulze. 1975. Flussseeschwalbe (Sterna hirundo L.) wieder Brutvogel in der Oberlausitz. Abh. Ber. Naturkundemus. Gorlitz 48: 19-20.

Lloyd, C. S., C. J. Bibby and M. J. Everett. 1975. Breeding terns in Britain and Ireland in 1969-74. Brit. Birds 68: 221-237.

Nikolskii, I. D. 1975. [Some acoustic signals in the behavior of the Common Tern Sterna hirundo.] Zool. Zh. 54: 1734-1737. [In Russian with English summary.]

Nisbet, I. C. T. 1975. Selective effects of predation in a tern colony. Condor 77: 221-226.

Nisbet, I. C. T. and M. E. Cohen. 1975. Asynchronous hatching in Common and Roseate Terns, Sterna hirundo and S. dougallii. Ibis 117: 374-379.

Norderoog, H. 1975. Vergleichende Untersuchungen zum Fortpflanzungsverhalten und zum Problem der arttrennenden Mechanismen an Fluss- und Kustenseeschwalben (Sterna hirundo L. und S. paradisaea Pont.). Dissertation zur Erlangung des Doktorgrades des Fachbereichs Biologie der Universitat Hamburg. 71 pp. [In German with English summary.]

Rinnhoffer, G. 1975. Flussseeschwalben beim Fischfang. Falke 22: 415-417.

1974

Cruickshank, A. D. 1974. Field identification of difficult birds. II. Four similar terns. Fla. Field Nat. 2: 1-3.

De Visser, E. 1974. Het visdiefje (Sterna hirundo) - waarnemingen te Gent/Terdonk broedseizoen 1973. Wielewaal 40: 40-43.

Filonov, K. P., V. I. Lysenko and V. D. Siokhin. 1974. [Peculiarities of Limicolae and Lari nesting on islands of Molochny Estuary (the Sea of Azov).] Vestn. Zool. 1974: 52-58. [In Russian with English summary.]

Fimreite, N. 1974. Mercury contamination of aquatic birds in northwestern Ontario. J. Wildl. Manage. 38: 120-131.

Gilbertson, M. 1974b. Seasonal changes in organochlorine compounds and mercury in Common Terns of Hamilton Harbor, Ontario. Bull. Environ. Contam. Toxicol. 12: 726-732.

Gochfeld, M. 1974a. Waterbird colonies of Long Island, New York. 2. Wantagh Parkway colony. Kingbird 24: 47-50.

______. 1974b. Prevalence of subcutaneous emphysema in young terns, skimmers and gulls. J. Wildl. Dis. 10: 115-120.

Gochfeld, M. and D. B. Ford. 1974. Reproductive success in Common Tern colonies near Jones Beach, Long Island, New York, in 1972: a hurricane year. Proc. Linn. Soc. N.Y. 72: 63-76.

Greenhalgh, M. E. 1974. Population growth and breeding success in a saltmarsh Common Tern colony. Naturalist (Leeds) 93: 121-127.

Heim, P. J. 1974. Flussseeschwalbenbrut auf Floss im Zurcher Obersee bei Nuolen. Ornithol. Beob. 71: 318-319. [In German.]

Hume, R. A. and P. J. Grant. 1974. The upperwing patterns of adult Common and Arctic Terns. Brit. Birds 67: 133-136.

Langham, N. P. E. 1974. Comparative breeding biology of the Sandwich Tern. Auk 91: 255-277.

LeCroy, M. and S. LeCroy. 1974. Growth and fledging in the Common Tern (Sterna hirundo). Bird-Banding 45: 326-340.

Lemmetyinen, R. 1974. Comparative breeding ecology of the Arctic and the Common Tern with special reference to feeding. Reps. Dep. Zool., Univ. Turku No. 3. 19 pp.

Moller, A. P. 1974. Fjordterne Sterna hirundo rugende pa to egne aeg og et af haettemage Larus ridibundus. Dan. Ornithol. Foren. Tidsskr. 68: 67-68. [In Danish with English summary.]

Nisbet, I. C. T. 1974a. Unusual prey of Common Terns: swim-bladders of large fish. Wilson Bull. 86: 170-171.

Ranftl, H. and F. Lechner. 1974. Einige neure Erfahrungen mit kunstlichen Niststatten fur Flusssseeschwalben Sterna hirundo. Anz. Ornithol. Ges. Bayern 13: 99-102. [In German.]

Reese, J. G. 1974. Solitary Common Tern nest displaced by Mallard. Md. Birdlife 30: 102.

Robbins, C. S. 1974. Probable interbreeding of Common and Roseate Terns. Brit. Birds 67: 168-170.

Rolls, J. C. 1974. Common Terns roosting on water. Brit. Birds 67: 120-121.

Roshevskii, Yu. K. 1974. Dinamika gruppovogo effekta v gnezdovom povedenii rechnoi krachki. [Dynamics of the group effect in nesting behavior of the Common Tern.] Mat. 6-i Vsesoyuzn, Orn. Konf., Part I, Moskva. 166 pp.

Schodde, R. and I. J. Mason. 1974. Common Tern in the Northern Territory. Emu 74: 103-104.

Taylor, I. R. 1974. The feeding behaviour and ecology of Sandwich, Common and Arctic Terns on the Ythan Estuary, Aberdeenshire. Ph.D. thesis, Univ. Aberdeen/Aberdeen, Scotland.

Wilkinson, R. B. and K. Atkin. 1974. Census of breeding Black-headed Gulls, Common Terns, Ringed Plovers and Little Ringed Plovers in 1973. Trans. Lincs. Nat. Un. 18: 141-145.

1973

Drury, W. H. 1973-74. Population changes in New England seabirds. Bird-Banding 44: 267-313; 45: 1-15.

Duffy, D. C. and C. La Farge. 1973. The birds of Great Gull Island 1966-1972. Linn. Soc. N.Y. viii and 44 pp.

Dunn, E. K. 1973a. Changes in fishing ability of terns associated with wind-speed and sea surface conditions. Nature 244: 520-521.

_____. 1973b. Robbing behavior of Roseate Terns. Auk 90: 641-651.

Dyck, J., B. Olsen, H. Meltofte, M. Permin and J. Rabol. 1973. Debat: forstat fa FO 1-73. Fjordterne skudt: et svar. Om 'indsamling' af fugle. Feltornithologen 15: 72-73.

Gochfeld, M. 1973c. Encrusted wings causing flightlessness in young terns. Wilson Bull. 85: 236-237.

Hatch, D. R. M. 1973. Hatched egg-shells covering Common Tern eggs. Blue Jay 31: 91.

Hays, H. and G. D. Cormons. 1973. Plastic particles found in tern pellets, on coastal beaches and at factory sites. Linn. Newsl. 27: 1-4.

Hays, H., E. Dunn and A. Poole. 1973. Common, Arctic, Roseate, and Sandwich Terns carrying multiple fish. Wilson Bull. 85: 233-236.

Kremer, R. 1973. The relationships between clutch size, chick growth, and chick survival in the Common Tern (Sterna hirundo). M.S. thesis, C.W. Post Coll./Long Island, NY.

Lemmetyinen, R. 1973a. Feeding ecology of Sterna paradisaea Pontopp. and S. hirundo L. in the archipelago of southwestern Finland. Ann. Zool. Fenn. 10: 507-525.

_____. 1973b. Breeding success in Sterna paradisaea Pontopp. and S. hirundo L. in southern Finland. Ann. Zool. Fenn. 10: 526-535.

McNicholl, M. K. 1973a. Habituation of aggressive responses to avian predators by terns. Auk 90: 902-904.

Mery, S. C. 1973. Third specimen of Common Tern for Oklahoma. Bull. Okla. Ornithol. Soc. 6: 30.

Nisbet, I. C. T. 1973a. Courtship-feeding, egg-size and breeding success in Common Terns. Nature 241: 141-142.

_____. 1973b. Terns in Massachusetts: present numbers and historical changes. Bird-Banding 44: 27-55.

Nisbet, I. C. T. and H. Alexander. 1973. The Common Tern: friend of the wind. Natl. Geogr. Mag. 144: 234-247.

Roberts, J. S. 1973. Second Common Tern specimen for Oklahoma. Bull. Okla. Ornithol. Soc. 6: 21-22.

Rolls, J. C. 1973. Prolonged mobbing of Common Tern by Swallows and Jackdaws. Brit. Birds 66: 169.

Switzer, B., V. Lewin and F. H. Wolfe. 1973. DDE and reproductive success in some Alberta Common Terns. Can. J. Zool. 51: 1081-1086.

Unhola, A. 1973 ms. Kalatiiran (Sterna hirundo) ravintoekologiasta eraassa sisavesipopulaatiossa. MS, Dep. of Zool., Univ. Turku., Finland. [In Finnish.]

Vermeer, K. 1973a. Comparison of food habits and mercury residues of Caspian and Common Terns. Can. Field-Nat. 87: 305.

1972

Collins, C. T. and M. LeCroy. 1972. Analysis of measurements, weights, and composition of Common and Roseate Tern eggs. Wilson Bull. 84: 187-192.

Duffy, D. C. 1972. Records from Great Gull Island, 1972. Kingbird 22: 163-164.

Dunn, E. K. 1972b. Studies on terns with particular reference to feeding ecology. Ph.D. thesis, Univ. Durham/Durham, England.

Gilbertson, M. and L. M. Reynolds. 1972. Hexachlorobenzene (HCB) in the eggs of Common Terns in Hamilton Harbour, Ontario. Bull. Environ. Contamn. Toxicol. 7: 371-373.

Gloe, P. 1972. Ein Massenabzug von Fluss- und Kustenseeschwalben (Sterna hirundo et Sterna paradisaea) an der Meldorfer Bucht. Ornithol. Mitt. 24: 170-172.

Griffin, A. C. M. 1972. Bridled, Sooty, and Common Terns at Townsville. Sunbird 3: 39.

Haverschmidt, F. 1972. Further evidence of the 'portlandica' plumage phase of terns. Brit. Birds 65: 117-119.

Hays, H. and R. W. Risebrough. 1972. Pollutant concentrations in abnormal young terns from Long Island Sound. Auk 89: 19-35.

Hopkins, C. D. and R. H. Wiley. 1972. Food parasitism and competition in two terns. Auk 89: 583-594.

Houston, C. S. 1972. Recoveries of Saskatchewan Common Terns. Blue Jay 30: 216-217.

Isenmann, P. 1972b. Donnees sur les quartiers d'hiver des sternes pierregarins Sterna hirundo nees en France et en Suisse. [Data about the winter quarters of Common Terns Sterna hirundo born in France and Switzerland.] Nos Oiseaux 31: 297-299. [In French with English summary.]

Langham, N. P. E. 1972. Chick survival in terns (Sterna spp.) with particular reference to the Common Tern. J. Anim. Ecol. 41: 385-395.

Lazell, J. D., Jr. and I. C. T. Nisbet. 1972. The tern-eating Garter Snakes of Nomans Land. Man Nat., June 1972: 27-29.

LeCroy, M. 1972. Young Common and Roseate Terns learning to fish. Wilson Bull. 84: 201-202.

LeCroy, M. and C. T. Collins. 1972. Growth and survival of Roseate and Common Tern chicks. Auk 89: 595-611.

Lemmetyinen, P. and T. Raitis. 1972. Occurrence of *Schistocephalus solidus* Creplin (Cestoidea, Dibothriocephalidae) in Common and Arctic Terns in southern Finland. Ann. Zool. Fenn. 9: 208-211.

Nisbet, I. C. T. 1972. Disaster year for terns. Man Nat., Dec. 1972: 16-21.

Nisbet, I. C. T. and W. H. Drury. 1972. Measuring breeding success in Common and Roseate Terns. Bird-Banding 43: 97-106.

Osieck, E. 1972. Sterke achteruitgang de Visdief (*Sterna hirundo* L.) als broedvogel in Nederland. Vogeljaar 20: 130-136.

Raynor, G. S. 1972. Overland feeding flights by the Common Tern on Long Island. Kingbird 22: 63-71.

Stromar, L. 1972. [Oological investigations of the species *Sterna hirundo* L. on the Croatian coast.] Larus 24: 103-105. [English translation from Serbo-Croatian.]

Vermeer, K. 1972. Comparison of the clutch initiation of Caspian and Common terns at Lake Winnipeg. Blue Jay 30: 218-220.

1971

Duffy, D. C. 1971. Report on Great Gull Island: summer 1970. Kingbird 21: 60-61.

Eades, R. 1971. An artificial raft as a nesting site for terns on the Dee. Seabird Rep. 1970: 45.

Elliott, C. C. H. 1971. Analysis of the ringing and recoveries of three migrant terns. Ostrich Suppl. 9: 71-82.

Gochfeld, M. 1971. Premature feather loss--a "new" disease of terns on Long Island, N.Y. Kingbird 21: 206-211.

Hakala, T. and M. Jokinen. 1971. Pesiva kalatiirapopulaatio tehdashallin katolla. [A population of Common Terns nesting on the roof of a factory.] Ornis Fenn. 48: 135-137. [In Finnish with English summary.]

Hays, H. and M. LeCroy. 1971. Field criteria for determining incubation stage in eggs of the Common Tern. Wilson Bull. 83: 425-429.

Hays, H. and R. W. Risebrough. 1971. The early warning of the terns. Nat. Hist. 80 (9): 38-47.

Langham, N. P. E. 1971. Seasonal movements of British terns in the Atlantic Ocean. Bird Study 18: 155-175.

Lemmetyinen, R. 1971. Nest defence [sic] behaviour of Common and Arctic Terns and its effects on the success achieved by predators. Ornis Fenn. 48: 13-24.

Myers, M. 1971. Chandeleur-Ho. La. Ornithol. Soc. News 60: 3-4.

Nisbet, I. C. T. 1971c. Downward turn for terns? Mass. Audubon Newsl. 11: 8.

Ouellet, H. 1971. Capture au Venezuela d'une Sterne Commune baguee en Gaspesie, Quebec, Canada. [Capture in Venezuela of a Common Tern banded at the Gaspe Peninsula, Quebec, Canada.] Tchebec 1: 15. [In French with English summary.]

Parkes, K. C., A. Poole and H. Lapham. 1971. The Ruddy Turnstone as an egg predator. Wilson Bull. 83: 306-308.

Switzer, B., V. Lewin and F. H. Wolfe. 1971. Shell thickness, DDE levels in eggs, and reproductive success in Common Terns (Sterna hirundo) in Alberta. Can. J. Zool. 49: 69-73.

1970

Chestney, R. 1970. Notes on the breeding habits of Common and Sandwich Terns on Scolt Head Island. Trans. Norfolk Norwich Nat. Soc. 21: 353-363.

Collins, C. T. 1970. The Black-crowned Night Heron as a predator of tern chicks. Auk 87: 584-586.

Cooper, D., H. Hays and C. Pessino. 1970. Breeding of the Common and Roseate Terns on Great Gull Island [New York]. Proc. Linn. Soc. N.Y. 71: 83-104.

Duffy, D. C. 1970. Observations on Great Gull Island - summer 1969. Kingbird 20: 169-170.

Hatch, J. J. 1970. Predation and piracy by gulls at a ternery in Maine. Auk 87: 244-254.

Hays, H. 1970a. Common Terns pirating fish on Great Gull Island. Wilson Bull. 82: 99-100.

______. 1970b. Great Gull Island report on nesting species 1967-68. Proc. Linn. Soc. N.Y. 71: 105-119.

Heilbrun, L. H. 1970. Great Gull Island, its history and biology. Proc. Linn. Soc. N.Y. 71: 55-79.

Jensen, R. A. C. 1970. Common Tern identification. Ostrich 41: 267.

King, B. 1970. Common Tern in flight apparently attempting to break shell of crab. Brit. Birds 63: 341.

Ludwig, E. 1970. Ist die Flussseeschwalbe (Sterna hirundo) ein Kulturfolger? Ornithol. Mitt. 22: 68.

Mather, J. R. 1970. An analysis of 58 immature terns Sterna hirundo L. and S. macrura Naum. from Filey, Yorkshire. Naturalist (Hull) 913: 63-66.

Pessino, C. 1970. Great Gull Island visits 1962-1966. Proc. Linn. Soc. N.Y. 71: 80-82.

Raynor, G. S. 1970. An African recovery of a North American Common Tern. Bird-Banding 41: 310-311.

Rucner, D. 1970. [The Common Tern, Sterna hirundo, a nester of the Adriatic Islands belt.] Larus 21-22: 83-85. [English translation from Serbo-Croatian.]

Ryden, O. 1970. On the behaviour in an alarm-evoking, constant stimulus situation in a "natural experiment." Observations on a pair of Herring Gulls (Larus argentatus) and Common Terns (Sterna hirundo) breeding on the same islet. J. Ornithol. 111: 48-53.

Stevenson, J. G., R. E. Hutchinson, J. B. Hutchinson, B. C. R. Bertram and W. H. Thorpe. 1970. Individual recognition by auditory cues in the Common Tern (Sterna hirundo). Nature 226: 562-563.

Stromar, L. 1970. Prilog poznavanju biologije galebova klaukavaca, Larus argentatus Pontopp., i cigra obicnih, Sterna hirundo L., te njihovih medusobnih odnosa na nekim Kornatskim otocima. [The biology of the Herring Gull, Larus argentatus Pontopp., and Common Tern, Sterna hirundo L. and interelationships on some Kornat Islands.] Larus 21-22: 87-93. [English translation from Serbo-Croatian.]

Vande Weghe, J.-P. 1970. Identification of the Common Tern and the Arctic Tern. Calif. Birds 1: 33-36.

Witt, K. 1970. Bestandsentwicklung und Daten zur Brutbiologie der Flussseeschwalbe (Sterna hirundo) am Oberrhein. Vogelwelt 91: 24-28. [In German with English summary.]

1969

Boecker, M. 1969. Beziehungen zwischen Nistmaterial und Umgebungs-vegetation der Nester bei der Flussseeschwalbe (Sterna hirundo). [Relationships between the nesting material and the surrounding vegetation of the nests of the Common Tern (Sterna hirundo).] Bonn. Zool. Beitr. 20: 125-129. [In German with English summary.]

Dunstan, T. C. 1969. Tern mortality due to entanglement in nylon monofilament fishline. Loon 41: 50-51.

Eckert, J. 1969. The Common Tern in south Australia. S. Austr. Ornithol. 25: 87-89.

Glover, B. 1969. An additional record of the Common Tern. S. Austr. Ornithol. 25: 89.

Grant, P. J. and R. E. Scott. 1969. Field identification of juvenile Common, Arctic and Roseate Terns. Brit. Birds 62: 297-299.

Lemmetyinen, R. 1969 ms. Kala- ja lapintiiran (Sterna hirundo ja S. paradisaea) pesimibiologinen vertailu. MS in Dep. Zool., Univ. Turku, Finland. [In Finnish.]

McGowan, A. F. 1969. Common Tern, Sterna hirundo, nesting on roof in Pompano Beach. Fla. Nat. 42: 172.

Motteau, J. and C. de Joux. 1969. A propos de la nidification de la Sterne pierregarin Sterna hirundo en Brenne. Oiseau Rev. Fr. Ornithol. 39: 270.

Needham, F. 1969. Nesting status of the Common Tern in southeastern North Carolina. Chat 33: 101-102.

Neubauer, W. 1969. Zu einigen Fragen der Brutbiologie und des Verhaltens der Verhaltens der Flussseeschwalbe (Sterna hirundo). Beitr. Vogelkd. 14: 238-241.

Rogers, A. E. F. 1969a. Common Tern recovery in Australia. Austr. Bird Bander 7: 36.

Scott, R. E. and P. J. Grant. 1969. Uncompleted moult in Sterna terns and the problem of identification. Brit. Birds 62: 93-97.

Stanescu, D. 1969. Observatii asupra specilor Recurvirostra avosetta L. 1758 (Ciocintors) si Sterna hirundo L. 1758 (Chira), intr-o colonie mixta. [Observations on the Avocet (Recurvirostra avosetta) and the Common Tern (Sterna hirundo) at a mixed colony on Beibugeac (Romania).] Ocrotirea Nat. 13: 73-82. [In Romanian with German summary.]

1968

Boecker, M. 1968a. Der "Futterungserfolg" bei Fluss- und Kustenseeschwalbe (*Sterna hirundo* und *St. paradisaea*). [The "feeding results" of the Common and Arctic Tern (*Sterna hirundo* and *St. paradisaea*).] Vogelwelt 89: 221-225. [In German with English summary.]

_____. 1968b. Zur Tagesaktivat der Seeschwalben. [On the daily activity of terns.] J. Ornithol. 109: 62-66. [In German with English summary.]

Bub, H. 1968. Kunstlich erbrutete und aufgezogene Flussseeschwalbe (*Sterna h. hirundo*) im Afrika wiedergefangen: Vogelwarte 24: 277.

Fournier, O. 1968. Un caractere peu utilise pour la determination de la Sterne arctique juvenile. Alauda 36: 286.

Howard, D. V. 1968. Do New England terns have a future? Mass. Audubon 53: 2-9.

Hughes, M. R. 1968. Renal and extrarenal sodium excretion in the Common Tern *Sterna hirundo*. Physiol. Zool. 41: 210-219.

Langham, N. P. E. 1968. The comparative biology of terns, *Sterna* spp. Ph.D. thesis, Univ. Durham/Durham, England.

Lemmetyinen, R. 1968. The migration routes of Finnish Common and Arctic Terns (*Sterna hirundo* and *S. paradisaea*) in Scandinavia. Ornis Fenn. 45: 114-124.

Pearson, T. H. 1968. The feeding biology of sea-bird species breeding on the Farne Islands, Northumberland. J. Anim. Ecol. 37: 521-552.

Pessino, C. M. 1968. Red-winged Blackbird destroys eggs of Common and Roseate Terns. Auk 85: 513.

1967

Becker, W. B. 1967. Experimental infection of Common Terns with tern virus: influenza virus A/tern/South Africa/1961. J. Hygiene 65: 61-65.

Boecker, M. 1967. Vergleichende Untersuchungen zur Nahrungs- und Nistokologie der Flussseeschwalbe (*Sterna hirundo* L.) und der Kustenseeschwalbe (*Sterna paradisaea* Pont.). [A comparative study on the feeding and nest ecology of the Common Tern (*Sterna hirundo* L.) and the Arctic Tern (*Sterna paradisaea* Pont.).] Bonn. Zool. Beitr. 18: 15-126. [In German.]

Cymborowski, B. and B. Szulc-Olechowa. 1967. Porowanie rozwoju postembrionalnego rybitwy pospolitej, *Sterna hirundo* L. w warunksch naturalnych i w hodowli. [Comparison of postembryonal development of Common Tern, *Sterna hirundo* L. in natural and artificial conditions.] Acta Ornithol. 10: 163-173. [English translation from Polish.]

Langham, N. P. 1967. The synchronization of laying in terns. Ibis 109: 476.

Ling, R. 1967. Vordlevaid andmeid jogi ja randtiiru pesitmus okoloogiast. [Comparative data on the breeding ecology of the Common and Arctic Tern.] Ornitol. Kogumik 4: 90-113. [In Estonian with Russian and English summaries.]

Vermeer, K. 1967. Common Terns (Sterna hirundo) nesting at Miquelon Lake, Alberta. Can. Field-Nat. 81: 274-275.

Winterbottom, J. M. 1967. Ringed tern recovery. Ostrich 38: 158.

1966

Attiwill, A. R. 1966. Common Terns at Naracoorte. S. Austr. Ornithol. 24: 94.

Bochenski, Z. 1966. Nesting of Common and Black Terns. Acta Zool. Cracov. 11: 423-449.

Dobrinskii, L. N. 1966. [Geographical variability of morphological characters in two closely related species of terns (Sterna hirundo L. and S. paradisaea Pontopp.).] Vnutrividovaya Izmench. Pozvon. Zhivotn. i Mikroevol. Sverdlovsk (Akad. Nauk): 351-356. [In Russian.]

Gochfeld, M. 1966. Mortality among the Common Terns of the Short Beach, L.I., colony. Linn. Newsl. 19: 1-3.

Houston, C. S. 1966. Fatal entanglement of Common Tern. Blue Jay 24: 79.

Johnston, R. 1966. Tern trapped by cockle. Brit. Birds 59: 75-76.

Nebelsiek, U. 1966. Das Schicksal der Flussseeschwalbe (Sterna hirundo) und der Lachseeschwalbe (Gelochelidon nilotica) als Brutvogel Bayerns. Anz. Ornithol. Ges. Bayern 7: 823-846. [In German with English summary.]

Nickell, W. P. 1966. Common Terns nest on muskrat lodges and floating cattail mats. Wilson Bull. 78: 123-124.

Rittinghaus, H. 1966. Sterna hirundo (Laridae). Nahrungserwerb (Stosstauchen). Pp. 531-540 in G. Wolf (ed.) Encyclopaedia Cinematographica, Inst. f. Wissenschaftlichen Film, Gottingen. [In German.]

Rowan, M. K. 1966. Recovery of ringed Common Tern. Ostrich 37: 191.

Taverner, J. H. 1966. The Needs Oar gullery and ternery. Hampshire Bird Rep. 23: 32-45.

Vande Weghe, J.-P. 1966. La sterne pierregarin Sterna hirundo et la sterne arctique Sterna paradisaea. Identification et passage en Belgique. Aves 3: 1-5.

Winterbottom, J. M. 1966. Ringed tern recovery. Ostrich 37: 137.

1965

Bauer, K. 1965. Zur Nahrungsokologie einer binnenlandischen Population der Flussseeschwalbe (Sterna hirundo). Egretta 8: 35-51.

Drury, W. H., Jr. 1965b. Gulls vs. terns: clash of coastal nesters. Mass. Audubon 64: 207-211.

Hitchcock, W. B. 1965. Geography and seasonal movements of the Common Tern in Australia. Emu 64: 157-171.

Madge, S. C. 1965. Common Terns feeding on bread. Brit. Birds 58: 299.

McCaskie, G. and E. A. Cardiff. 1965. Notes on the distribution of the Parasitic Jaeger and some members of the Laridae in California. Condor 67: 542-544.

Niquille, J. and K. Niquille 1965. Fruhes Schlupfdatum der Flussseeschwalbe. Ornithol. Beob. 62: 120.

Onno, S. 1965. Attachment to the nest (Ostreue) in the Common Gull, Common Tern, and Arctic Tern. Commun. Baltic Comm. Study Bird Migr. 3: 140-162.

Taverner, J. H. 1965. Observations on breeding Sandwich and Common Terns. Brit. Birds 58: 5-9.

Voous, K. H. 1965. Nesting and nest-sites of Common Terns and Dougall's Terns in the Netherlands Antilles. Ibis 107: 430-431.

Witt, K. 1965. Eine neue Kolonie der Flussseeschwalbe (Sterna hirundo) am Oberrhein bei Breisach 1964. Mitt. Bad. Landesver. Naturk. 8: 603-606.

1964

Edberg, R. 1964. Fisktarnans (Sterna hirundo) hackning vid Hjalmaren. [Common Terns (Sterna hirundo) breeding at Hjalmaren.] Var Fagelvarld 23: 97-102. [In Swedish with English summary.]

Grosskopf, G. 1964. Sterblichkeit und Durchschnittsalter einiger Kustenvogel. J. Ornithol. 105: 427-449. [In German with English summary.]

Gustafsson, G. 1964. Dwarfed eggs of the Tufted Duck (Aythya fuligula) and the Common Tern (Sterna hirundo). Var Fagelvarld 23: 68-69.

Hitchcock, W. B. and K. A. Hindwood. 1964. Occurrence of the Common Tern in Australia and the southwest Pacific. Bird-Banding 35: 204.

Nickell, W. P. 1964a. Fatal entanglements of Herring Gulls (*Larus argentatus*) and Common Terns (*Sterna hirundo*). Auk 81: 555-556.

_____. 1964b. Some mammal predators in a colony of Common Terns. Bird-Banding 35: 40.

Power, G. 1964. Breeding success of the Common Tern on the north shore of the Gulf of St. Lawrence in 1961 and 1962. Arctic 17: 51-53.

Szulc-Olechowa, B. 1964. Badania nad rozwojem postembrionalnym mewy smieszki, *Larus ridibundus* L., i rybitwy zwyczajnej, *Sterna hirundo* L. [Studies on the postembrional development of the Black-headed Gull, *Larus ridibundus* L., and the Common Tern, *Sterna hirundo* L.] Acta Ornithol. 8: 415-433. [In Polish with English summary.]

1963

Gillespie, M. 1963. Travels of Common Terns. EBBA News 26: 160-165.

Heim, P. J. 1963. Flussseeschwalbenbrut bei Nuolen am Zurcher Obersee. Ornithol. Beob. 60: 69-70.

Houston, C. S. 1963. Common Tern recovery from the Cook Islands. Bird-Banding 34: 160-161.

Lind, H. 1963b. Nogle sociale reaktioner hos terner. [Notes on social behavior in terns.] Dan. Ornithol. Foren. Tidsskr. 57: 155-175. [In Danish with English summary.]

1962

Clement, R. C. and R. E. Woodruff. 1962. A history of the nesting gulls and terns of Rhode Island, 1889-1961. Narragansett Nat. 5: 108-111, 125-128.

Houston, C. S. 1962. Common Tern recovery from Cook Islands. Blue Jay 20: 58-59.

Lebedeva, M. I. 1962. [Migrations of the Common Tern.] Migr. Zhivotn. Akad. Nauk SSSR 3: 87-91. [In Russian.]

Ludwig, J. P. 1962a. Banded Common Terns in the Pacific. Ring 3: 109-110.

_____. 1962b. A survey of the gull and tern populations of Lakes Huron, Michigan, and Superior. Jack-Pine Warbler 40: 104-119.

Rittinghaus, H. 1962. Die Seeschwalben auf der Insel Minsener Oldenog. Oldenb. Jahrb. 61: 93-104. [In German.]

Rowan, M. K. 1962. Mass mortality among European Common Terns in South Africa in April-May 1961. Brit. Birds 55: 103-114.

Schloss, W. 1962. Ringfunde der Flussseeschwalbe (Sterna hirundo). Auspicium 1: 395-443.

1961

Hallman, R. C. 1961. Common Tern (Sterna hirundo) nesting in northwest Florida. Fla. Nat. 34: 221-222.

Jacobsen, J. R. 1961. Bestemmelse af Havterne (Sterna paradisaea Pont.) og Fjordterne (Sterna hirundo L.) i naturen. [Identification of Arctic Tern (Sterna paradisaea Pont.) and Common Tern (Sterna hirundo L.) in nature.] Dan. Ornithol. Foren. Tidsskr. 55: 89-96. [In Danish with English summary.]

Radford, M. C. 1961. A study of the British ringing records of the Common Tern and Arctic Tern and comparison with some foreign records. Bird Study 8: 174-184.

1960

Anon. 1960. Recovery of tern ringed in Finland. Ostrich 31: 34.

Cullen, J. M. 1960a. Some adaptations in the nesting behaviour of terns. Proc. Internatl. Ornithol. Congr. 12: 153-157.

Rahne, U. and R. Reinecke. 1960. Brutversuch der Flussseeschwalbe (Sterna hirundo) auf den Braunschweiger Rieselfeldern. Beitr. Naturkd. Nieders. 13: 103-105.

1959

Andersen, F. S. 1959. Bills, eggs, and nests of captured Arctic Terns (Sterna paradisaea) and Common Terns (S. hirundo). Dan. Ornithol. Foren. Tidsskr. 53: 84-102.

Helminen, M. 1959. A nest probably common to two pairs of Common Tern (Sterna hirundo). Ornis Fenn. 36: 42-44.

Wainwright, C. B. 1959. Common Tern nesting on vegetation above water. Brit. Birds 52: 387.

1958

Anon. 1958. Banded birds reported and traced. J. Br. Guiana Mus. Zoo 18: 10-11.

Austin, O. L., Jr. 1958. Verification of Australian Common Tern recovery. Bird-Banding 29: 41-42.

Rooth, J. 1958. Relations between Black-headed Gulls (Larus ridibundus) and terns (Sterna spp.) in the Netherlands. Internatl. Comm. Bird Preserv. Bull. 7: 117-119.

Smith, N. G. 1958. Common Tern attacking Greater Shearwater. Proc. Linn. Soc. N.Y. 66-70: 89-90.

van Iersel, J. J. A. and A. C. A. Bol. 1958. Preening of two tern species. A study on displacement activities. Behaviour 13: 1-88.

1957

Ansingh, F. H. and H. J. Koelers. 1957. Common Tern (Sterna h. hirundo) breeding in the Netherlands Antilles. Auk 74: 266.

Haverschmidt, F. 1957. The bill colour of summering immature Common Terns. Ardea 45: 176-178.

Lendon, A. H. 1957. Common Tern (Sterna hirundo) in South Australia. S. Austr. Ornithol. 22: 40.

Mills, D. H. 1957. Herring Gulls and Common Terns as possible predators of lobster larvae. J. Fish. Res. Board Can. 14: 729-730.

Preston, F. W. 1957. Pigmentation of eggs: variation in the clutch sequence. Auk 74: 28-41.

Wiktor, J. 1957. Interesujaca kolonia rybitwy pospolitej (Sterna hirundo L.) na Zalewie Szczecinskim. [An interesting colony of the Common Tern (Sterna hirundo L.) in the Szczecin Haff.] Przyr. Pol. Zach. 1: 114-120. [In Polish.]

1956

Austin, O. L. and O. L. Austin, Jr. 1956. Some demographic aspects of the Cape Cod population of Common Terns (Sterna hirundo). Bird-Banding 27: 55-66.

Dunnet, G. M. 1956a. Common Tern, Sterna hirundo hirundo L., banded in Sweden and recovered in Australia. CSIRO Wildl. Res. 1: 68.

_____. 1956b. Common Tern Sterna hirundo hirundo in Western Australia. West. Austr. Nat. 5: 86-88.

Goldsmith, T. H. and D. R. Griffin. 1956. Further observations of homing terns. Biol. Bull. (Woods Hole) 111: 235-239.

Grierson, J. R. 1956. Behaviour of Common Tern after eggs had been stolen. Brit. Birds 49: 85.

ten Kate, C. G. B. 1956. Visdief (Sterna hirundo) broedt twee eigen eiren uit een van een Scholekster (Haematopus ostralegus). [Common Tern brooding two eggs and one of an Oystercatcher (Haematopus ostralegus).] Limosa 29: 148. [In Dutch with English summary.]

1955

Alexander, M. M. 1955. The nesting of the Common Tern at Montezuma [NY]. Bird-Banding 26: 161-162.

Gemperle, M. G. and F. W. Preston. 1955. Variation of shape in the eggs of the Common Tern in the clutch-sequence. Auk 72: 184-198.

Griffin, D. R. and T. H. Goldsmith. 1955. Initial flight directions of homing birds. Biol. Bull. (Woods Hole) 108: 264-276.

Gross, A. O. 1955. Changes of certain seabird populations along the New England coast of North America. Proc. Internatl. Ornithol. Congr. 11: 446-449.

Powell, P. R. 1955. Common Tern playing with object in flight. Brit. Birds 48: 282.

Tebbutt, C. F. 1955. Common Tern nesting in Huntingdonshire. Brit. Birds 48: 89.

1954

Burckhardt, D. 1954. Ruckmeldung einer Flussseeschwalbe. Ornithol. Beob. 51: 27.

Grant, R. H. 1954. Common Tern feeding from tin can. Proc. Linn. Soc. N.Y. 63-65: 74.

Sherwood, M. P. 1954. A new nesting locality for the Common Tern. Wilson Bull. 66: 145.

1953

Austin, O. L. 1953a. The migration of the Common Tern (Sterna hirundo) in the Western Hemisphere. Bird-Banding 24: 39-55.

_____. 1953b. A Common Tern at least 23 years old. Bird-Banding 24: 20.

Borodulina, T. L. 1953. Biologiya i rybokhozyaistvennoe znachenie rechnoi krachki. [The biology of the Common Tern and its importance for the fishing economy.] Tr. Inst. Morfol. Zhivotn. Akad. Nauk SSSR 9.

Bourne, W. R. P. 1953. Common Terns nesting inland in south Lincolnshire. Brit. Birds 46: 347.

Gill, G. 1953. An unusual nest of the Common Tern (Sterna hirundo). Auk 70: 80.

Hoffmann, H. L. 1953. Form und Enstehung des Zeichnungsmusters dunenjunger Flussseeschwalben Sterna hirundo. Rev. Suisse Zool. 60: 653-706.

Kobayashi, K. 1953. Occurrence of Sterna albifrons sinensis and Sterna hirundo longipennis at Osaka Bay, Honshu, Japan. Emu 53: 146-148.

Kuroda, N. 1953b. [A note on Sterna hirundo: a genetic consideration about avian coloration.] Misc. Rep. Yamashina Inst. Ornithol. 2: 74-77. [In Japanese with English summary.]

Richardson, R. A. 1953. A distinction in flight between Arctic and Common Terns. Brit. Birds 46: 411-412.

Stricker, W. and R. Ryser. 1953. Die Flussseeschwalbenkolonie bei Altenrhein und am Fanel in Jahre 1952. Ornithol. Beob. 50: 20-23. [In German.]

Thonen, W. 1953. Zur Brutablosung bei der Flussseeschwalbe. Ornithol. Beob. 50: 50.

1952

Andrews, L. G. 1952. The nesting habits and social behavior of the Common Tern, Sterna hirundo hirundo, at Presque Isle, Erie, Pennsylvania. M.S. thesis, Univ. Pittsburgh/Pittsburgh, PA.

Stricker, W. 1952. Die Flusseeschwalben- und Lachmowen-Kolonie bei Altenrhein in Jahren 1950 und 1951. Ornithol. Beob. 49: 5-8.

1951

Austin, O. L. 1951a. Group adherence in the Common Tern. Bird-Banding 22: 1-15.

Hitchcock, W. B. and N. J. Favaloro. 1951. Victorian records of Sterna striata Gm. and Sterna hirundo longipennis Nordm. Mem. Natl. Mus. Victoria 17: 207-214.

Swaab, J. 1951. Visdief, Sterna hirundo L., in practkleed met zwarte snavel. Ardea 39: 370-371. [In Dutch.]

1950

Austin, O. L. 1950a. A Common Tern twenty years old. Bird-Banding 21: 18.

_____. 1950b. Renesting by the Common Tern. Bird-Banding 21: 18.

Putnam, W. L. 1950. Feeding flights of Common Terns across the Niagara Peninsula. Can. Field-Nat. 64: 51-52.

1949

Austin, O. L. 1949. Site tenacity, a behaviour trait of the Common Tern (Sterna hirundo Linn). Bird-Banding 20: 1-39.

Manville, R. H. 1949. A nesting colony of terns. Jack-Pine Warbler 27: 158-160.

McGiffert, J. 1949. Common Tern perching on flower-head. Brit. Birds 42: 27-28.

1948

Austin, O. L. 1948. Predation by the Common Rat (Rattus norvegicus) in the Cape Cod colonies of nesting terns. Bird-Banding 19: 60-65.

Fry, V. 1948. Another Common Tern nest with seven eggs. Auk 65: 604-605.

Gibb, J. 1948. Report on the inland passage of Arctic and Common Terns in the spring of 1947. Brit. Birds 41: 167-173.

McArthur, H. E. 1948. Common Terns nesting in Illinois. Bird-Banding 19: 74.

Wetherbee, D. K. 1948. Common Terns on Labrador. Auk 65: 463.

1947

Austin, O. L. 1947a. A study of the mating of the Common Tern (Sterna h. hirundo). Bird-Banding 18: 1-16.

Austin, O. L. 1947b. Longevity record for the Common Tern. Bird-Banding 18: 30.

Warburton, F. E. 1947. Common Tern's nest with seven eggs. Auk 64: 459.

1946

Austin, O. L. 1946a. The status of the Cape Cod terns in 1944: a behavior study. Bird-Banding 17: 10-27.

Crowell, E. M. and S. Crowell. 1946. The displacement of terns by Herring Gulls at the Weepecket Islands. Bird-Banding 17: 1-10.

Ludwig, C. C. 1946. Common Tern. [Illinois] Audubon Bull. 58: 11-14.

1945

Austin, O. L. 1945. The role of longevity in successful breeding by the Common Tern (Sterna hirundo). Bird-Banding 16: 21-28.

1944

Austin, O. L. 1944. The status of Tern Island and Cape Cod terns in 1943. Bird-Banding 15: 133-139.

Hindwood, K. A. 1944. Occurrence of the eastern Common Tern (Sterna hirundo longipennis) in Australia. Emu 44: 41-43.

1943

Griffin, D. R. 1943. Homing experiments with Herring Gulls and Common Terns. Bird-Banding 14: 7-33.

Marshall, N. 1943. Factors in the incubation behavior of the Common Tern. Auk 60: 574-588.

Noll, H. 1943. Die Flussseeschwalbe am Untersee (Sterna hirundo L.). Ornithol. Beob. 40: 101-109. [In German.]

Wood, M. S. 1943. Common and Arctic Terns. Field 181: 487.

1942

Austin, O. L. 1942. The life span of the Common Tern (Sterna hirundo). Bird-Banding 13: 159-176.

Guggisberg, C. A. W. 1942. Die Flussseeschwalbe am Fanelstrand. Ornithol. Beob. 39: 38-50. [In German.]

Marshall, N. 1942. Night desertion by nesting Common Terns. Wilson Bull. 54: 25-31.

Noll, H. 1942. La Sterne pierregarin (Sterna hirundo L.) a l'Utersee. Nos Oiseaux 16: 157-169. [In French.]

1941

Hewitt, O. H. 1941. Common Terns nesting on muskrat houses. Auk 58: 579-580.

Palmer, R. S. 1941a. A behavior study of the Common Tern. Proc. Boston Soc. Nat. Hist. 42: 1-119.

_____. 1941b. 'White-faced' terns. Auk 58: 164-178.

1940

Austin, O. L. 1940. Some aspects of individual distribution in the Cape Cod tern colonies. Bird-Banding 11: 155-169.

Palmer, R. S. 1940. A behavior study of the Common Tern, Sterna hirundo Linnaeus. Ph.D. thesis, Cornell Univ./Ithaca, NY.

Shainin, V. E. 1940. Encounters with the Common Tern. Univ. State N.Y. Bull. Schools 26: 258-259.

1939

Kuhlemann, P. 1939. Beobachtungen an einer durch Flussseeschwalben (Sterna h. hirundo L.) aus Vertauschtem E. erbruteten und aufgezagenen Silbermowe (Larus a. argentatus Pontopp.). Z. Tierpsychol. 3: 75-84. [In German.]

Suomalainen, H. 1939. Uber die Brutbiologie der Kustenseeschwalbe, Sterna macrura Naum. in ihrem Verhaltnis zu derjenigen der Flussseeschwalbe, Sterna h. hirundo L. in den Scharen des Finnischen Meerbusens. Ann. Zool. Soc. Zool. Bot. Fenn. Vanamo 6: 16-23. [In German.]

1938

Austin, O. L. 1938. Some results from adult trapping in the Cape Cod colonies. Bird-Banding 9: 12-25.

Floyd, C. B. 1938. Experiments with terns at Tern Island, Chatham, Massachusetts. Bull. Mass. Audubon Soc. 21: 2-4.

Harris, A. T. 1938. Nesting of the Herring Gull and Common Tern. Oologist 55: 102-104.

Palmer, R. S. 1938. Tern mortality along the Maine coast. Bird-Banding 9: 117-123.

Poncy, P. 1938. Danse nuptiale? de la Sterne Pierregarin, Sterna hirundo (L.). Ornithol. Beob. 35: 8-9. [In French.]

Southern, H. N. 1938. Posturing and related activities of the Common Tern (Sterna h. hirundo L.). Proc. Zool. Soc. (Lond.) 108: 423-431.

Tinbergen, N. 1938. Erganzende Beobachtungen uber die Paarbildung der Flussseeschwalbe (Sterna h. hirundo L.). Ardea 27: 247-249. [In German.]

1936

Bergman, G. and E. Fabricius. 1936. Sterna macrura and Sterna hirundo: downy plumage of nestlings compared. Ornis Fenn. 13: 34-36.

Burtch, V. 1936. Common Tern (Sterna hirundo hirundo) nesting on Oneida Lake in western New York. Auk 53: 446.

Latham, R. 1936. The rise and fall of a tern colony. Univ. State N.Y. Bull. Schools 22: 135-136.

Stegmann, B. 1936. Die geographischen Formen der Flussseeschwalbe in der Palaarktis. Ornithol. Monatsber. 44: 102-107. [In German.]

1935

Crowell, S. 1935. A lengthened egg-laying interval in the Common Tern. Auk 52: 86.

Floyd, C. B. 1935. An age record of the Common Tern. Bird-Banding 6: 35.

Melzer, J. P. 1935. Another Common Tern recovery in Puerto Rico. Bird-Banding 6: 69.

Robinson, H. W. 1935. Mortality among young Common Terns in Lancashire. Brit. Birds 29: 186.

Steinbacher, G. 1935. Schnabelfarbung bei der Flussseeschwalbe (Sterna hirundo) und Kustenseeschwalbe (St. paradisaea). Vogelzug 6: 39-40.

van Oordt, G. J. 1935. Een biologisch verschil tusschen Sterna hirundo L. en Sterna macrura Naum. Ardea 24: 262. [In Dutch.]

1934

Albertsen, W. 1934. Gatten treue bei der Flusseeschwalbe [sic.], Sterna h. hirundo L. Vogelzug 5: 192. [In German.]

Austin, O. L. 1934. The status of Cape Cod terns in 1934. Bird-Banding 5: 155-171.

Christoleit, E. 1934. Balzfluge bei Seeschwalben. Beitr. Fortpfl. Vogel 10: 52-56. [In German.]

Robinson, H. W. 1934a. Mortality among young Common Terns in Lancashire. Brit. Birds 28: 211-212.

_____. 1934b. Large clutches of eggs in terns. Brit. Birds 28: 150.

van Oordt, G. J. 1934. Uber einen biologischen Unterschied zwischen Fluss- und Kustenseeschwalben (Sterna hirundo und Sterna paradisaea). Beitr. Fortpfl. Vogel 10: 5-6. [In German.]

1933

Austin, O. L., Jr. 1933. The status of Cape Cod terns in 1933. Bird-Banding 4: 190-198.

Floyd, C. B. 1933. Common Tern recovery in Ontario. Bird-Banding 4: 160.

Robinson, H. W. 1933. Great mortality among young terns in Lancashire. Brit. Birds 27: 138-139.

1932

Austin, O. L., [Sr.] 1932a. The status of Cape Cod terns in 1932. Bird-Banding 3: 143-156.

Austin, O. L., Jr. 1932b. Further contributions to the knowledge of the Cape Cod Sterninae. Bird-Banding 3: 123-139.

Crowell, E. M. 1932. Two Common Tern returns and a Roseate Tern recovery. Bird-Banding 3: 33-34.

Floyd, C. B. 1932a. Strange disappearance of nesting Penikese Island terns. Bird-Banding 3: 173-174.

_____. 1932b. Report on tern-banding on Cape Cod during 1931. Bird-Banding 3: 63-65.

Pettingill, O. S., Jr. 1932. Two Common Tern recoveries on their wintering grounds. Bird-Banding 3: 31.

Robinson, H. W. 1932. Mortality among young Common Terns. Brit. Birds 26: 168.

Savage, E. U. 1932. Size of clutches of Common Tern. Brit. Birds 26: 201.

1931

Bowdish, B. S. 1931. A Common Tern recovery. Bird-Banding 2: 185.

Harrisson, T. H. 1931. On the normal flight speeds of birds. Brit. Birds 25: 86-96.

Jackson, C. F. and P. F. Allan. 1931. Experiment in the recolonization of the Common Tern (*Sterna hirundo*). Auk 48: 17-21.

Lincoln, F. C. 1931. Common Tern recovered in Guadeloupe. Bird-Banding 2: 81.

Manuel, C. G. 1931a. The relation of gulls and terns to the commercial fisheries of Saginaw Bay, Michigan, with particular reference to the Common Tern, *Sterna hirundo* Linnaeus. Ph.D. thesis, Univ. Michigan/Ann Arbor, MI.

Manuel, C. G. 1931b. Bird predators of Common Tern. Auk 48: 592.

Marples, G. and F. C. R. Jourdain. 1931. Large clutches of Common Terns' eggs. Brit. Birds 25: 82-83.

Peabody, P. B. 1931. Common Tern. Oologist 48: 74.

Pettingill, O. S., Jr. 1931. An analysis of a series of photographs of the Common Tern. Wilson Bull. 43: 165-172.

Robinson, H. W. 1931. Mortality among young Common Terns. Brit. Birds 25: 135-136.

Robinson, H. W. and E. U. Savage. 1931. Large clutches of Common Terns' eggs. Brit. Birds 25: 104.

Tinbergen, N. 1931. Zur Paarungsbiologie der Flussseeschwalbe (Sterna hirundo hirundo L.). Ardea 20: 1-17. [In German.]

1930

Campbell, L. W. 1930. Common Terns nesting near Toledo, Ohio. Wilson Bull. 42: 108-109.

Fletcher, L. B. 1930. A Common Tern recovery. Bird-Banding 1: 145.

Floyd, C. B. 1930. Further banding notes from Tern Island, Massachusetts. Bird-Banding 1: 181-184.

Wendehorst, R. 1930. Fluss- und Kustenseeschwalbe auf Trischen. Ein Beitrag zur Unterscheidung beider Arten in freier Natur. Ornithol. Monatsber. 38: 133-137. [In German.]

1929

Austin, O. L., Jr. 1929. Contributions to the knowledge of the Cape Cod Sterninae. Bull. N.E. Bird-Banding Assoc. 5: 123-140.

Floyd, C. B. 1929a. Recoveries of Common Terns banded at Chatham, Massachusetts. Bull. N.E. Bird-Banding Assoc. 5: 43-46.

_____. 1929b. Notes on banding terns at Chatham, Massachusetts, for 1929. Bull. N.E. Bird-Banding Assoc. 5: 144-148.

Hanni, E. 1929. Von unserer Flussseeschwalben-kolonie am Fanel. Ornithol. Beob. 26: 189-190.

1928

Floyd, C. B. 1928. Notes on banding terns at Chatham, Massachusetts, for 1928. Bull. N.E. Bird-Banding Assoc. 4: 125-132.

Geyr von Schweppenburg, H. 1928. Sterna hirundo am Mittelrhein. Ornithol. Monatsber. 36: 144-145.

1927

Floyd, C. B. 1927. Notes on the development of young Common and Roseate Terns. Bull. N.E. Bird-Banding Assoc. 3: 95-101.

Lincoln, F. C. 1927. Notes on the migration of young Common Terns. Bull. N.E. Bird-Banding Assoc. 3: 23-28.

Lyon, W. I. 1927. The Fox Snake feeds on the eggs of the Common Tern. Wilson Bull. 39: 186.

Thomas, E. S. 1927. Tern banding on Lake Erie. Wilson Bull. 39: 184-186.

White, F. B. 1927. Common and Arctic Terns at Seabrook, New Hampshire. Bull. N.E. Bird-Banding Assoc. 3: 36-37.

1926

Bretsch, C. 1926. Nesting of the Common Tern at Thousand Islands, Jefferson County, New York. Wilson Bull. 38: 200-201.

Brown, R. H. 1926. Fledging-period of Common Tern. Brit. Birds 20: 131.

Cerva, F. A. 1926. Zwei Bruten der Fluss-Seeschwalbe (Sterna hirundo L.) in Jahre 1923. Aquila 22-23: 173-176.

Collinge, W. E. 1926. An investigation of the food of terns at Blakeney Point, Norfolk. Trans. Norfolk Norwich Nat. Soc. 12: 35-52.

Floyd, C. B. 1926. Additional experiences in banding terns at Tern Island, Chatham, Mass. Bull. N.E. Bird-Banding Assoc. 2: 68-72.

1925

Bigger, W. K. 1925. The breeding of the Common Tern in Palestine. Ibis (12th Ser.) 1: 294-296.

Floyd, C. B. 1925. Six days in a Massachusetts tern colony. Bull. N.E. Bird-Banding Assoc. 1: 58-60.

Nystrom, E. W. 1925. Studier over roskarien (Arenaria interpres L.) vid boplatsen. Ornis Fenn. 2: 97-99. [In German.]

1924

Forbush, E. H. 1924. Gulls and terns feeding on the Seventeen-year Cicada. Auk 41: 468-470.

Hastings, W. E. 1924. Five hundred Common Terns banded. Wilson Bull. 36: 41.

1923

Irwin, J. O. and K. Pearson. 1923. On the nest and eggs of the Common Tern (*S. fluviatilis*). A third cooperative study. Biometrika 15: 294-345.

Thienemann, J. 1923. Eine ostpreussiche Flussseeschwalbe (*Sterna hirundo*) in Sudafrika erbeutet. Ornithol. Monatsber. 31: 33-34.

1922

Pemberton, J. R. 1922. A large tern colony in Texas. Condor 24: 37-48.

[Sclater, W. L.] 1922. Ringed tern in South Africa. Ibis (11th Ser.) 4: 603.

1921

Collinge, W. E. 1921. Winter occurrence of the Common Tern in Scotland. Scott. Nat. 1921: 133.

Glegg, W. E. 1921. The nesting of the Little and Common Tern, and other species, on the Essex coast. Essex Nat. 19: 238-241.

Lincoln, F. C. 1921. American Common Tern recovered in West Africa. Auk 38: 453-454.

1919

Rowan, W., E. Wolff, P. L. Sulman, K. Pearson, E. Isaacs, E. M. Elderton and M. Tildesley. 1919. On the nests and eggs of the Common Tern (*S. fluviatilis*). A cooperative study. Biometrika 12: 308-354.

1916

Cahn, A. R. 1916. The terns of Weepecket Islands, Massachusetts. Wilson Bull. 28: 11-18.

Ingram, C. 1916. [The colour pattern of nestling terns.] Bull. Br. Ornithol. Club 36: 68-70.

1915

Massey, H. 1915. Nest of Common Tern with ten eggs. Brit. Birds 9: 73.

1914

Galloway, A. B. and A. L. Thomson. 1914. Notes on the high mortality among young Common Terns in certain seasons. Scott. Nat. 1914: 271-278.

Rowan, W., K. M. Parker and J. Bell. 1914. On homotyposis and allied characters in the eggs of the Common Tern. Biometrika 10: 144-168.

1913

Borrer, C. D. 1913. [Some erythristic eggs of the Common Tern.] Bull. Br. Ornithol. Club 31: 112.

Lonnberg, E. 1913. On Sterna hirundo Linn. and on the name of the Common Tern. Ibis (10th Ser.) 1: 301-303.

1911

Bachmann, A. 1911. Von der Sterna hirundo. Ornithol. Monatschr. 36: 356-358.

1910

Bachmann, A. 1910. Von der Sterna hirundo. Ornithol. Monatschr. 35: 426-428.

Hepburn, T. 1910. The nesting of the Common Tern and Black-headed Gull in Colchester Harbour. Zoologist (London) 14: 137-143.

Willett, G. 1910. A Southern California spring record for the Common Tern. Condor 12: 174.

1909

Noble, H. 1909. Common Terns on Holyhead Skerries. Brit. Birds 3: 90-91.

Robinson, H. W. 1909. Notes on the breeding of the Common and Sandwich Terns. Brit. Birds 3: 169-171.

1908

Kirkman, F. B. 1908. Variation in the nests of Arctic and Common Terns. Brit. Birds 2: 78-82, 101-108.

Noble, H. 1908. Common Terns on the Holyhead Skerries. Brit. Birds 2: 64.

1907

Soderberg, R. 1907. Om fisktarnaggensfarger. [On the color of the eggs of the Common Tern.] Fauna Flora 2: 14-20.

1906

Jones, L. 1906. A contribution to the life history of the Common (*Sterna hirundo*) and Roseate (*S. dougallii*) Terns. Wilson Bull. 18: 35-47.

1903

Jones, L. 1903a. The terns of the Weepecket Islands, Massachusetts. Wilson Bull. 15: 94-100.

1902

Dutcher, W. 1902. Results of special protection to gulls and terns obtained through the Thayer Fund. Auk 19: 34-64.

1901

Dutcher, W. 1901. Results of special protection to gulls and terns obtained through the Thayer Fund. Auk 18: 76-104.

Strong, R. M. 1901. Notes on terns. *Sterna hirundo*, *S. dougalli* and *S. antillarum*. Wilson Bull. 13: 69-70.

1899

MacKay, G. H. 1899. The terns of Muskeget and Penikese Islands, Massachusetts. Auk 16: 259-266.

Strong, R. M. 1899. Notes on the Common Tern. *Sterna hirundo*. Wilson Bull. 11: 50-52.

1898

MacKay, G. H. 1898. The terns of Muskeget Island, Massachusetts. Part IV. Auk 15: 168-172.

Reed, J. H. 1898. The terns of Great Gull Island, N.Y., during 1897. Auk 15: 40-43.

1897

Howe, R. A., Jr. 1897a. The terns of Dyer's and the Weepecket Islands. Auk 14: 203-205.

MacKay, G. H. 1897a. The terns of Penikese Island, Massachusetts. Auk 14: 278-284.

_____. 1897b. The terns of Muskeget Island, Massachusetts. Part III. Auk 14: 383-390.

<u>1896</u>

MacKay, G. H. 1896. The terns of Muskeget Island, Massachusetts. Part II. Auk 13: 47-55.

<u>1895</u>

Call, A. B. 1895. Breeding habits of terns. Auk 12: 178.

MacKay, G. H. 1895. The terns of Muskeget Island, Massachusetts. Auk 12: 32-48, 178.

<u>1889</u>

Dutcher, B. H. 1889. Bird notes from Little Gull Island, Suffolk Co., New York. Auk 6: 124-131.

<u>1879</u>

Brewster, W. 1879. The terns of the New England coast. Bull. Nuttall Ornithol. Club 4: 13-27.

<u>1875</u>

Ridgway, R. 1875. Note on <u>Sterna longipennis</u> Nordmann. Am. Nat. 9: 54-55.

Adult Common Tern in breeding plumage. Photograph by Pat Lynch.

ARCTIC TERN

(*Sterna paradisaea*)

[DA: Havterne, DU: Noordse Stern, FI: Lapintiira, FR: Sterne arctique, GE: Kustenseeschwalbe, IC: Kria, IT: Rondine di mare codalunga, NW: Rodnebbterne, PO: Rybitwa popielata, PR: Gaivina, SP: Charran artico, SW: Rodnabbad tarna, Silvertarna]

GENERAL DISTRIBUTION

North America Arctic Terns breed in interior Alaska and on the coasts as far west as Attu Island in the Aleutians (Sowls et al. 1978). In Canada they breed from northern Yukon, northern Mackenzie, Banks, Ellesmere, and Baffin Islands south to northwestern British Columbia, southern Mackenzie, northern Saskatchewan, northern Manitoba, and northern Ontario to James Bay, central Quebec, New Brunswick, and Nova Scotia (AOU 1957, Godfrey 1966). In the contiguous United States Arctic Terns breed locally on the Atlantic coast in Maine and Massachusetts (Erwin 1979a, Korschgen 1979), and recently (1977) on the Pacific coast at Jetty Island, Puget Sound, Washington (Manuwal et al. 1979). The latter is a very small, disjunct population, 825 mi (1300 km) southeast of the nearest known colony.

Most birds from breeding populations in eastern North America move east across the Atlantic to the west coasts of Europe and Africa, thence south to Antarctica. Birds drifting eastward may account for records from the south Indian Ocean, Australia, and New Zealand. Arctic Terns from breeding populations in western North America are believed to move east and south along the Pacific coasts of North and South America (Salomonsen 1967, Watson 1975).

World Distribution In the Old World Arctic Terns breed in Greenland, Iceland, Great Britain, on islets off the coast of Brittany in France, in the Netherlands, on the mainland coasts of the Baltic, and in Norway. They breed on the coasts and islands of Eurasia from Spitsbergen east through northern Russia and northern Siberia to at least Wrangel Island in the northeast and south in eastern Siberia to the Bering Sea. They also breed (or bred) on the Commander Islands (Dement'ev and Gladkov 1951, Voous 1960, Vaurie 1965, Cramp et al. 1974).

Arctic Terns have been reported casually from the Hawaiian and Phoenix Islands in the Pacific Ocean (AOU 1957, Clapp 1975), and they occasionally visit New Zealand and southern Australia (Serventy et al. 1971).

Migrants from Eurasian populations apparently generally follow the same routes as birds from North America. Birds from the Bering Strait and eastern

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Taxonomic note: sometimes appears in recent literature as *Sterna macrura*.

Siberia move to the west coast of North America and then southward along the shores of Central and South America. Those breeding along the Arctic coast of Eurasia move west and then south along the Atlantic coasts of Europe and Africa (Salomonsen 1967).

Arctic Terns winter circumpolarly in antarctic and subantarctic waters. In this area they are apparently most abundant from the Weddell Sea east to about 150° E, in areas of the Antarctic pack-ice zone (Watson 1975). Small numbers winter in waters off southern South America and South Africa (Salomonsen 1967).

Return migrants apparently follow the eastern coasts of South and North America, and some birds cross the ocean to follow the African coast north (Dorst 1960). An unknown proportion of terns that probably breed in western North American migrate north directly through the central Pacific (King 1967). These portions of the migration are poorly documented.

DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

Few Arctic Terns have been recorded from the southeastern United States, in part because they usually remain well offshore and in part because of the difficulty in distinguishing this species from similar species of *Sterna*. Nonetheless, they have been recorded from all the southeastern states except Alabama, Mississippi, and Louisiana.

North Carolina There are five records for North Carolina, three from spring and two from fall.

1973	19 May	1	seen off Hatteras	Teulings 1973c
1976	6 Sep.	1	seen off Hatteras	Lee and Rowlett 1979
1977	18 May	1	imm. male coll. ca. 32 mi ESE Oregon Inlet	Lee and Rowlett 1979
1977	21 May	5	seen 18 mi S Cape Hatteras	Lee and Rowlett 1979
1979	2 Sep.	3	seen off Hatteras	LeGrand 1980a

South Carolina There is only one very recent record from South Carolina: a bird seen 5 and 12 May 1979 at Huntington Beach State Park (LeGrand 1979c).

Georgia The only record for Georgia is an adult female collected by Francis Harper 22 May 1921 on the Suwannee Creek, Ware County, 2 miles from the Okefenokee Swamp (Burleigh 1958).

Florida - Atlantic Coast We found only eleven records of Arctic Terns along the Atlantic coast of Florida through the spring of 1980:

1952	20 Apr.	1	seen at Fernandina Beach	Hebard 1952
1975	27 Apr.	1	coll. at Key Biscayne	Kale 1977
1977	5 May	6±	seen at Dynamite Point	Kale 1977
1977	8 May	1	seen at SE of Islamorada	Kale 1977
1977	21 May	3	seen (1 coll.) E of Ponce Inlet	Kale 1977
1978	29 Apr.	10	seen off Ponce Inlèt	Kale 1978a
1978	27 Apr.	1	seen "perched on floating board"	Kale 1978a
1979	27 Apr.	1	seen off Pompano Beach	Kale 1979
1979	3 May	6	seen off Ponce Inlet	Kale 1979
1979	9 May	2	seen off Islamorada	Kale 1979
1980	27 Apr.	1	seen 75 mi off Ponce Inlet	Kale 1980

Florida - Gulf Coast There are two sight records of the Arctic Tern from this area. One was seen 19-20 July 1979 at St. George's Island (Ogden 1979) and another was seen 14 September 1979 on the causeway to this island (Wamer et al. 1980).

Texas We know of only five sight records for the state.

1961	13 Sep.	1	seen at La Porte	Webster 1962a, Oberholser 1974
1968	19 Aug.	1	seen off Port Aransas south jetty (feeding with Common Terns)	Webster 1969a, Oberholser 1974
1975	20 Apr.	3	seen at Port Aransas	Webster 1975c
1975	12 Apr.	4-5	seen at Bolivar flats	Webster 1975c
1975	26 Apr.	6±	seen at Bolivar flats	Webster 1975c

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

Breeding Arctic Terns are circumpolar breeders. In the New World they nest south to Washington in the west and to Massachusetts in the east. In the Old World, they breed south to France and the Netherlands in the west and to eastern Siberia and the Bering Sea in the east.

Bianki (1967) speculated that the total world population of Arctic Terns was high, "...apparently running into millions of pairs." As of 1969-70, this was the most abundant nesting tern in Britain and Ireland and had a breeding population of at least 30,773 pairs (Cramp et al. 1974). The population in the White Sea area of the northwestern U.S.S.R. was once estimated at not less than 25,000 pairs (Bianki 1967). In the early 1970's, an estimated 5,750 pairs bred in Denmark (Salomonsen 1979) and about 21,000 pairs bred on the Norwegian coast (Bruns 1979).

About 12,500 pairs breed in coastal Alaska (Sowls et al. 1978). The number breeding in the contiguous United States is much smaller. In 1977 an estimated 1,640 pairs nested in Maine, and 73 pairs nested in Massachusetts (Erwin and Korschgen 1979). The population in Massachusetts has been steadily declining since the early 1950's (Erwin 1978a). An isolated colony recently discovered in Washington contained 7-10 pairs (Manuwal et al. 1979).

Winter Arctic Terns winter circumpolarly in antarctic and subantarctic waters.

Migration Southward migration occurs primarily off the west coast of Europe and Africa and the west coast of the Americas. The return route is not well known, but many birds apparently follow the east coast of the Americas. This is consistant with the few records available from the southeastern United States (Tables 60, 61). This tern occurs off the Atlantic coast mainly in spring and primarily in pelagic waters. How many migrate off the coast is unknown, but Rowlett (1980) considered them rare in spring in the southern Chesapeake Bight over the Continental Shelf in waters 77 km (47.8 mi) offshore and beyond.

HABITAT

Nesting Arctic Terns nest colonially in vegetated or unvegetated areas of open ground and on sandy or pebbly substrates. A wide variety of habitats may be used, and the selection apparently depends largely on what is available and on whether other nesting species of larids are present. Cramp et al. (1974) noted that these terns tend to nest in the more sparsely vegetated areas in colonies containing other species. When nesting alone they use areas with lush vegetation.

In Iceland most colonies occur along the coast, but some are found inland. Sites with some vegetation are preferred to those with none (Gudmundsson 1956). Commonly used nesting habitats include dry, densely vegetated meadows, hummocky grasslands, marshes, poorly vegetated sandy or gravel flats, stony or rocky areas, lava flows, and shingle beaches and banks in rivers. Less commonly used or exceptional sites include piles of dried seaweed washed ashore and, in one instance, a forest floor between birch trees on a small island (Gudmundsson 1956).

Table 60. Dates of occurrence for Arctic Terns in the coastal southeastern United States.

State	Number of occurrences	Dates of occurrence: Spring	Dates of occurrence: Fall
North Carolina	5	18 - 21 May	6 - 7 September
South Carolina	1	5 - 12 May	------------
Georgia	1	22 May	------------
Florida-Atlantic Coast	11	20 April - 21 May	------------
Florida-Gulf Coast	2	------------	19 July - 14 Sep.
Texas	5	12 - 26 April	13 September

Table 61. Approximate number of Arctic Terns recorded by month for the coastal southeastern United States (a).

State/region	APR	MAY	JUL	AUG	SEP	TOTALS
North Carolina	-	7	-	-	4	11
South Carolina	-	1	-	-	-	1
Georgia	-	1	-	-	-	1
Florida-Atlantic Coast	15	18	-	-	-	33
Subtotal-ATLANTIC COAST	15	27	-	-	4	46
Florida-Gulf Coast	-	-	1	-	1	2
Alabama	-	-	-	-	-	-
Mississippi	-	-	-	-	-	-
Louisiana	-	-	-	-	-	-
Texas	15	-	-	1	1	17
Subtotal-GULF COAST	15	-	1	1	2	19
Total-ALL AREAS	30	27	1	1	6	65

(a) Where an indefinite number was seen (e.g., 2-3), we assumed that the smaller number was present. There were no records for the months not listed.

In Spitsbergen these terns prefer to nest on small, level islands in freshwater lakes and eiderholms near saltwater (Lovenskiold 1964 in Bruns 1979). Extremes in nesting habitat used in this area are epitomized by two colonies studied by Bengtson (1971). One was in a boggy meadow covered with luxurient green moss, sedge, and grass; the other was on an unvegetated beach covered with sand, gravel, and stones.

Preferred nesting habitat in the vicinity of Kandalaksha Bay, northwestern U.S.S.R. is maritime meadows along the coast (Bianki 1967). Near Churchill, Manitoba, most colonies were found on islands in small freshwater ponds. A small proportion of the colonies were in tundra or marsh habitats and one was found on mainland beach (Evans and McNicholl 1972). None was more than 7 km (4.3 mi) from the coast of Hudson Bay.

Feeding Breeding Arctic Terns usually feed near their breeding colonies. In southwestern Finland, these terns prefer to feed along shores with sparse vegetation and clear water (Lemmetyinen 1976). Lemmetyinen's observations that most of the primary prey (threespine sticklebacks, *Gasterosteus aculeatus*) were males in breeding colors led him (1973b) to conclude that they had been caught on spawning grounds in shallow inshore waters.

Breeding Arctic Terns in the Farne Islands spent about 50 minutes away from the nest when foraging. Using this fact and an estimated flight speed of 30 mi/hr (48 km/hr), Pearson (1968) calculated a maximum foraging range of 12.5 mi (20 km). In West Spitsbergen, breeding birds usually foraged within 100 yds (90 m) of shore, but some were seen feeding over brackish water and inland on a freshwater tundra lake (Burton and Thurston 1959).

Nonbreeding and Offshore The Arctic Tern usually occurs well offshore during migration and is one of the most pelagic of terns. Occasionally, individuals are found inshore. DuMont (1976) saw an Arctic Tern feeding with Common Terns "virtually over the breaking waters" at Assateague Island, Maryland, 28 May 1973.

FOOD AND FEEDING BEHAVIOR

Arctic Terns feed mainly by surface-plunging but also by dipping and surface-seizing. They often hawk for insects, sometimes over aquatic habitats where they seldom fish (Lemmetyinen 1976).

How much a particular feeding technique is used varies from area to area, probably as a result of differences in foods available. Arctic Terns in southwestern Finland frequently picked insects from the surface of the water or hawked them from the air (Lemmetyinen 1973a), but aerial foraging was rare in the Farne Islands (Pearson 1968). In the Sitkalidak Stait, Arctic Terns surface-plunged, seized prey from the water's surface while in flight (contact-dipping), and sometimes surface-seized (Baird and Moe 1978). In the Kandalaksha Bay area of the northwestern U.S.S.R., these terns fed primarily by plunging and only rarely picked food from the surface of the water (Bianki 1967).

Periods of peak feeding activity have been related both to time of day and to tide cycle. Skipnes (1977a) reported that breeding birds near Kristiansund, Norway, forage most actively in the evening, with a minor peak of activity at sunrise. In the Sitkalidak Strait area, Alaska, Baird and Moe (1978) found that peak periods for feeding young occur one to two hours before high tide or one to two hours after low tide.

A considerable proportion of a breeding adult's time may be spent foraging. Pearson (1968) estimated that an adult might fish from 54 to 103% [sic] of the daylight hours.

On the Antarctic wintering grounds Arctic Terns feed primarily on euphausiids and fish. In some areas krill may constitute the entire diet (Watson 1975). In breeding areas this species feeds mostly on small fish, crustacea, insects, cephalopods, molluscs, and, occasionally, earthworms. Various studies usually indicate that either small fish (Belopol'skii 1957, Bianki 1967, Pearson 1968, Hopkins and Wiley 1972, Hays et al. 1973, Lemmetyinen 1976) or crustaceans (Hartley and Fisher 1936, Burton and Thurston 1959) are the food items most frequently taken. Gudmundsson's (1956) remarks indicate that Arctic Terns consume a higher proportion of invertebrates than do other species of *Sterna*. The foods that are most important in the diet may vary considerably from area to area; consequently, we briefly summarize food habits as described for several different areas in North America.

Maine, Petit Manan Island According to Hopkins and Wiley (1972), young were fed on herring (*Clupea harengus*) "almost exclusively." This conclusion was based largely on observations of terns seen carrying food to young rather than on a detailed analysis of food habits.

New Brunswick, Machias Seal Island Fish commonly taken were hake (*Urophycis* sp.), lumpfish (*Cyclopterus lumpus*), and butterfish (*Peprilus triacanthus*). Other organisms such as cicadas (*Okanagana canadensis*), a small annelid (*Nereis pelagica*), and squids (*Loligo pealei*) dominated the diet for short periods (Hawksley 1957).

Manitoba, Churchill Ninespine sticklebacks (*Pungitius pungitius*) were commonly eaten (Hawksley 1957).

Northwest Territories, West Ellesmere Island Adults fed mostly on amphipods and small squid while chicks were fed small fish (Parmalee and MacDonald 1960 in Cramp et al. 1974).

Alaska, Sitkalidak Strait Fish, mainly capelin (*Mallotus villosus*) and Pacific sand lance (*Ammodytes hexapterus*), and euphausiids were eaten. Young were fed only fish (Baird and Moe 1978).

Fish eaten in the Old World include threespine sticklebacks (*Gasterosteus aculeatus* (Gudmundsson 1956, Bianki 1957, Lemmetyinen 1976), sand lance (*Ammodytes*) (Gudmundsson 1956, Pearson 1968, Hays et al. 1973), capelin, herring (Gudmundsson 1956), sprat (*Clupea sprattus*) (Hays et al. 1973) and coalfish

[= pollock] (Pollachius virens) (Gudmundsson 1956).

The Arctic Tern feeds more often on invertebrates than does the closely related Common Tern. Such differences have been noted in breeding populations in southwestern Finland (Lemmetyinen 1973a), at Wangerooge in the North Sea (Boecker 1967 in Hopkins and Wiley 1972, Lemmetyinen 1973a), and at Petit Manan Island, Maine (Hopkins and Wiley 1972). At the Farne Islands, Arctic Terns ate more insect food than Common Terns (Pearson 1968), but the difference was not as great as in other studies. In the Sitkalidak Strait area, however, the Arctic Tern is predominantly piscivorous while its nesting associate, the Aleutian Tern (Sterna aleutica), consumes considerable amounts of insects and other invertebrates (Baird and Moe 1978).

Seasonal changes in the diets of birds at the breeding grounds have also been recorded for Arctic Terns. Adult terns in the outer Kustavi archipelago, southwestern Finland, ate both fish (predominantly Gasterosteus aculeatus) and crustaceans (predominantly Idotea baltica), but the proportion of fish taken increased considerably later in the season. On the other hand, adults from the middle archipelago depended on fish throughout the season (Lemmetyinen 1973a). Young from the middle archipelago fed largely on Gasterosteus, and its importance in the diet increased as the season progressed. Insects were more important in the diet than were crustaceans (Lemmetyinen 1973a). A similar pattern of change also occurred at Kandalaksha Bay, northwestern U.S.S.R., where Arctic Terns fed primarily on crustaceans until the arrival of Gasterosteus (Bianki 1967).

Pearson (1968) also reported a seasonal change in food habits. At the Farne Islands, Northumberland, the proportion of ammodytid fish in the diet decreased later in the season, with the terns eating more clupeids as they became more abundant.

Some data are also available on the size of food taken by Arctic Terns. The mean size of the primary fish prey (Gasterosteus) eaten by adults in southwestern Finland ranged from 5.0 to 5.5 cm (2.0-2.2 in). Arctic Terns caught fish of fairly uniform length throughout the season, although the mean size of the fish available varied greatly. Newly hatched chicks ate smaller fish than did adults, but older chicks were offered fish as large as or larger than those eaten by the adults (Lemmetyinen 1973a).

The mean length of prey taken during the breeding season in the Sitkalidak Strait area of Alaska was 7.46 cm (2.9 in) (Baird and Moe 1978).

SUSCEPTIBILITY TO OIL POLLUTION

Arctic Terns, like many of the other larids, are relatively insusceptible to the direct effects of oiling. King and Sanger (1979), in their vulnerability index for marine birds in the Pacific Northwest, where this tern is moderately abundant, gave Arctic Terns a low rating. In the southeastern United States, where these terns occur only as uncommon pelagic migrants, there seems no likelihood of any severe impact on the species.

BIBLIOGRAPHY

1982

Braune, B. M. and D. E. Gaskin. 1982a. Feeding ecology of nonbreeding populations of larids off Deer Island, New Brunswick. Auk 99: 67-76.

_____. 1982b. Feeding methods and diving rates of migrating larids off Deer Island, New Brunswick. Can. J. Zool. 60: 2190-2197.

Freedman, B. and J. Svoboda. 1982. Populations of breeding birds at Alexandra Fjord, Ellesmere Island, Northwest Territories, compared with other Arctic localities. Can. Field-Nat. 96: 56-60.

Kemp, J. B. 1982. Identification of juvenile Common, Arctic and Roseate Terns. Brit. Birds 75: 129.

Lemmetyinen, R., P. Rantamaki and A. Karlin. 1982. Levels of DDT and PCB's in different stages of life cycle of the Arctic Tern Sterna paradisaea and the Herring Gull Larus argentatus. Chemosphere 11: 1050-1068.

Ohlendorf, H. M., J. C. Bartonek, G. J. Divoky, E. E. Klaas and A. J. Krynitsky. 1982. Organochlorine residues in eggs of Alaskan seabirds. U.S. Fish Wildl. Serv. Spec. Sci. Rep. Wildl. 345. 41 pp.

Stewart, D. 1982. Sight record of an Arctic Tern at Portland, Victoria. Austr. Bird Watcher 9: 245.

von Haartman, L. 1982. The Arctic Tern Sterna paradisaea -- a new inhabitant of the inshore archipelago. Ornis Fenn. 59: 63-76.

1981

Hume, R. A. 1981. Mystery photographs. 57. Brit. Birds 74: 394-395.

Oreel, G. J. 1981. On field identification of Common and Arctic Tern. Dutch Birding 3: 18.

1980

Bergman, G. 1980. Single-breeding versus colonial breeding in the Caspian Tern Hydroprogne caspia, the Common Tern, Sterna hirundo and the Arctic Tern Sterna paradisaea. Ornis Fenn. 57: 141-152. [In English with Finnish summary.]

Burton, J. and J. Chalifour. 1980. Trapping nesting terns: a modified method. Inl. Bird Banding 52: 36.

Ekstrom, L. 1980. Silvertarnor dranker kraka. [Arctic Terns drown Hooded Crow.] Var Fagelvarld 39: 405-406.

Forster, R. 1980. The identification and occurrence of "portlandica" type Arctic Terns in Massachusetts. Bird Obs. East. Mass. 8: 91-93.

Keller, T. C., A. Bruner and M. Brown. 1980. Possibly Indiana's first Arctic Tern. Indiana Audubon Q. 58: 142-145.

Lemmetyinen, R. and P. Rantamaki. 1980. DDT and PCB residues in the Arctic Tern (Sterna paradisaea) nesting in the archipelago of southwestern Finland. Ann. Zool. Fenn. 17: 141-146.

Middleton, W. R. 1980. Arctic Tern sighting at Brigantine National Wildlife Refuge. Cassinia 58: 24.

Mikkola, E., M. Ojanen and M. Orell. 1980. Lapin- ja kalatiirat pyydystavat kuoriutuvia surviassaaskia (Diptera, Chironomidae). [Emerging chironomids (Diptera) eaten by Sterna paradisaea and S. hirundo.] Ornis Fenn. 57: 42. [In Finnish with English summary.]

Pulliainen, E. and A. Marjakangas. 1980. Eggshell thickness in eleven sea and shore bird species of the Bothnian Bay. Ornis Fenn. 57: 65-70.

Wamer, N. O., H. M. Stevenson and J. E. Cavenagh, Jr. 1980. Sight records of the Arctic Tern on the Gulf coast of Florida. Fla. Field Nat. 8: 49.

Wren, J. 1980. Possible sighting of the Arctic Tern at Cairns, North Queensland. Austr. Bird Watcher 8: 168-169.

1979

Baird, P. A. and M. A. Hatch. 1979. Breeding biology and feeding habits of seabirds of Sitkalidak Strait, 1977-1978. Pp. 107-186 in Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators, Volume 2. NOAA, Environ. Res. Lab., Boulder, CO.

Boekelheide, R. and G. Divoky. 1979. Post-breeding migration of Arctic Terns in northwestern Alaska. (Abstract only). Pac. Seabird Group Bull. 6: 42.

Brady, A. 1979. Arctic Tern observation off New Jersey coast. Cassinia 57: 49.

Braune, B. M. 1979. Feeding ecology of migration populations of Bonaparte's Gulls, Common Terns and Arctic Terns. M.S. thesis, Univ. Guelph/Guelph, Ontario.

Bruns, H. 1979. Zur nistokologischen Potenz der Kustenseeschwalbe (Sterna paradisaea) im arktischen Brutgebiet. Kustenseeschwalbe nistet im Industriegelande von Spitsbergen. Ornithol. Mitt. 31: 3-19. [In German.]

Latham, P. C. M. 1979. An Arctic Tern at the Tarawera River mouth. Notornis 26: 63-67.

Manuwal, D. A., P. W. Mattocks, Jr. and K. O. Richter. 1979. First Arctic Tern colony in the contiguous western United States. Am. Birds 33: 144-145.

Nysewander, D. R. and D. B. Barbour. 1979. The breeding biology of marine birds associated with Chiniak Bay, Kodiak Island, 1975-1978. Pp. 21-106 _in_ Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators, Volume 2. NOAA, Environ. Res. Lab., Boulder, CO.

Rittinghaus, H. 1979. Beitrage zur okologischen Potenz einiger Seeschwalbenarten (_Sterna albifrons_, _Sterna hirundo_, _Sterna paradisaea_, _Sterna sandvicensis_). Ornithol. Mitt. 31: 73-85, 99-119. [In German.]

Taylor, I. R. 1979a. The kleptoparasitic behaviour of the Arctic Skua, _Stercorarius parasiticus_, with three species of tern. Ibis 121: 274-282.

Vader, W. 1979. En Makeligrodnebbterne. [Arctic Tern hunting from telephone wire.] Fauna 32: 34-35. [In Norwegian with English summary.]

1978

Baird, P. 1978. Comparative ecology of Arctic and Aleutian Terns. Pac. Seabird Group Bull. 5: 45-46.

Baird, P. A. and R. A. Moe. 1978. The breeding biology and feeding ecology of marine birds in the Sitkalidak Strait area, Kodiak Island, 1977. Pp. 313-524 _in_ Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators, Volume 3. NOAA, Environ. Res. Lab., Boulder, CO.

Boekelheide, R. J. and G. J. Divoky. 1978. The role of sea-ice for Arctic Terns breeding on an arctic Alaska barrier island. Pac. Seabird Group Bull. 5: 52.

Burggraeve, G. 1978. Waarnemingen en ferste broedgeval voor Belgie van de Noordse Stern, _Sterna paradisaea_, te Knokke. [First breeding record for Belgium of the Arctic Tern _Sterna paradisaea_ in Knokke.] Gerfaut 68: 99-106. [In Dutch with French and English summaries.]

Devillers, P. 1978. Illustration du plumage juvenile des Sternes artique (_Sterna paradisaea_) et Pierregarin (_S. hirundo_). [Identification of juvenal plumage of Arctic Tern (_Sterna paradisaea_) and Common Tern (_S. hirundo_).] Gerfaut 68: 91-96. [In French with Dutch and English summaries.]

Erwin, R. M. 1978a. Population and colony site dynamics in selected Massachusetts waterbirds. Proc. 1977 Conf. Colonial Waterbird Group 1: 19-25.

Erwin, R. M. 1978b. Coloniality in terns: the role of social feeding. Condor 80: 211-215.

Furness, R. W. 1978. Energy requirements of seabird communities: a bioenergetics model. J. Anim. Ecol. 47: 39-53.

Kumerloeve, H. 1978. Hohes Alter einer Kustenseeschwalbe (Sterna paradisaea). Vogelwarte 29: 281. [In German.]

Mead, C. J. 1978. Tern mortality in West Africa as shown by British and Dutch ringing results. (Abstract only.) Ibis 120: 110.

Nysewander, D. and E. Hoberg. 1978. The breeding biology of marine birds associated with Chiniak Bay, Kodiak Island, 1977. Pp. 525-574 in Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators, Volume 3. NOAA, Environ. Res. Lab., Boulder, CO.

1977

Belopolskii, L., G. Goryainova, N. Milovanova, I. Petrova and N. Polonik. 1977. Osobennosti razmnozheniya polyainoi krachki na Baltiiskom, Belom, i Barentssevom moryakh. [Particulars of the breeding of the Arctic Tern on the Baltic, White, and Barents Seas.] Ornitologiya 13: 95-99. [In Russian.]

Busse, K. 1977. Pragungsbedingte akustische Arterkennungsfahigkeit der Kuken der Flussseeschwalben und Kustenseeschwalben (Sterna hirundo L. und S. paradisaea Pont.). [Acoustic ability of species recognition in chicks of the Arctic and Common Terns (Sterna hirundo L. and Sterna paradisaea Pont.) acquired by early experiments.] Z. Tierpsychol. 44: 154-161. [In German with English summary.]

Busse, K. and K. Busse. 1977. Pragungsbedingte Beindung von Kustenseeschwalbenkuken (Sterna paradisaea Pont.) an die Eltern und ihre Fahigkeit, sie an der Stimme zu erkennen. [Attachment of Arctic Tern chicks (Sterna paradisaea Pont.) to their parents by means of imprinting, and their ability to recognize the parents by voice.] Z. Tierpsychol. 43: 287-294. [In German with English summary.]

Cox, J. B. 1977. White-fronted Terns in South Australia and notes on the identification of similar terns. S. Austr. Ornithol. 27: 179-184.

Laybourne, S., S. A. M. Manson and P. M. Collett. 1977. Arctic Terns breeding inland in Caithness. Scott. Birds 9: 301.

Mardal, W. 1977. Nogle resultater af undersogelser i en nordvestjsk bestand af Havtarne (Sterna paradisaea). I. Indledning og bestandsstorrelse. Naturnyt 6: 50-55.

Nysewander, D. and P. Knudtson. 1977. The population ecology and migration of seabirds, shorebirds, and waterfowl associated with Constantine Harbor, Hinchinbrook Island, Prince William Sound, 1976. Pp. 500-575 in Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators, Volume 2. NOAA, Environ. Res. Lab., Boulder, CO.

Parmalee, D. F. 1977. Adaptations of Arctic Terns and Antarctic Terns within Antarctic ecosystems. Pp. 687-702 in Adaptations within arctic ecosystems. Gulf Publ. Co., Houston, TX.

Skipnes, K. 1977a. Dognrytme hos rodnebbterna, Sterna paradisaea, i tiden for egglegging. [The daily activity of Arctic Terns, Sterna paradisaea, in the pre-laying period.] Fauna 30: 201-213. [In Norwegian with English summary.]

_____. 1977b. Mennesker og fugler som forstyrrende faktober for rugeatferden til Rodnebbterna. [Men and birds as disturbing factors for the incubation behavior of the Arctic Tern, Sterna paradisaea.] Sterna 16: 13-18. [In Norwegian with English summary.]

Smith, P. W. 1977. Arctic Tern off New Jersey. N.J. Audubon 3: 102.

1976

Coulson, J. C. and J. Horobin. 1976. The influence of age on the breeding biology and survival of the Arctic Tern (Sterna paradisaea). J. Zool. 178: 247-260.

DuMont, P. G. 1976. Sabine's Gull and Arctic Tern sightings near Ocean City. Md. Birdlife 32: 108.

Erdman, T. C. 1976. Arctic Terns in Wisconsin. Passenger Pigeon 38: 129-131.

Lemmetyinen, R. 1976. Feeding segregation in the Arctic and Common Terns in southern Finland. Auk 93: 636-640.

Mes, R. and R. Schuckard. 1976. Een onderzock naar verschillen in fourageeractiviteit tussen Visdief Sterna hirundo en Noordse Stern Sterna paradisaea op de Engelsmanplaat (NL). Versl. Tech. Gegevens Inst. Taxon. Zool. Amst. 11: 1-36. [In Dutch with English summary.]

Nisbet, I. C. T. 1976c. Returns from terns. Mass. Audubon Newsl. 15: 3-5.

Rowlett, R. A. 1976. Sabine's Gull and Arctic Terns off Ocean City. Md. Birdlife 32: 107.

1975

Bardarson, H. R. 1975. [Arctic Terns (Sterna paradisaea) robbing fish from Black Guillemots (Cepphus grylle) in northwest Iceland.] Natturufraedingurinn 45: 37-42. [In Icelandic with English summary.]

Clapp, R. B. 1975. Arctic Terns from the Phoenix Islands and at sea in the Central Pacific. Condor 77: 100.

Fjeldsa, J. 1975. En taksering af haettemage Larus ridibundus og havterne Sterna paradisaea i Myvatn-omradet, N. O. Island. Dan. Ornithol. Foren. Tidsskr. 69: 65-72. [In Danish with English and French summaries.]

Hatch, J. J. 1975. Homing experiments with Arctic Terns released over land and sea. Bird-Banding 46: 47-54.

Lloyd, C. S., C. J. Bibby and M. J. Everett. 1975. Breeding terns in Britain and Ireland in 1969-74. Brit. Birds 68: 221-237.

Monson, G. and S. M. Russell. 1975. Arctic Tern in Arizona. Auk 92: 153-154.

Norderoog, H. 1975. Vergleichende Untersuchungen zum Fortpflanzungsverhalten und zum Problem der arttrennenden Mechanismen an Fluss- und Kustenseeschwalben (Sterna hirundo L. und S. paradisaea Pont.). Dissertation zur Erlangung des Doktorgrades des Fachbereichs Biologie der Universitat Hamburg. 71 pp. [In German with English summary.]

1974

Bundy, G. 1974. Identification of juvenile Arctic Terns. Brit. Birds 67: 246-247.

Cruickshank, A. D. 1974. Field identification of difficult birds: II. Four similar terns. Fla. Field Nat. 2: 1-3.

Dittberner, H. and W. Dittberner. 1974. Zum Vorkommen der Kustenseeschwalbe (Sterna paradisaea) in Brandenburg. Beitr. Vogelkd. 20: 211-215.

Grant, P. J. 1974. Identification of juvenile Arctic Terns. Brit. Birds 67: 247.

Green, J. C. 1974. Arctic Tern and Little Gull as migrants in Duluth [Minnesota]. Loon 46: 52-57.

Hatch, J. J. 1974. Longevity record for the Arctic Tern. Bird-Banding 45: 269-270.

Hume, R. A. and P. J. Grant. 1974. The upperwing patterns of adult Common and Arctic Terns. Brit. Birds 67: 133-136.

Langham, N. P. E. 1974. Comparative breeding biology of the Sandwich Tern. Auk 91: 255-277.

Lemmetyinen, R. 1974. Comparative breeding ecology of the Arctic and the Common Tern with special reference to feeding. Rep. Dep. Zool. Univ. Turku 3. 19 pp.

Lemmetyinen, R., P. Portin and S. Vuolanto. 1974. Polymorphism in relation to the substrate in chicks of Sterna paradisea Pontopp. Ann. Zool. Fenn. 11: 265-270.

Taylor, I. R. 1974. The feeding behaviour and ecology of Sandwich, Common and Arctic Terns on the Ythan Estuary, Aberdeenshire. Ph.D. thesis, Univ. Aberdeen/Aberdeen, Scotland.

1973

Bruun, J. B. 1973. Unge terner. Feltornithologen 15: 182-184.

Burleigh, T. D. 1973. First Arctic Tern recorded in Idaho. Auk 90: 693.

Godfrey, W. E. 1973. A possible shortcut spring migration route of the Arctic Tern to James Bay, Canada. Can. Field-Nat. 87: 51-52.

Hays, H., E. Dunn and A. Poole. 1973. Common, Arctic, Roseate, and Sandwich Terns carrying multiple fish. Wilson Bull. 85: 233-236.

Lemmetyinen, R. 1973a. Feeding ecology of Sterna paradisaea Pontopp. and S. hirundo L. in the archipelago of southwestern Finland. Ann. Zool. Fenn. 10: 507-525.

_____. 1973b. Breeding success in Sterna paradisaea Pontopp. and S. hirundo L. in southern Finland. Ann. Zool. Fenn. 10: 526-535.

_____. 1973c. Clutch size and timing of breeding in the Arctic Tern in the Finnish archipelago. Ornis Fenn. 50: 18-28.

McNicholl, M. K. 1973a. Habituation of aggressive responses to avian predators by terns. Auk 90: 902-904.

Milledge, D. R. 1973. A third Arctic Tern Sterna macrura for Tasmania. Tasmanian Nat. 35: 5.

Nisbet, I. C. T. 1973b. Terns in Massachusetts: present numbers and historical changes. Bird-Banding 44: 27-55.

Robinson, R. D. 1973. Arctic Tern record. S. Austr. Ornithol. 26: 133.

1972

Evans, R. M. and M. K. McNicholl. 1972. Variations in the reproductive activities of Arctic Terns at Churchill, Manitoba. Arctic 25: 131-141.

Gloe, P. 1972. Ein Massenabzug von Fluss- und Kustenseeschwalben (Sterna hirundo et Sterna paradisaea) an der Meldorfer Bucht. Ornithol. Mitt. 24: 170-172.

Hopkins, C. D. and R. H. Wiley. 1972. Food parasitism and competition in two terns. Auk 89: 583-594.

Langham, N. P. E. 1972. Chick survival in terns (Sterna spp.) with particular reference to the Common Tern. J. Anim. Ecol. 41: 385-395.

Lazell, J. D., Jr., and I. C. T. Nisbet. 1972. The tern-eating Garter Snakes of Nomans Land. Man Nat., June 1972: 27-29.

Lemmetyinen, R. 1972a. Growth and mortality in the chicks of Arctic Terns in the Kongsfjord area, Spitsbergen in 1970. Ornis Fenn. 49: 45-53.

_____. 1972b. Nest defence behaviour in the Arctic Tern Sterna paradisaea towards stuffed nest predators on Spitsbergen. Rep. Kevo Subarctic Res. Stat. 9: 28-31.

Lemmetyinen, R. and T. Raitis. 1972. Occurrence of Schistocephalus solidus Creplin (Cestoidea, Dibothriocephalidae) in Common and Arctic Terns in southern Finland. Ann. Zool. Fenn. 9: 208-211.

Realini, G. 1972. Cattura di sterna codalunga (Sterna macrura - Naumann). Riv. Ital. Ornitol. 42: 180-182.

Ridgely, R. S. 1972. Arctic Tern (Sterna paradisaea) at South Amboy, New Jersey. Cassinia 53: 39-40.

Ross, C. C. 1972. Two unrecorded nesting species on Grand Manan Island. Can. Field-Nat. 86: 85.

Trainer, J. E. 1972. Arctic Terns in Pennsylvania. Cassinia 53: 48.

Zucchi, H. 1972. Kustenseeschwalben (Sterna paradisaea) begleiten Eiderenten (Somateria mollissima). Ornithol. Mitt. 24: 243.

1971

Bengtson, S.-A. 1971. Breeding success of the Arctic Tern, Sterna paradisaea (Pontoppidan) in the Kongsfjord area, Spitsbergen in 1967. Norw. J. Zool. 19: 77-82.

Collins, H. B. 1971. The Arctic Tern Sterna macrura. Bokmakierie 23: 27.

Elliott, C. C. H. 1971. Analysis of the ringing and recoveries of three migrant terns. Ostrich Suppl. 9: 71-82.

Gloe, P. 1971. Beseidlung der Insel Helmsand durch die Lachmowe (Larus ridibundus) und ihr Eindringen in die Brutplatze de Fluss- und Kustenseeschwalben (Sterna hirundo et St. paradisaea). Corax 3: 176-183. [In German.]

Langham, N. P. E. 1971. Seasonal movement of British terns in the Atlantic Ocean. Bird Study 18: 155-175.

Lemmetyinen, R. 1971. Nest defence behaviour of Common and Arctic Terns and its effects on the success achieved by predators. Ornis Fenn. 48: 13-24.

1970

Bianki, V. V. and L. A. Khiyap. 1970. [Study of "Osttreue" and mortality of adult Arctic Tern.] Mater. Probait. Ornitol. Konf. 1970: 25-30. [In Russian.]

Evans, R. M. 1970. Oldsquaws nesting in association with Arctic Terns at Churchill, Manitoba. Wilson Bull. 82: 383-390.

Hatch, J. J. 1970. Predation and piracy by gulls at a ternery in Maine. Auk 87: 244-254.

Mather, J. R. 1970. An analysis of 58 immature terns *Sterna hirundo* L. and *S. macrura* Naum. from Filey, Yorkshire. Naturalist (Hull) 913: 63-66.

Vande Weghe, J.-P. 1970. Identification of the Common Tern and the Arctic Tern. Calif. Birds 1: 33-36.

1969

Eckhardt, R. C. 1969. Minimum time paths and the migration of the Arctic Tern. Pp. 1-26 *in* Geography and the properties of surface series. Harv. Pap. Theor. Geogr. 26.

Emmerson, M. H. 1969. Panic flight behaviour in the Arctic Tern (*Sterna paradisaea*). J. Durham Univ. Biol. Soc. 15: 16-20.

Feare, C. J. 1969. Arctic Terns feeding on earthworms. Brit. Birds 62: 237.

Frew, H. 1969. Arctic Tern in Manakau Harbour. Notornis 16: 56.

Grant, P. J. and R. E. Scott. 1969. Field identification of juvenile Common, Arctic and Roseate Terns. Brit. Birds 62: 297-299.

Horobin, J. M. 1969. The breeding biology of an aged population of Arctic Terns. Ibis 111: 443.

Lemmetyinen, R. 1969 ms. Kala- ja lapintiiran (*Sterna hirundo* ja *S. paradisaea*) pesimisbiologinen vertailu. MS in Dep. Zool., Univ. Turku, Finland. [In Finnish.]

Scott, R. E. and P. J. Grant. 1969. Uncompleted moult in *Sterna* terns and the problem of identification. Brit. Birds 62: 93-97.

1968

Boecker, M. 1968a. Der "Futterungserfolg" bei Fluss- und Kustenseeschwalbe (*Sterna hirundo* und *St. paradisaea*). [The "feeding results" of the Common Tern and Arctic Tern (*Sterna hirundo* and *St. paradisaea*.] Vogelwelt 89: 221-225. [In German with English summary.]

Fournier, O. 1968. Un caractere peu utilise pour la determination de la Sterne arctique juvenile. Alauda 36: 286.

Gill, M. 1968. Some aspects of the breeding ecology of Arctic Terns (*Sterna paradisaea*). J. Durham Univ. Biol. Soc. 14: unpaginated.

Gwynn, A. M. 1968. The migration of the Arctic Tern. Austr. Bird Bander 6: 71-75.

Hoogerwerf, A. 1968. Noordse Stern (*Sterna paradisaea*) op Ameland. Limosa 41: 155-156.

Langham, N. P. E. 1968. The comparative biology of terns, *Sterna* spp. Ph.D. thesis, Univ. Durham/Durham, England.

Lemmetyinen, R. 1968. The migration routes of Finnish Common and Arctic Terns (*Sterna hirundo* and *S. paradisaea*) in Scandinavia. Ornis Fenn. 45: 114-124.

McNicholl, M. 1968. Trapping nesting Arctic Terns. Inl. Bird Banding News 40: 8-11.

Pearson, T. H. 1968. The feeding biology of sea-bird species breeding on the Farne Islands, Northumberland. J. Anim. Ecol. 37: 521-552.

Schloss, W. 1968. Ringfunde der Kustenseeschwalbe (*Sterna macrura*). Auspicium 2: 384-402.

Smart, I. H. M. [ed.] 1968. Pp. 26-43 *in* University of Dundee Scoresby Land Expedition 1968. Cyclostyled report. 61 pp.

1967

Boecker, M. 1967. Vergleichende Untersuchungen zur Nahrungs und Nistokologie der Flussseeschwalbe (*Sterna hirundo* L.) und der Kustenseeschwalbe (*Sterna paradisaea* Pont.). [A comparative study on the feeding and nest ecology of the Common Tern (*Sterna hirundo* L.) and the Arctic Tern (*Sterna paradisaea* Pont.).] Bonn. Zool. Beitr. 18: 15-126. [In German.]

Gullestad, N. and M. Norderhaug. 1967. Undersokelser av produksjon og hekkeforlop hos Rodnebbterne i Svalbardomradet i 1965. [Breeding conditions and productivity of the Arctic Tern in Svalbard in 1965.] Nor. Polarinst. Medd. 95: 176-182. [In Norwegian with English summary.]

Ling, R. 1967. Vordlevaid andmeid jogi ja randtiiru pesitmus okoloogiast. [Comparative data on the breeding ecology of the Common and Arctic Tern.] Ornitol. Kogumik 4: 90-113. [In Estonian with Russian and English summaries.]

Mulder, A. 1967. Decemberwaarneming van een Nordse Stern (Sterna paradisaea). [December record of Arctic Tern (Sterna paradisaea).] Limosa 40: 144-145. [In Dutch with English summary.]

Raitis, T. and R. Lemmetyinen. 1967. Schistocephalus solidus-heisimadon esiintymisesta tirroissa. [On the occurrence of Schistocephalus solidus (Cestoda) in terns.] Ornis Fenn. 44: 68-72. [In Finnish with English summary.]

Salomonsen, F. 1967. Migratory movements of the Arctic Tern (Sterna paradisaea Pontoppidan) in the southern ocean. K. Dan. Vidensk. Selsk. Biol. Medd. 24: 1-42.

Scherner, E. R. 1967. Uber Nahrungserwerb und Bakterien-Tragertum bei Kustenseeschwalben (Sterna paradisaea) auf Island und Gronland. J. Ornithol. 108: 228-229.

1966

Beere, M. R. 1966. The Arctic Tern. Birds Illust. 12: 176-177.

Dobrinskii, L. N. 1966. [Geographical variability of morphological characters in two closely related species of terns (Sterna hirundo L. and S. paradisaea Pontopp.).] Vnutrividovaya Izmench. Pozvon. Zhivotn. i Mikroevol. Sverdlovsk (Akad. Nauk): 351-356. [In Russian.]

Korner, H. K. 1966a. Zur Eirollbewegung der Kustenseeschwalbe (Sterna macrura Naum.) [On egg-rolling of the Arctic Tern.] Z. Tierpsychol. 23: 315-323. [In German with English summary.]

______. 1966b. Untersuchunge zur Eirollbewegung der Kustenseeschwalbe (Sterna macrura Naum.) auf Norderoog. Jordsand Mitt. 1966: 51-63.

Taverner, J. H. 1966. The Needs Oar gullery and ternery. Hampshire Bird Rep. 23: 32-45.

Vande Weghe, J.-P. 1966. La sterne pierregarin Sterna hirundo et la sterne arctique Sterna paradisaea. Identification et passage en Belgique. Aves 3: 1-5.

1965

Imber, M. J. 1965. Arctic Tern on Foxton Beach. Notornis 12: 157.

Onno, S. 1965. Attachment to the nest (Ostreue) in the Common Gull, Common Tern and Arctic Tern. Commun. Baltic Comm. Study Bird Migr. 3: 140-162.

1964

Johnston, D. M. 1964. Ecologic aspects of lipid deposition in some post-breeding Arctic birds. Ecology 45: 848-852.

Lovenskiold, H. 1964. Avifauna Svalbardensis with a discussion on the geographical distribution of the birds in Spitsbergen and adjacent islands. Nor. Polarinst. Skr. 103: 1-131.

Morzer Bruyns, W. F. J. and K. H. Voous. 1964. Arctic Tern (Sterna paradisaea) in Southern Indian Ocean. Ardea 52: 117-118.

Norderhaug, M. 1964. Studier av Rodnebbternas (Sterna macrura) biologi pa Vestspitsbergen. [Studies of the Arctic Tern in West Spitsbergen.] Fauna 17: 137-154. [In Norwegian with English summary.]

Quine, D. A. and J. M. Cullen. 1964. The pecking response of young Arctic Terns Sterna macrura and the adaptiveness of the "releasing mechanism". Ibis 106: 145-173.

Reid, A. J. 1964. Arctic Tern: second Victorian record. Emu 64: 38.

1963

Lind, H. 1963b. Nogle sociale reaktioner hos terner. [Notes on social behavior in terns.] Dan. Ornithol. Foren. Tidsskr. 57: 155-175. [In Danish with English summary.]

Serventy, D. L. 1963. Second record of a ringed Arctic Tern in southwestern Australia. West. Austr. Nat. 9: 22-23.

Sutter, E. 1963. Ein schweizerisches Belegexemplar der Kustenseeschwalbe. Ornithol. Beob. 60: 141-142.

1962

Rittinghaus, H. 1962. Die Seeschwalben auf der Insel Minsener Oldenog. Oldenb. Jahrb. 61: 93-104. [In German.]

Wall, L. E. 1962. Another Arctic Tern in Tasmania. Emu 62: 209-210.

1961

Edgar, A. T. 1961. Arctic Terns near Manukau Heads. Notornis 9: 173.

Jacobsen, J. R. 1961. Bestemmelse af Havterne (Sterna paradisaea Pont.) og Fjordterne (Sterna hirundo L.) i naturen. [Identification of Arctic Tern (Sterna paradisaea Pont.) and Common Tern (Sterna hirundo L.) in nature.] Dan. Ornithol. Foren. Tidsskr. 55: 89-96. [In Danish with English summary.]

Nero, R. W. 1961. The Arctic Tern in Saskatchewan. Blue Jay 19: 60-67.

Radford, M. C. 1961. A study of the British ringing records of the Common Tern and Arctic Tern and comparison with some foreign records. Bird Study 8: 174-184.

1960

Cullen, J. M. 1960a. Some adaptations in the nesting behaviour of terns. Proc. Internatl. Ornithol. Congr. 12: 153-157.

_____. 1960b. The aerial display of the Arctic Tern and other species. Ardea 48: 1-37.

Drury, W. H., Jr. 1960. Breeding activities of Long-tailed Jaeger, Herring Gull and Arctic Tern on Bylot Island, Northwest Territories, Canada. Bird-Banding 31: 63-79.

Kowalski, S. 1960. La Sterne Arctique a l'ile Dumet (Sterna paradisaea Pontoppidan 1763) son identification dans la nature. Alauda 28: 258-261. [In French.]

1959

Andersen, F. S. 1959. Bills, eggs and nests of captured Arctic Terns (Sterna paradisaea) and Common Terns (S. hirundo). Dan. Ornithol. Foren. Tidsskr. 53: 84-102.

Burton, P. J. K. and M. H. Thurston. 1959. Observations on Arctic Terns in Spitsbergen. Brit. Birds 52: 149-161.

Mossman, A. S. 1959. Notes on gull and tern food habits in Alaska. (Abstract only.) Proc. Alaska Sci. Conf. 10: 86-87.

Solyanik, G. A. 1959. Nakhozdenie okol'tsovannoi polyarnoi Sterna paradisaea Brunn. v Antartike. [Find of a banded Arctic Tern, Sterna paradisaea Brunn., in Antarctica.] Inf. Byull. Sov. Antarkt. Eksped. 11. Leningrad. [In Russian.]

1958

Hindwood, K. A. 1958. The Arctic Tern in Australia. Emu 58: 259-263.

Phillips, W. W. A. 1958. Terns (Chlidonias leucopterus and Sterna macrura) and other birds in mid-Atlantic in late April. Ibis 100: 276-277.

Storr, G. M. 1958. Migration routes of the Arctic Tern. Emu 58: 59-62.

1957

Belopol'skii, L. O. 1957. Ekolologiya morskikh kolonial'nykh ptits barentsova morya. [Ecology of sea colony birds of the Barents Sea.] Israel Progr. Sci. Transl., Jerusalem. 346 pp. [1961 translation from the Russian by R. Ettinger and C. Salzmann.]

Cullen, J. M. 1957. Plumage, age and mortality in the Arctic Tern. Bird Study 4: 197-207.

Grosskopf, G. 1957. Das Durchschnittsalter der auf Wangerooge nistenden Kustenseeschwalben (Sterna macrura). J. Ornithol. 98: 65-70. [In German.]

Hawksley, O. 1957. Ecology of a breeding population of Arctic Terns. Bird-Banding 28: 57-92.

Storr, G. M. and N. E. Milward. 1957. Another Arctic Tern in Western Australia. West. Austr. Nat. 5: 231-232.

1956

Cullen, J. M. 1956. A study of the behaviour of the Arctic Tern (Sterna macrura). Ph.D. thesis, Oxford Univ./Oxford, England.

Dunnet, G. M. 1956. Arctic Tern, Sterna macrura Naum., banded in Russia and recovered in Western Australia. CSIRO Wildl. Res. 1: 134.

Gudmundsson, F. 1956. Islenzikir fuglar. XIV. Kria (Sterna paradisaea). [Icelandic birds. XIV. The Arctic Tern (Sterna paradisaea).] Natturufraedingurinn 26: 206-217. [In Icelandic with English summary.]

Storr, G. M. 1956. Arctic Terns on the Swan River. West. Austr. Nat. 5: 70-72.

1955

Bergman, G. 1955. Die Beziehungen zwischen Bodenfarbe der Reviere und Farbe der Kucken bei Hydroprogne tschegrava und Sterna macrura. [On the colour variation of the chicks of Hydroprogne tschegrava and Sterna macrura, and the influence of the ground colour on the chicks' colouration.] Ornis Fenn. 32: 69-83. [In German with English and Finnish summaries.]

Lloyd, H. 1955. Mid-Atlantic migration of Long-tailed Jaegers and terns. Can. Field-Nat. 69: 24.

Rooth, J. 1955. Problomen rond de Noordse Stern, naar anleiding van waarnemingen op Griend. [Problems around the Arctic Tern (Sterna macrura) in connection with observations made on the Isle of Griend (Netherlands).] Levende Nat. 58: 137-140. [In Dutch with English summary.]

1954

Hitchcock, W. B. 1954. Occurrence of the Arctic Tern in South Australia. S. Austr. Ornithol. 21: 45-56.

Lewis, W. J. 1954. Notes on the breeding of an Arctic Tern in immature plumage on the Northern Hares, Farne Islands, in 1953. Trans. Nat. Hist. Soc. Northumbr. N.S. 11(2): 60.

Morgan, D. G. 1954. A second Australian record of the Arctic Tern. Emu 54: 58-59.

1953

Richardson, R. A. 1953. A distinction in flight between Arctic and Common Terns. Brit. Birds 46: 411-412.

Zimmermann, H. 1953. Der Tretakt bei der Kustenseeschwalbe (Sterna macrura). Ornithol. Mitt. 5: 173.

1952

Alexander, H. G. 1952. Arctic Tern with yellow bill and legs in autumn. Brit. Birds 45: 469-470.

Downes, M. C. 1952. Arctic Terns in the subantarctic. Emu 52: 306-310.

Hebard, F. V. 1952. Sight record of Arctic Tern in Florida. Fla. Nat. 25: 126.

Hitchcock, W. B. 1952. An Australian specimen of the Arctic Tern. Emu 52: 68-69.

Paulian, P. 1952. Une capture de Sterna paradisaea Pontoppidan a l'Ile Amsterdam. Oiseau Rev. Fr. Ornithol. 22: 320-321. [In French.]

1951

Austin, O. L. 1951b. Age record for the Arctic Tern. Bird-Banding 22: 179.

1950

Armstrong, E. A. 1950. Intruder responses by birds outside their breeding areas. Brit. Birds 43: 332.

Hawksley, O. 1950. A study of the behavior and ecology of the Arctic Tern, Sterna paradisaea Brunnich. Ph.D. thesis, Cornell Univ./Ithaca, NY.

1949

Bruns, H. 1949. Ist die Kustenseeschwalbe (Sterna macrura Naum.) ein seltener Brutvogel auf den Ostfriesischen Inseln. Beitr. Naturkd. Nieders. 7: 5-7. [In German.]

Coulson, J. C. 1949. Arctic Tern perching on telephone wire. Brit. Birds 42: 28.

Hawksley, O. 1949. Transatlantic Arctic Tern recoveries. Bird-Banding 20: 185-186.

Rawcliffe, C. P. 1949. Kestrel taking young Arctic Tern. Brit. Birds 42: 90.

Shortt, T. M. 1949. Arctic Tern banded in Greenland, recovered in Ontario. Bird-Banding 20: 50.

Tebbutt, C. F. 1949. Arctic Terns nesting singly. Brit. Birds 42: 126.

1948

Gibb, J. 1948. Report on the inland passage of Arctic and Common Terns in the spring of 1947. Brit. Birds 41: 167-173.

Gordon, S. 1948. Arctic Tern scavenging. Brit. Birds 41: 127.

Lack, D. 1948. The significance of clutch size. Part II. Ibis 90: 25-45.

Tucker, B. W. 1948. The bill colour of the Arctic Tern. Brit. Birds 41: 188-189.

Williamson, K. 1948. Arctic Terns scavenging. Brit. Birds 41: 31.

1947

Williams, R. B. 1947. Notes on the Arctic Tern in Alexander Archipelago, southeastern Alaska. Auk 64: 143-144.

1946

Austin, O. L. 1946b. Age record for the Arctic Tern. Bird-Banding 17: 168.

Eddy, G. 1946. Arctic Tern on Puget Sound, Washington. Murrelet 27: 53.

Kullenberg, B. 1946. Uber Verbreitung und Wanderrungen von vier Sterna-Arten. Ark. Zool. 38: 1-80. [In German.]

1945

Durango, S. 1945. Om silvertarnans, _Sterna macrura_ Naum., hackningssamhallen och sociabiliteten mellan denna art och andra fogler. Sven. Naun. Revy 4. [In Swedish.]

Suomalainen, H. 1945. Eine Bermerkung uber die Brutbiologie der Kustenseeschwalbe, in ihrem Verhaltnis zu derjenigen der Flussseeschwalbe. Ornis Fenn. 22: 57-61.

1944

Eklund, C. R. 1944. Nesting notes on the Arctic Tern. Auk 61: 648.

1943

Wood, M. S. 1943. Common and Arctic Terns. Field 181: 487.

1942

Bullough, W. S. 1942. Observations on the colonies of the Arctic Tern (_Sterna macrura_ Naumann) on the Farne Islands. Proc. Zool. Soc. Lond. 112: 1-12.

1941

Palmer, R. S. 1941b. 'White-faced' terns. Auk 58: 164-178.

1940

Austin, O. L. 1940. Some aspects of individual distribution in the Cape Cod tern colonies. Bird-Banding 11: 155-169.

1939

Pettingill, O. S., Jr. 1939. History of one hundred nests of Arctic Tern. Auk 56: 420-428.

Suomalainen, H. 1939. Uber die Brutbiologie der Kustenseeschwalbe, _Sterna macrura_ Naum. in ihrem Verhaltnis zu derjenigen der Flussseeschwalbe, _Sterna h. hirundo_ L. in den Scharen des Finnischen Meerbusens. Ann. Zool. Soc. Zool. Bot. Fenn. Vanamo 6: 16-23. [In German.]

1938

Austin, O. L. 1938. Some results from adult tern trapping in the Cape Cod colonies. Bird-Banding 9: 12-25.

Palmer, R. S. 1938. Tern mortality along the Maine coast. Bird-Banding 9: 117-123.

1936

Bergman, G. and E. Fabricius. 1936. Sterna macrura and Sterna hirundo: downy plumage of nestlings compared. Ornis Fenn. 13: 34-36.

Hartley, C. H. and J. Fisher. 1936. The marine foods of birds in an inland fjord region in West Spitsbergen. Part 2. Birds. J. Anim. Ecol. 5: 370-389.

Rathbone, H. B. 1936. Arctic Terns feeding on biscuit. Brit. Birds 29: 255.

Whistler, H. 1936. Arctic Tern in Kashmir. Ibis (13th Ser.) 6: 600-601.

1935

Gross, A. O. 1935. Two Labrador banding records. Bird-Banding 6: 23-25.

Steinbacher, G. 1935. Schnabelfarbung bei der Flussseeschwalbe (Sterna hirundo) und Kustenseeschwalbe (St. paradisaea). Vogelzug 6: 39-40.

van Oordt, G. J. 1935. Een biologisch verschil tusschen Sterna hirundo L. en Sterna macrura Naum. Ardea 24: 262. [In Dutch.]

1934

Austin, O. L. 1934. The status of Cape Cod terns in 1934. Bird-Banding 5: 155-171.

van Oordt, G. J. 1934. Uber einen biologischen Unterschied zwischen Fluss- und Kustenseeschwalben (Sterna hirundo und Sterna paradisaea). Beitr. Fortpfl. Vogel 10: 5-6. [In German.]

1933

Austin, O. L., Jr. 1933. The status of Cape Cod terns in 1933. Bird-Banding 4: 190-198.

Haverschmidt, Fr. 1933. Het voorkomen van den Noordschen Stern (Sterna macrura Naum.) als Broedvogel in Nederland. Ardea 22: 138-144. [In Dutch.]

1932

Austin, O. L. 1932a. The status of Cape Cod terns in 1932. Bird-Banding 3: 143-156.

Dircksen, R. 1932. Die Biologie des Austernfischers, der Brandseeschwalbe und der Kustenseeschwalbe nach Beobachtungen und Untersuchungen auf Noorderoog. J. Ornithol. 80: 427-520. [In German.]

Flock, C. 1932. Note on the Arctic Tern in Bristol Bay region, Alaska. Murrelet 13: 26.

1930

Falla, R. A. 1930. The Arctic Tern (Sterna paradisaea Brunnich). An occurrence in New Zealand. N. Z. J. Sci. Technol. 12: 27.

Wendehorst, R. 1930. Fluss- und Kustenseeschwalbe auf Trischen. Ein Beitrag zur Unterscheidung beider Arten in freier Natur. Ornithol. Monatsber. 38: 133-137.

1929

Austin, O. L., Jr. 1929. Contributions to the knowledge of the Cape Cod Sterninae. Bull. N.E. Bird-Banding Assoc. 5: 123-140.

1928

Austin, O. L., Jr. 1928. Migration routes of the Arctic Tern (Sterna paradisaea Brunnich). Bull. N.E. Bird-Banding Assoc. 4: 121-125.

1927

White, F. B. 1927. Common and Arctic Terns at Seabrook, New Hampshire. Bull. N.E. Bird-Banding Assoc. 3: 36-37.

1921

Robinson, H. W. 1921a. Status of Arctic Tern in Lancashire. Brit. Birds 14: 281.

_____. 1921b. Status of Arctic Terns in Lancashire and the Farnes. Brit. Birds 15: 92.

1920

Hersey, F. S. 1920. The probable breeding of the Aleutian Tern in southeastern Alaska--a query. Condor 22: 203-204.

Walker, E. P. 1920. Southerly nesting records of the Arctic Tern in southeastern Alaska. Condor 22: 72-73.

1916

Griscom, L. 1916. The Arctic Tern in central New York. Auk 33: 319.

1909

Bickerton, W. 1909. British nesting terns. Proc. Zool. Soc. Lond. 1909: 800-802.

Wright, W. C. 1909. Arctic Terns feeding on Crane and May flies. Brit. Birds 3: 91.

1908

Kirkman, F. B. 1908. Variation in the nests of Arctic and Common Terns. Brit. Birds 2: 78-82, 101-108.

1905

Hantzsch, B. 1905. Beitrag zur Kenntnis der Vogelwelt Islands. R. Friedlander & Sohn, Berlin. [In German.]

1902

Bryan, W. A. 1902. The Arctic Tern in Hawaii. Auk 19: 394-395.

Henshaw, H. W. 1902. Occurrence of the Arctic Tern (*Sterna paradisaea*) in the Hawaiian Islands. Auk 19: 195.

1895

Call, A. B. 1895. Breeding habits of terns. Auk 12: 178.

1874

Ridgway, R. 1874. Notice of a species of tern new to the Atlantic coast of North America. Am. Nat. 8: 433.

1853

Lawrence, G. A. 1853. Descriptions of new species of birds of the genera *Ortyx* Stephens, *Sterna* Linn., and *Icteria* Vieillot. Am. Lyceum Nat. Hist. N.Y. 6: 1-4.

FORSTER'S TERN

(Sterna forsteri)

[SP: Charran de Forster]

GENERAL DISTRIBUTION

North America Forster's Terns breed in the Canadian Prairie Provinces from Lake Isle and Fawcett Lake in northern Alberta, east to Sled Lake in northern Saskatchewan, and to Halcrow Lake and Lake Winnipeg in north-central and eastern Manitoba, thence south to Stobart Lake in Alberta, Cypress Lake in Saskatchewan, and the Glenboro Marshes of southern Manitoba. They are evidently more abundant in Manitoba than in the provinces to the west (Gerrard and Whitfield 1971). From Canada these terns breed south through eastern Washington and Oregon to south-central California, central Idaho, northern Utah, southeastern Wyoming, eastern Colorado, eastern South Dakota, central Iowa, and southeastern Wisconsin (AOU 1957). They also breed from eastern Long Island, New York (rarely) (Zarudsky 1981), southern New Jersey (Buckley and McCaffrey 1978), southeastern Maryland, and eastern Virginia to southern South Carolina (rarely), and from Alabama to coastal Texas and probably Tamaulipas (Godfrey 1966, Gandy and Turcotte 1970, Oberholser 1974, Imhof 1976b).

Forster's Terns winter from central California and Baja California to southwestern Mexico and rarely to Guatemala (AOU 1957, Blake 1977); from Virginia to northern Florida; along the Gulf coast from western Florida to eastern Mexico (Veracruz) (AOU 1957); and rarely to the West Indies (Bahamas, Lesser Antilles) (Bond 1971).

World Distribution Forster's Terns occur almost solely in the New World. Birds have wandered to 200-300 mi (320-480 km) east of Brazil (Blake 1977), British Columbia and Nova Scotia (Godfrey 1966), western Texas, New Hampshire, and Massachusetts (AOU 1957). One was recently seen in Cornwall, England (Cave 1982).

DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

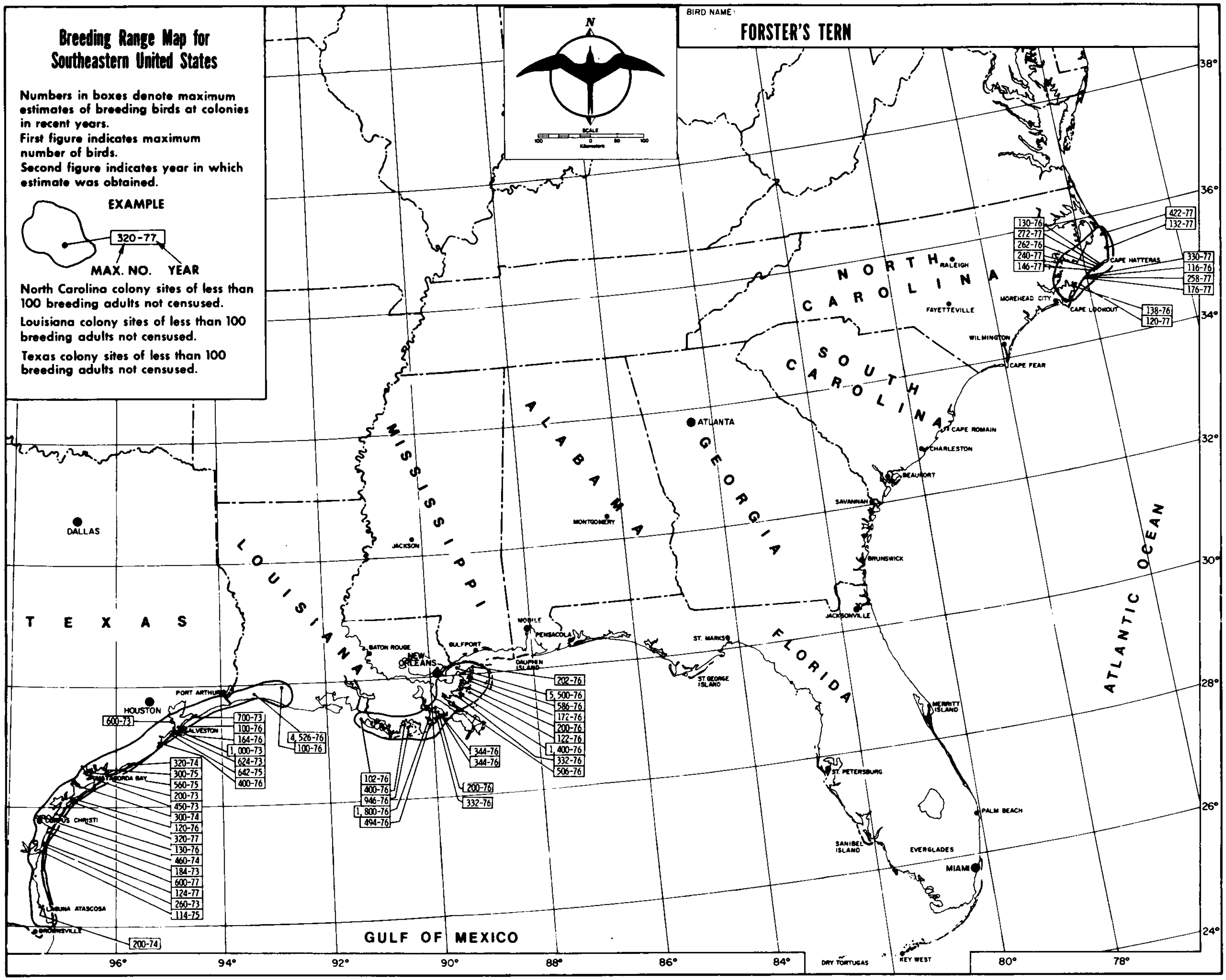
North Carolina Pearson et al. (1942) considered Forster's Terns only rare autumn migrants in North Carolina, but thought that "a few may possibly breed in the state..."; Wray and Davis (1959) added only a few sight records, including two from inland. As recently as 1972 they were thought to be only migrants and winter residents along the coast (Parnell and Soots 1979 ms) but now are common in winter (Potter et al. 1980) and at least occasionally abundant in fall (Table 62).

Breeding within the state was not adequately documented until 7 July 1971, when an unfledged juvenile was captured in North River Marsh (Teulings 1971d).

Table 62. Peak concentrations of wintering and migrant Forster's Terns in the coastal southeastern United States.

Date seen		Number seen	Locality	Source
			NORTH CAROLINA	
1973	22 Sep.	ca. 1,000	off Bird Shoal, Morehead City	Teulings 1974a
1975	29 Nov.	ca. 3,000	Cape Point, Hatteras Inlet	Teulings 1976a
			SOUTH CAROLINA	
1979	28 Jan.	150	Lake Moultrie (inland)	LeGrand 1979b
1901	18 June	"thousands"	Bird Bank, Bulls Bay	Wayne 1910
			FLORIDA	
1915	11 Apr.	75+	Shell Point near St. Marks	Howell 1932
1906	31 May	1,500	Passage Key, Tampa Bay	Howell 1932
1959	4 July	243	Alligator Point	Stevenson 1959c
1968	6 July	56	Lakeland (inland)	Stevenson 1968b
1970	8 Aug.	300	Lakeland (inland, 1 flock)	Ogden 1970
1956	15-16 Nov.	70	Lake Jackson (inland)	Stevenson 1957a
			ALABAMA	
1958	16 May	565	Dauphin Island	Imhof 1976b
1958	1 Nov.	310	Mobile Bay	Imhof 1976b
1956	28 Dec.	300	Cochrane Causeway	Imhof 1976b

A nest with one egg was found near Cape Lookout on 18 May 1973 (Fussell 1974), and a more thorough survey conducted that year revealed a breeding population of 1,700 birds (Soots and Parnell 1975a). Forster's Terns now breed in many areas in the northern half of the state (Soots and Parnell 1975a, Portnoy et al. 1981, Map 20). About 1,610 birds were found in 15 colonies in 1976 (Portnoy et al. 1981) and about 2,810 nesting birds were found in 31 colonies in 1977 (Parnell and Soots 1979 ms). By 1976 Forster's Terns had nested as far south as 34°52.7' N on Core Sound (Portnoy et al. 1981); the farthest south they were found nesting in 1977 was at Drum Inlet, Carteret County (34°51' N) (Parnell and Soots 1979 ms). Examination of survey data led Parnell and Soots (1979 ms) to conclude that "it is not clear as to whether the nesting population is increasing, decreasing, or stable."


Breeding Range Map for
Southeastern United States
Numbers in boxes denote maximum estimates of breeding birds at colonies in recent years.
First figure indicates maximum number of birds.
Second figure indicates year in which estimate was obtained.
EXAMPLE
320-77
MAX. NO. YEAR
North Carolina colony sites of less than 100 breeding adults not censused.
Louisiana colony sites of less than 100 breeding adults not censused.
Texas colony sites of less than 100 breeding adults not censused.
BIRD NAME:
FORSTER'S TERN
N
SCALE
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI
LOUISIANA
TEXAS
FLORIDA
ATLANTIC OCEAN
GULF OF MEXICO
RALEIGH
FAYETTEVILLE
MOREHEAD CITY
CAPE HATTERAS
CAPE LOOKOUT
WILMINGTON
CAPE FEAR
CAPE ROMAIN
CHARLESTON
BEAUFORT
SAVANNAH
BRUNSWICK
JACKSONVILLE
ATLANTA
MONTGOMERY
JACKSON
MOBILE
PENSACOLA
DAUPHIN ISLAND
GULFPORT
BATON ROUGE
NEW ORLEANS
ST. MARKS
ST GEORGE ISLAND
MERRITT ISLAND
ST. PETERSBURG
PALM BEACH
SANIBEL ISLAND
EVERGLADES
MIAMI
DRY TORTUGAS
KEY WEST
DALLAS
HOUSTON
PORT ARTHUR
GALVESTON
MATAGORDA BAY
CORPUS CHRISTI
LAGUNA ATASCOSA
BROWNSVILLE
130-76
272-77
262-76
240-77
146-77
422-77
132-77
330-77
116-76
258-77
176-77
138-76
120-77
202-76
5,500-76
586-76
172-76
200-76
122-76
1,400-76
332-76
506-76
344-76
344-76
200-76
332-76
102-76
400-76
946-76
1,800-76
494-76
4,526-76
100-76
600-73
700-73
100-76
164-76
1,000-73
624-73
642-75
400-76
320-74
300-75
560-75
200-73
450-73
300-74
120-76
320-77
130-76
460-74
184-73
600-77
124-77
260-73
114-75
200-74
38°
36°
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24°
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94°
92°
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88°
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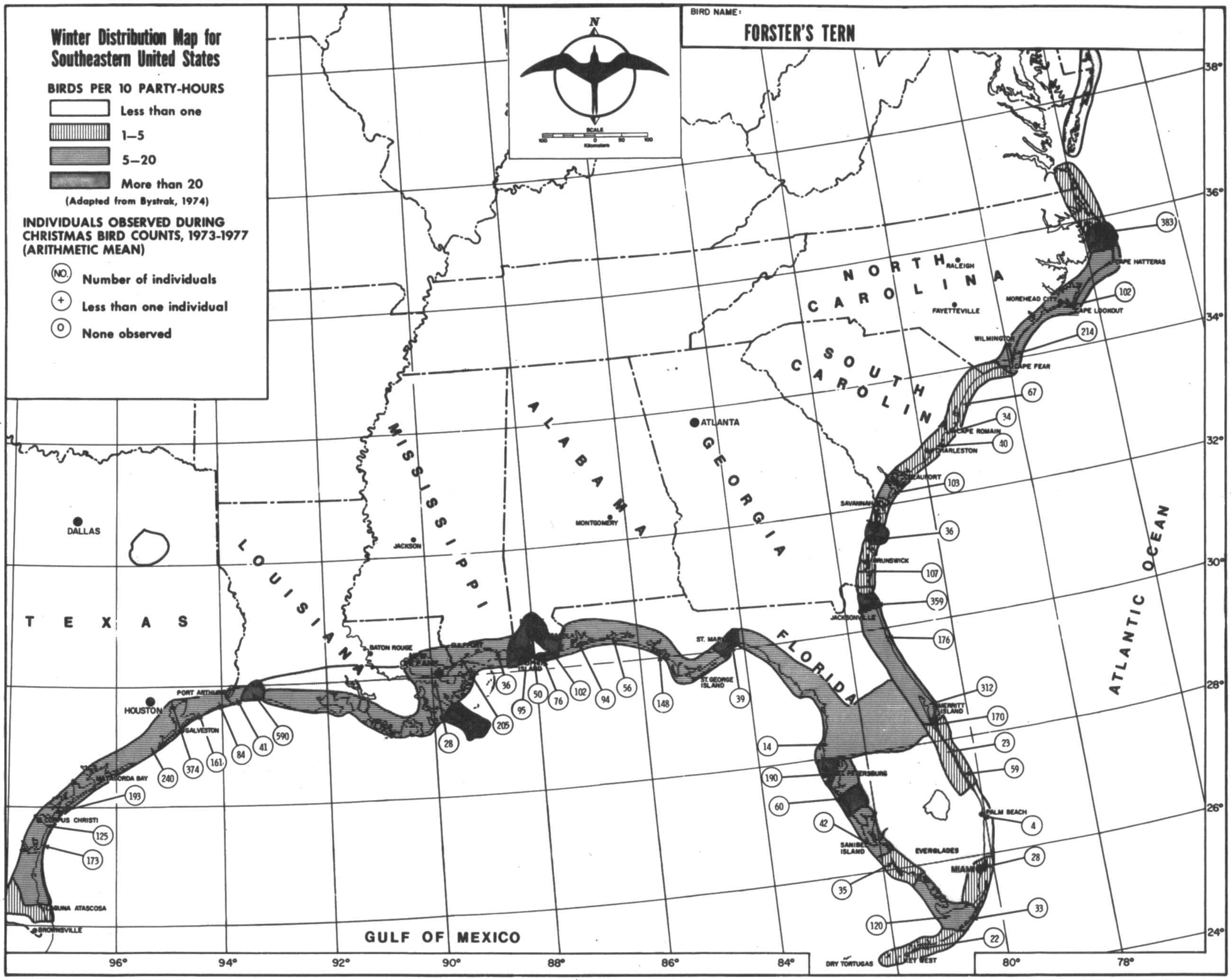
84°
80°
78°

Map 20


Winter Distribution Map for Southeastern United States
BIRDS PER 10 PARTY-HOURS
Less than one
1–5
5–20
More than 20
(Adapted from Bystrak, 1974)
INDIVIDUALS OBSERVED DURING CHRISTMAS BIRD COUNTS, 1973-1977 (ARITHMETIC MEAN)
NO.
Number of individuals
+
Less than one individual
0
None observed
N
SCALE
Kilometers
BIRD NAME:
FORSTER'S TERN
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI
LOUISIANA
TEXAS
FLORIDA
ATLANTIC OCEAN
GULF OF MEXICO
RALEIGH
FAYETTEVILLE
CAPE HATTERAS
MOREHEAD CITY
CAPE LOOKOUT
WILMINGTON
CAPE FEAR
CAPE ROMAIN
CHARLESTON
BEAUFORT
SAVANNAH
BRUNSWICK
JACKSONVILLE
MERRITT ISLAND
ST. PETERSBURG
SANIBEL ISLAND
EVERGLADES
PALM BEACH
MIAMI
KEY WEST
DRY TORTUGAS
ATLANTA
MONTGOMERY
JACKSON
BATON ROUGE
ST. MARKS
ST. GEORGE ISLAND
DALLAS
HOUSTON
PORT ARTHUR
GALVESTON
MATAGORDA BAY
CORPUS CHRISTI
LAGUNA ATASCOSA
BROWNSVILLE
383
102
214
67
34
40
103
36
107
359
176
312
170
23
59
4
28
33
22
120
35
42
60
190
14
39
148
56
94
102
76
50
95
36
205
28
590
41
84
161
374
240
193
125
173
38°
36°
34°
32°
30°
28°
26°
24°
96°
94°
92°
90°
88°
86°
84°
80°
78°

Map 21

Forster's Terns begin nesting by mid-May in North Carolina and flightless young may be present as late as late July or early August (Parnell and Soots 1979 ms). Colonies tend to be small and scattered. The 15 colonies censused in 1976 contained from 18 to 282 breeding birds (mean = 107.3) (Portnoy et al. 1981), and the 31 colonies found in 1977 contained from a single pair to 422 breeding birds (mean = 90.6) (Parnell and Soots 1979 ms). The mean size of the colonies in North Carolina is similar to, but somewhat larger than, the mean sizes of colonies found further north along the Atlantic coast. Erwin et al. (1981) reported means for colonies along the Delmarva Peninsula in 1976 and 1977 of 72 and 58 pairs, respectively, and means for colonies in New Jersey in 1978 and 1979 of 59 and 50, respectively. Median colony sizes, which are sometimes better measures of typical colony size, for these four years were 54, 49, 33, and 20, respectively. Median colony sizes for North Carolina fall within this range (47 and 48 for 1976 and 1977, respectively).

The three largest colonies found in 1976 were at Beacon Island, a marshy natural island with 282 breeding birds; an unnamed marshy island on the northern portion of Ocracoke Island with 262; and Tump Island with 138 breeding birds. These colonies were all in marsh and between them contained 42% of the breeding population. The three largest colonies found in 1977 were at Jack Shoal in Pea Island NWR, a marshy natural estuarine island with 422 breeding birds; at Beacon Island (330 breeding birds); and at a dredged material island at Hatteras Inlet (272 breeding birds). Between them, these colonies held 36% of the breeding population (Parnell and Soots 1979 ms).

Large numbers of Forster's Terns are present in North Carolina during fall migration from late July to November, with a peak from about late August through October or November. Few data are available on numbers occurring in migration, but observations of two concentrations of 1,000 birds or more (Table 62) suggest that numbers passing offshore may be substantially larger than can be accounted for by breeding populations to the north along the Atlantic coast. Forster's Terns are also common winter residents along the coast (Parnell and Soots 1979 ms, Map 21).

South Carolina Data on the abundance of Forster's Tern in South Carolina are sparse, but these terns occur regularly throughout the year. They are least common in summer and most common in winter (Sprunt and Chamberlain 1949). Forster's Terns are not known to breed in South Carolina at present, and there is only one satisfactory record of breeding in the past, based on three eggs collected 24 June 1940 at Bird Bank in Bull's Bay (Sprunt 1945).

Available data suggest that Forster's Terns follow the same pattern of occurrence in migration and winter in South Carolina as they do in North Carolina, but detailed information is lacking. In most winters Forster's Terns evidently are present in small numbers, but large flocks (Map 21) may occur sporadically (DuMont and DuMont 1973b). They are uncommon in spring when the few birds seen are probably those returning to nesting colonies in North Carolina and states to the north.

Georgia Forster's Terns do not breed in Georgia, but they are common winter residents (Burleigh 1958) and presumably are common on the coast in fall. They may arrive in early September, but peak numbers are not reached until November (Burleigh 1958). In 11 Christmas Bird Counts from 1958 to 1968 at Sapelo Island, the mean number of Forster's Terns seen was 107 (R.E. Hamilton 1969). This represented, on the average, 10.5% of the wintering larid population at this site.

Florida Forster's Terns are not known to breed in Florida, but they may occur irregularly at any time of year (Sprunt 1954). Kale (1979 ms a, 1979 ms b) regarded this species as abundant along both coasts in winter; peak populations are present from August to April or May.

Alabama Small numbers have nested in Mobile County in at least late June and July. This conclusion is based on only two nestings (Imhof 1976b) and the present breeding status in Alabama is poorly known. Forster's Terns become more abundant in the state on migration and during winter with the influx of birds from other areas (Map 21).

Mississippi Breeding of Forster's Terns in Mississippi has not been documented, but the species may breed there from time to time. Lovett Williams (in Portnoy 1977) found several hundred nests just over the state border in Louisiana in 1962, but no nests were found in Mississippi in 1976 (Portnoy 1977). Forster's Terns occur along the coast throughout the year, but are less abundant in mid-summer (June-early July) than during the fall. The largest numbers are present from late July through early November (Burleigh 1944).

Louisiana Louisiana has by far the largest concentration of nesting Forster's Terns in the southeastern United States and very likely in North America. Portnoy (1977) reported an estimated nesting population of 19,216 birds in 1976. The five largest colonies made up 73.8% of the total (Map 20), and the mean size of all colonies was much larger (mean = 565, median = 147, n = 34) than those found on the North Atlantic coast of the United States. Two of the colonies were extraordinarily large for this species. One containing about 5,500 breeding birds was found on Grassy Island in Lake Borgne on the Louisiana-Mississippi border, and the other, containing approximately 4,500 breeding birds, was found on Rabbit Island in Calcasieu Lake.

McNicholl's (1971) review of the biology of Forster's Tern showed that there is considerable variation in colony size. Colonies range in size from one to about 1,000 nests; larger colonies are exceptional. Colonies usually contain from 10 to 150 pairs. McNicholl also pointed out that some of the larger colonies that have been reported may have consisted of several discrete subcolonies with little or no social interaction between them.

Few data are available on the timing of the breeding season or on the breeding biology of Forster's Tern in Louisiana, but Oberholser (1938) indicated that it breeds from April to July and gave a range of egg dates from 24 April to 29 June. Portnoy (1977) found eggs from mid-March through late May in 1976.

Forster's Terns are common to abundant in winter and as migrants, and are somewhat less common, at least locally, during the summer (Oberholser 1938, Lowery 1974).

Texas Forster's Terns are common to fairly common along the Texas coast throughout the year (Oberholser 1974). They breed from early April to mid-July, and eggs have been recorded from 12 April through 10 June; dependent young have been reported through 11 July (Oberholser 1974).

Recent (1973-1978) breeding populations have varied from 3,140 in 1973 (Blacklock et al. 1978) to 5,828 in 1977 (Blacklock et al. 1978 ms). Most of the population breeds on the upper and central coasts. These areas contained 75.5% and 23.1%, respectively, of the birds censused from 1973 to 1976. Colonies are larger than along the North Atlantic seaboard, but are not as large as those in Louisiana. Seventy-seven colonies observed 1973-1976 by Blacklock et al. (1978) averaged 186 breeding birds (median = 100), and ranged in size from a single pair to 1,000 birds. (Colonies listed by Blacklock et al. may have subsumed one or more smaller colonies in some instances; consequently, the figures given here probably overstate mean and median colony size.)

The five principal breeding areas in 1976 contained about 63% of the breeding population. These colonies were found at Rollover Pass, Galveston County (ca. 500 breeding birds); on islands in West Galveston Bay (ca. 510); on West Bay Bird Island, Brazoria County (ca. 400); on a spoil island in Moses Lake, Galveston County (ca. 360); and in Neuces Bay, Neuces County (ca. 230).

Blacklock et al. (1978) believed that populations of Forster's Terns in Texas are slowly declining as a result of the effects of human disturbance and environmental pollutants. They mention unpublished work by Kirke King, who reported numerous dead young containing high levels of DDT and PCB at Texas coastal colonies.

Forster's Terns are common in migration along the Texas coast from late March to early June, and from late July to late October (Oberholser 1974). Peak numbers occur in August-September and March-April (Blacklock 1978 ms). In winter, Forster's Terns are common along the coast (Oberholser 1974).

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

Breeding Forster's Terns are Nearctic breeders in three discrete areas: in the Canadian Prairie Provinces south to California and across the northern U.S. as far east as Wisconsin and Iowa; on the Atlantic coast from New Jersey to North Carolina; and on the Gulf coast from Alabama through Texas. At present the species is not known to breed in South Carolina, Georgia, Florida and Mississippi but probably breeds in at least the latter. The breeding population in the southeastern U.S. in 1976 is estimated at about 24,000 birds (Table 63), but this total is based on scanty data and may not adequately represent the average number breeding in each state.

Table 63. Recent estimates of Forster's Tern populations nesting in the southeastern United States.

State	Number found breeding in 1976 (a)	Percent of southeastern breeding population	Maximum numbmr found breeding in recent years and year
North Carolina	1,610	6.7	2,810 (1977)
Louisiana	19,220	79.9	19,220 (1976)
Texas	3,240	13.5	8,620 (1973)
	24,070		

(a) Figures rounded to the nearest 10.

Surveys of the North Atlantic coast from Maine to Virginia in 1977 revealed a total of only about 4,160 breeding birds, about 930 in New Jersey, 1,040 in Maryland, and 2,190 in Virginia (Erwin 1979a). Some 1,328 bred in New Jersey in 1979 (not 1,167 as in Erwin et al. 1981 [Erwin, pers. comm.]).

Information on the size of breeding populations in other areas is incomplete or nonexistent. Some 6,000 birds breed in 13 colonies in the San Francisco Bay region (Gill and Mewaldt 1979). About 600 birds bred in the Great Lakes region during 1976, but only about 50 were found there the following year (Scharf 1978). The number breeding in the Prairie Provinces is unknown, but Forster's Terns are apparently more abundant in Manitoba than in provinces to the west (Gerrard and Whitfield 1971). Despite gaps in the data, it is apparent that the southeastern United States contains a substantial majority of the total number of breeding Forster's Terns.

Winter Forster's Terns winter commonly in the southeast, least abundantly in the northern portions of the southeast Atlantic coast and most abundantly on the Texas coast (Map 21). They also winter farther south on both coasts of Mexico and Guatemala. Terns from the San Francisco Bay area winter from coastal southern California to the southern Pacific coast of Mexico (Gill and Mewaldt 1979).

Migration Forster's Terns occur in migration throughout the southeast, but data on migration are few and there is little information based on marked birds. Table 62 gives information on numbers present during the peak of migration; they are considerably more abundant in the fall than in the spring on the Atlantic coast. Forster's Terns usually arrive on the breeding grounds several weeks before laying begins (Rockwell 1911, McNicholl 1971) and remain in the vicinity of the breeding area for some time after the young fledge.

HABITAT

Nesting Forster's Terns nest primarily in colonies in salt- and freshwater marshes. They typically nest in extensive marshy areas and are absent from small marshes (Bergman et al. 1970, McNicholl 1971). Marshy bays, marshy parts of islands, or marshy edges of streams all may be used. Secondary nesting habitats include sand or gravel bars, beaches, or grassy islands (McNicholl 1971). Forster's Terns prefer to nest in vegetated areas that are partly open to water. Eighty-nine percent of 111 nests examined at Delta, Manitoba, were in such partially open sites; none were in areas completely surrounded by vegetation (McNicholl 1971). Storey (1978) found that the nest sites of Forster's Terns in New Jersey, Maryland, and Virginia were significantly farther from open water than were those of marsh-nesting Common Terns. Forster's Terns also consistently nested on marsh areas that were not exposed to water to the northeast; most of the storms that cause the most nest destruction in this area come from the northeast.

Nests may be built on rafts of dead vegetation accumulated by wind or wave action, or they may be floating. The rafts are usually composed of reeds (*Scirpus*) or cattail (*Typha*), but other materials such as *Spartina*, sedges, seaweed, and algae have also been reported (McNicholl 1971). Muskrat (*Ondatra zibethicus*) houses were widely used as a nesting substrate in the Barr Lake region of Colorado (Rockwell 1911), in Iowa (Berman et al. 1970), and in Manitoba (McNicholl 1971).

In Iowa, 83.2% of 107 nests observed were on muskrat lodges, 11.2% were on floating rootstocks of cattail (*Typha angustifolia*) and 5.6% were on floating dead emergent vegetation. Nests were placed an average of 21.4 cm (8.4 in) above the water. Those on active and inactive muskrat lodges were on the average 29.8 cm (11.7 in) and 15.0 cm (5.9 in) above water, respectively. Those on floating cattails and floating dead emergent vegetation averaged 6.0 cm (2.4 in) and 4.7 cm (1.9 in) above water, respectively (Bergman et al. 1970). Similar differences in the heights of nests above water were found at Delta Marsh, Manitoba (McNicholl 1971). There, 41 nests on muskrat houses averaged 8.15 in (20.7 cm) above water, and 61 floating nests averaged 3.1 in (7.9 cm) above water. Overall, nests averaged 5.13 in (13.0 cm) above water. The lower average height in this study probably reflects the smaller proportion (40.2%) of nests found on muskrat houses by McNicholl (1971) than by Bergman et al. (1970).

Old, appropriated, or abandoned nests of Western Grebes (*Aechmophorus occidentalis*) or Pied-billed Grebes (*Podilymbus podiceps*) are also used as nest sites (McNicholl 1971). Birds in California frequently used dikes in evaporation ponds and dredge-spoil islets for nest sites (Sibley 1953, Gill and Mewaldt 1979). Nests along the northeastern portion of the U.S. Atlantic coast are found predominantly in natural marshes. Those observed in New Jersey by Buckley and McCaffrey (1978) were placed on wrack in salt marsh; none was on dredged material.

In the southeastern United States, Forster's Terns nest predominantly in natural marshy situations. Those nesting in North Carolina are usually found in marshes, on natural estuarine islands or in marshes adjacent to barrier beaches. Of the nests censused in 1977, 77% were in such habitats, and the rest were on man-made or man-modified sites (Parnell and Soots 1979 ms). About 30% of the nests were found on dredged-material sites the previous year (Portnoy et al. 1981). Most of the nests (75%) found by Parnell and Soots (1979 ms) were on wrack, drifted mats of smooth cordgrass (Spartina alterniflora), or eelgrass (Zostera marina). Most colonies were in smooth cordgrass marshes, but some were also found in saltmeadow cordgrass (Spartina patens) or sea oxeye (Borrichia frutescens).

Almost all nests in Louisiana are on wrack in marshy areas. Only 0.8% of the breeding birds censused in 1976 were on spoil deposits (Portnoy 1977). Most of the nests on wrack in marshes were in saline (63%) or brackish (35%) waters. Forster's Terns nest primarily on grassy islands in salt bays in Texas (Oberholser 1974). Most nests censused in 1976 and 1977 (59.3% and 74.1%, respectively) were in natural sites; the rest were on sites composed of dredged material (Chaney et al. 1978).

Feeding Breeding Forster's Terns feed over or near the marshes in which they nest. Those feeding at Elkhorn Slough, California, fed over the entire slough. However, they fed mostly over shallow water up to about 1 m (3 ft) deep over mudflats at flood tide (Baltz et al. 1979). Birds at a shallow saltpond on San Francisco Bay foraged over the entire pond but concentrated over the sloping south margin (Salt and Willard 1971). Salt and Willard believed that the terns chose this area because it was sheltered from the wind and provided better visibility for the foraging terns.

Nonbreeding and Offshore In the southeastern United States, wintering Forster's Terns are birds of coastal areas. They are seen inland only occasionally, except in Florida where they frequently occur along lakes and ponds (Sprunt 1954). They prefer harbors, marshy bays, estuaries, lagoons, and inlets (Sprunt and Chamberlain 1949, Burleigh 1958, Oberholser 1974, Imhof 1976b). Birds feed solitarily or in flocks, but we lack quantitative information.

The distance that Forster's Terns occur offshore is not well documented. Rowlett (1980) indicated that the few fall migrants seen in the northern Chesapeake Bight were found over shallow coastal waters within 20 km (12 mi) of shore. Some Forster's Terns have been reported considerably farther out at sea. Kale (1979 ms b) noted two observations from well off the Gulf coast of Florida--one of a single bird 29 mi (47 km) off Pinellas County in February, the other of a flock of "thousands" 80 mi (129 km) off Naples in November. Rowlett (1980) observed one bird 133 km (83 mi) east of Rehobeth Beach, Delaware, in August.

FOOD AND FEEDING BEHAVIOR

Salt and Willard (1971) presented the only detailed account of foraging of Forster's Terns. Most of their observations were made at a shallow (up to 1 m [3 ft] deep) evaporation pond on the north shore of San Francisco Bay. The terns fed solitarily or in loose groups, but never in coordinated flocks.

When winds were light (8-24 km/hr [5-15 mi/hr]) the terns flew slowly above the water, occasionally stopped to hover in one place, and then dove directly down to the water to seize fish. When winds were strong (over 33 km/hr [20 mi /hr]), the terns used an undulating flight in which they rose to heights of 18-27 m (60-90 ft) and then dove at an angle to the surface. Fish were seldom captured during strong winds.

When food was well dispersed these terns flew at about 6-8 m (19.7-26.2 ft) and infrequently hovered. They hovered continuously at 3-5 m (9.8-16.4 ft) when Salt and Willard (1971) believed the prey was densely concentrated. When fish were concentrated in one area because the pond had been drained to about 3-6 cm (1-2 in) deep, the terns remained within a few meters of the shore and hunted from a height of only 30 cm (12 in). All fish caught at this pond were within 30 cm of the surface.

Forster's Terns at Delta, Manitoba, also fed near the surface (McNicholl 1971). Diving Forster's Terns there usually did not submerge entirely and often only the bill and part of the head were immersed. Other authors (cited by McNicholl 1971) indicated that deeper dives may occur, but this does not appear to be well documented. McNicholl (1971) also noted that most foraging at Delta Marsh was done solitarily, but that as many as 30 terns were seen hovering over a large school of fish. Two other hunting techniques were noted: 1) foraging from perches and 2) hawking insects. Forster's Terns were often seen diving from perches directly into the water at Delta. Such foraging was usually done from posts, but in one instance a tern dove into the water from a perch on a telephone wire. McNicholl did not witness Forster's Terns hawking insects, but noted numerous references in the literature that indicated that this tern frequently does so, seizing prey in the air, or from the surface of the water, or from vegetation on the ground.

Salt and Willard (1971) analysed the feeding success of Forster's Terns near San Francisco Bay. They found that the percentage of fish captured per attempt varied throughout the year, with the highest success (39.4%) in November-December and the lowest in April-May (15.3%). Overall, 24% of all dives (n = 1,538) resulted in the capture of a fish. Hunting success (calculated as the number of fish-weight units captured per unit of hunting time) differed, ranging from 1.34 units/sec in April-May to 0.12 units/sec in December-January. Salt and Willard (1971) found no clear relationship between success in capturing fish and the amount of cloud cover. The results were the same for the entire season, but success was greater on cloudy days than on clear days during the spring, and lower in the summer and fall.

Little is known of the diet of Forster's Terns, and much of the available information is anecdotal. McNicholl (1971) made an exhaustive summary of scattered remarks in the literature and concluded that the diet consists mainly of small fish and insects, with a considerable proportion of the latter being aquatic in origin. Despite indications in the literature that Forster's Terns at times are strongly insectivorous, McNicholl (1971) presented convincing evidence that birds on the breeding grounds at Delta, Manitoba, are almost exclusively piscivorous.

Species of fish identified in the diet include sunfish (Lepomis sp.), peamouth (Mylocheilus caurinus), fathead minnow (Pimephales sp.), carp (Cyprinus carpio), and trout-perch (Percopsis omiscomaycus) (McNicholl 1971 and references therein). Insect food recorded includes dragonflies (Odonata), caddisflies (Trichoptera), and grasshoppers (Orthoptera). Crustacea and frogs are also occasionally taken (McNicholl 1971).

Aughey (1878) reported that the stomachs of two birds collected in Nebraska in May contained grasshoppers, fish remains, crayfish, and an unidentified lizard. McAtee and Beal (1912) reported the contents of 34 stomachs obtained in North America by the Bureau of Biological Survey. These contained, by volume, 98% fish and 2% crustaceans. The most important food was menhaden (Brevoortia tyrannus - 28.2%), which was found in the stomachs of birds collected in South Carolina in November, in Georgia in December, and in Florida in January. Silvery anchovies (Stolephorus sp. - 24.1%) were the next most important item in the diet, and had been eaten in Georgia and Florida from November through January. Freshwater minnows made up 20.5% of the diet. Other fish eaten to a lesser extent were Florida pompano (Trachinotus carolinus), round herring (Etrumeus teres), plains killifish (Fundulus zebrinus), and brook sticklebacks (Culaea inconstans).

Howell (1932) reported the contents of 63 stomachs collected by the Biological Survey that probably included those reported by McAtee and Beal (1912). Ninety percent contained silvery anchovies, menhaden, killifish, and "minnows." Fish eaten most frequently were anchovy, menhaden, and perch. Five of the stomachs contained insects, three had insect larvae and two had grasshoppers. One stomach contained a large shrimp.

Baltz et al. (1979) reported on the stomach contents of 15 Forster's Terns collected in July at Elkhorn Slough, Monterey County, California. Shiner perch (Cymatogaster aggregata) and northern anchovy (Engraulis mordax), most of which were juveniles, were taken with almost equal frequency and between them accounted for about 80% of the diet. A few adult arrow gobies (Clevelandia ios), one juvenile topsmelt (Atherinops affinis) and one night smelt (Spirinchus starksi) were also eaten. The mean size (standard length) of prey taken, calculated from otoliths found in stomachs, was 37.5 mm (1.5 in). Fish eaten at a pond near San Francisco Bay were about 1-10 cm (0.4-3.9 in) long (Salt and Willard 1971). The mean (estimated) length of the fish captured declined steadily from spring through fall. Few data are available on the size of fish eaten elsewhere.

IMPORTANT BIOLOGICAL PARAMETERS

Egg Laying Forster's Terns in North Carolina, Virginia, and New Jersey lay mostly in mid-May to mid-June, but those in Louisiana and Texas lay earlier and may start in April. Peak laying occurs in May and June in most parts of the range. In Iowa, Forster's Terns began nesting in the last week of May or the first week of June from 1966 to 1968 (Bergman et al. 1970). Nest initiation continued to mid-June in 1967, but the late nests evidently were second attempts by birds whose first nests were destroyed. Egg dates for Utah and Manitoba (Bent 1921) suggest that most laying there takes place in June, but laying occurred largely between mid- and late May at south San Francisco Bay in 1975, and a few eggs were laid as late as the first week of July (M. Coulter, pers. comm.).

Mean Clutch Size Clutches contain from 1-4 eggs, although 3-egg clutches are the most common (Coulter, pers. comm.; Rockwell 1911, Bergman et al. 1970, McNicholl 1971). Nests containing 5 or 6 eggs have been found, but these are believed to represent the efforts of two females. Data on mean clutch size are few and often inadequate (Table 64).

Table 64. Mean clutch sizes reported for the Forster's Tern (a).

Mean clutch size	Number of clutches	Locality and year of observation	Source
2.6	80	Manitoba, Forster's Bay	McNicholl 1971
2.5	92	Iowa, Rush Lake, Dan Green Slough	Bergman et al. 1970
2.80	35	California, south San Francisco Bay	Coulter, pers. comm,
2.01	61	Texas, island in Laguna Madre, 1977	Chaney et al. 1978
2.18	11	Texas, island in Rollover Bay, 1977	Chaney et al. 1978

(a) Some of these figures, derived from counts of contents of nests during short-term visits (e.g., Chaney et al. [1978]) do not adequately represent clutch size for the population because some nests may have been completed after the visit and others may have been lost previously.

Incubation Period In Iowa, the average incubation period for 11 nests was 24.2 days (Bergman et al. 1970). In Manitoba, 33 eggs averaged 24.21 days until the first sign of hatching was seen, with a range of 18 to 29 days. The mean breaking period (period from the first sign of hatching to emergence of the chick) for 32 of these eggs was 2.82 days (McNicholl 1971). Together, these periods suggest a mean incubation period of about 27 days. This figure may be somewhat high, however, because of overlap in the calculation of the two periods.

Hatching Success Little information is available on hatching success for Forster's Terns. In some studies, hatching success has been calculated only for colonies in which at least some eggs hatched with data from colonies that lost all eggs being excluded. Consequently, figures presented on hatching success for this species have overestimated this figure for the entire population. Judging from the scant data available to us, hatching success in Forster's Tern is low. Usually only a small proportion of eggs laid successfully hatch. McNicholl (1971) reported that 33 of 217 eggs hatched at Delta, Manitoba, a success rate of 15.2%. Chaney et al. (1978) reported hatching success of 12.5%

at one colony in Rollover Bay, Texas, but this figure is based a sample of only 24 eggs; other colonies observed on Jigsaw Island and Bulkhead Reef failed completely due to storm tides. Malcolm Coulter (in litt.) found an overall hatching success of 65.3% at 35 nests observed in south San Francisco Bay in 1975.

Age at Fledging Forster's Terns at San Francisco Bay fledged at 40 days (M. Coulter, pers. comm.), but Coulter believes that this was longer than usual because the birds were not well fed.

Fledging Success Adequate data on fledging success of Forster's Tern are unavailable. Bergman et al. (1970) reported a "nesting success" (proportion of nests in which at least one young hatched and evidently survived) of 12% for 107 nests in Iowa. (Data presented in Table 4 by Bergman et al. indicate that the nesting success of 4 nests was not determined. If 13 young fledged from the 103 nests whose success was known and these contained an average of 2.5 eggs, the fledging success [= number of eggs resulting in fledged young] was closer to 5%.)

Mortality of Eggs and Young At Delta, Manitoba, the main source of egg loss was daily wave action which washed eggs out of nests or piled floating vegetation on the nests and submerged them. Storms sometimes increased this loss. In 1968, 76% of eggs lost to known causes were lost to waves (McNicholl 1971). Heavy rains that resulted in high water in Iowa forced muskrats to add to their houses, resulting in the burial of the tern nests that were on top of the houses (Bergman et al. 1970).

Predation may be a factor in the loss of young, but there are few instances where this has been observed. Crows (Corvus sp.) have been observed killing an immature tern in New Hampshire (Finch 1968). Hawks, owls, and gulls probably also take eggs or young, but there is little direct evidence of this. Mink (Mustela vison) were thought to have caused some loss of young in Manitoba, but McNicholl (1971) regarded this species as only an occasional predator.

Because Forster's Terns usually nest in marshy habitats seldom visited by humans, disturbance is seldom a major factor in nesting failure. One exception, apparently caused by vandalism, was the total failure in 1976 of the colony at Grassy Island, Louisiana (Portnoy 1977). This colony was the largest in Louisiana and contained a breeding population almost equivalent to the total number found nesting along the North Atlantic coast of the United States during surveys in 1976 and 1977.

Renesting Although there were no marked adults in his study, McNicholl (1971) felt that his data strongly indicated that some of the Forster's Terns at Delta, Manitoba, "renested at least once, and possibly twice." Bergman et al. (1970) reported renesting after the loss of first nests in Iowa.

Age at First Breeding Unknown.

Maximum Natural Longevity A Forster's Tern banded and later recovered in Texas reached an age of 10 years and 3 months (Clapp et al. 1982a).

<u>Weights</u> We found very few published weights of Forster's Terns (Table 65).

Table 65. Weights (in grams) of Forster's Terns.

Mean Weight	Range	Number of birds	Sample and Season	Area	Source
128	----	1	males	Florida	Hartman 1955
119.3	115-123	3	females	Florida	Hartman 1955
30.0	----	1	dry, day-old chick	Manitoba	McNicholl 1971
21.3	18.6-23.7	11	fresh eggs	Manitoba	McNicholl 1971

SUSCEPTIBILITY TO OIL POLLUTION

Terns appear relatively insusceptible to direct mortality from oiling. We found no reports of oiled Forster's Terns and no reports of research on the secondary, indirect effects of oil on this species. Forster's Tern is a predominantly inshore species that makes frequent contact with the water when feeding. A large proportion of the world's population breeds and winters on the southeastern coast of the United States and in the Gulf of Mexico. Major instances of oil pollution in areas where these terns are abundant could have a disproportionately large effect on Forster's Tern, compared to the effect on more widely distributed species such as the Common Tern or Black Tern.

BIBLIOGRAPHY

<u>1983</u>

McNicholl, M. K. 1983. Hatching of Forster's Terns. Condor 85: 50-52.

<u>1982</u>

Cave, B. 1982. Forster's Tern: new to Britain and Ireland. Brit. Birds 75: 55-61.

Goossen, J. P., R. W. Butler, B. Stushnoff and D. Stirling. 1982. Distribution and breeding status of Forster's Tern, *Sterna forsteri*, in British Columbia. Can. Field-Nat. 96: 345-346.

Harris, B. 1982. 1981 gull and tern nesting in northeastern South Dakota. S. Dak. Bird Notes 34: 64-65.

McNicholl, M. K. 1982. Factors affecting reproductive success of Forster's Tern at Delta Marsh, Manitoba. Colonial Waterbirds 5: 32-38.

Reed, J. M., H. E. Hays and D. A. Zegers. 1982. Feeding behaviors and efficiencies of Common and Forster's Terns. Wilson Bull. 94: 567-569.

1981

Erwin, R. M., J. Galli and J. Burger. 1981. Colony site dynamics and habitat use in Atlantic coast seabirds. Auk 98: 550-561.

Harvey, T. E. 1981. The breeding ecology of Caspian and Forster's Terns in the Elkhorn Slough saltponds, California. (Abstract only.) Pac. Seabird Group Bull. 8: 93.

McNicholl, M. K. 1981. Interactions between Forster's Terns and Yellow-headed Blackbirds. Colonial Waterbirds 4: 150-154.

Raffaele, H. A. 1981. New records of bird species for Puerto Rico and one for the West Indies. Am. Birds 35: 142-143.

Zarudsky, J. 1981. Forster's Tern breeding on Long Island. Kingbird 31: 212-213.

1980

Brown, C. R. 1980. Recent winter records of Forster's Terns for Lake Texoma. Bull. Tex. Ornithol. Soc. 13: 25-26.

King, B. 1980. A Forster's Tern while in flight obtaining insects from the ground. Fla. Field Nat. 8: 48.

McNicholl, M. K. 1980. Territories of Forster's Terns. Proc. 1979 Conf. Colonial Waterbird Group 3: 196-203.

1979

Baltz, D. M., G. V. Morejohn and B. S. Antrim. 1979. Size selective predation and food habits of two California terns. West. Birds 10: 17-24.

Gill, R., Jr. and L. R. Mewaldt. 1979. Dispersal and migratory patterns of San Francisco Bay produced herons, egrets, and terns. N. Am. Bird Bander 4: 4-13.

McNicholl, M. K. 1979. Destruction to nesting birds on a marsh bay by a single storm. Prairie Nat. 11: 60-62.

1978

Storey, A. E. 1978. Adaptations in Common Terns and Forster's Terns for nesting in the salt marsh. Ph.D. thesis, Rutgers Univ./Newark, NJ. 194 pp.

Thompson, D. H. 1978. Declines in populations of colonial nesting waterbirds nesting within the floodplain of the upper Mississippi River. Proc. 1977 Conf. Colonial Waterbird Group 1: 26-37.

1976

Peck, G. K. 1976. Recent revisions to the list of Ontario's breeding birds. Ont. Field Biol. 30: 9-16.

1975

McNicholl, M. K. 1975a. Interactions between Forster's Terns and American Coots. Wilson Bull. 87: 109-110.

_____. 1975b. Forster's Tern--"Sea-swallows" of Delta Marsh. Manit. Nat. 16: 8-13.

1974

Armistead, H. T. 1974. Iceland Gulls, Forster's Terns nests, and breeding herons in Dorchester County, summer 1974. Md. Birdlife 30: 128-134.

Cruikshank, A. D. 1974. Field identification of difficult birds: II. Four similar terns. Fla. Field Nat. 2: 1-3.

Fussell, J. 1974. Forster's Tern nest found near Cape Lookout, N.C. Chat 38: 24.

1973

Davies, R. B., W. T. Burkhard and C. P. Hibler. 1973. Diplosomosis in North Park, Colorado. J. Wildl. Dis. 9: 362-367.

McNicholl, M. K. 1973a. Habituation of aggressive responses to avian predators by terns. Auk 90: 902-904.

_____. 1973b. Volume of Forster's Tern eggs. Auk 90: 915-917.

1972

Hatch, D. R. M. 1972. Breeding status of the Forster's Tern in Manitoba. Blue Jay 30: 102-104.

1971

Gerrard, J. M. and D. W. A. Whitfield. 1971. Breeding distribution of Forster's Tern in the prairie provinces. Blue Jay 29: 19-22.

McNicholl, M. K. 1971. The breeding biology and ecology of Forster's Tern (*Sterna forsteri*) at Delta, Manitoba. M.S. thesis, Univ. Manitoba/Winnipeg, MB. xiii and 652 pp.

Renaud, W. and D. Renaud. 1971. Another Saskatchewan colony of Forster's Tern. Blue Jay 29: 131.

Salt, G. W. and D. E. Willard. 1971. The hunting behavior and success of Forster's Tern. Ecology 52: 989-998.

Turnage, M., Jr. 1971. Forster's Tern feeding young in Pamlico County, N.C. Chat 35: 30.

1970

Bergman, R. D., P. Swain and M. W. Weller. 1970. A comparative study of nesting Forster's and Black Terns. Wilson Bull. 82: 435-444.

Grant, G. S. and J. Fussell, III. 1970. Forster's Terns summering in coastal North Carolina. Chat 34: 37-38.

1969

McNicholl, M. K. 1969. The courtship behaviour of Forster's Tern (*Sterna forsteri*) in Delta Marsh. Annu. Rep. Univ. Manit. Field Stn. Delta Marsh 4: 47-53.

1968

Finch, D. W. 1968. The changing seasons; the nesting season: June 1-August 15, 1968; Northeastern Maritime Region. Audubon Field Notes 22: 586-590.

1963

Gallup, F. 1963. Southward expansion of breeding range of Forster Tern on Pacific coast. Condor 65: 246.

Zuvanich, J. R. 1963. Forster Terns breeding in Kansas. Bull. Kansas Ornithol. Soc. 14: 1-3.

1961

Baird, J. 1961. A winter record of the Forster's Tern for Rhode Island. Wilson Bull. 73: 89.

Davis, D. G. 1961. Notes on a colony of Forster's Terns at Timnath Reservoir, Colorado. Condor 63: 341.

1960

Fox, E. 1960. Forster's Terns and Western Grebes nest at Regina. Blue Jay 18: 156.

1959

Chamberlain, J. L. 1959. A nesting colony of Forster's Terns and Black Skimmers in southwestern Louisiana. Wilson Bull. 71: 283-284.

1953

Sibley, C. G. 1953. Forster Terns breeding on San Francisco Bay, California. Condor 55: 278-279.

1945

Rogers, G. 1945. Forster's Tern in North Carolina. Auk 62: 457.

Sprunt, A., Jr. 1945. First nesting of Forster's Tern in South Carolina. Auk 62: 639.

1944

Clark, C. P. 1944. Forster's Tern in central-western Ohio. Auk 61: 474.

1941

Mitchell, E. T. 1941. Nesting of Forster's Tern in Hennipen County. Flicker 13: 19.

Nichols, M. N. 1941. Duck Hawk versus Forster Tern. Gull 23: 35-36.

1936

Campbell, L. W. and M. B. Trautman. 1936. The status of Forster's Tern in the western Lake Erie region of Ohio and Michigan. Auk 53: 213-214.

1935

Gromme, O. J. 1935. Forster's Tern (*Sterna forsteri*) breeding on the Lake Puckaway Marsh, Wisconsin. Auk 52: 86-87.

1933

Allen, F. H. 1933. Forster's Tern in Massachusetts again. Auk 50: 104.

Harris, A. T. 1933. The Forster Tern. Oologist 50: 31-32.

van Rossem, A. J. 1933. Terns as destroyers of birds' eggs. Condor 35: 49-51.

1929

Allen, F. H. 1929. Forster's Tern in Massachusetts. Auk 46: 100-101.

1928

Lincoln, F. C. 1928. Forster's Tern in the District of Columbia. Proc. Biol. Soc. Wash. 41: 209-210.

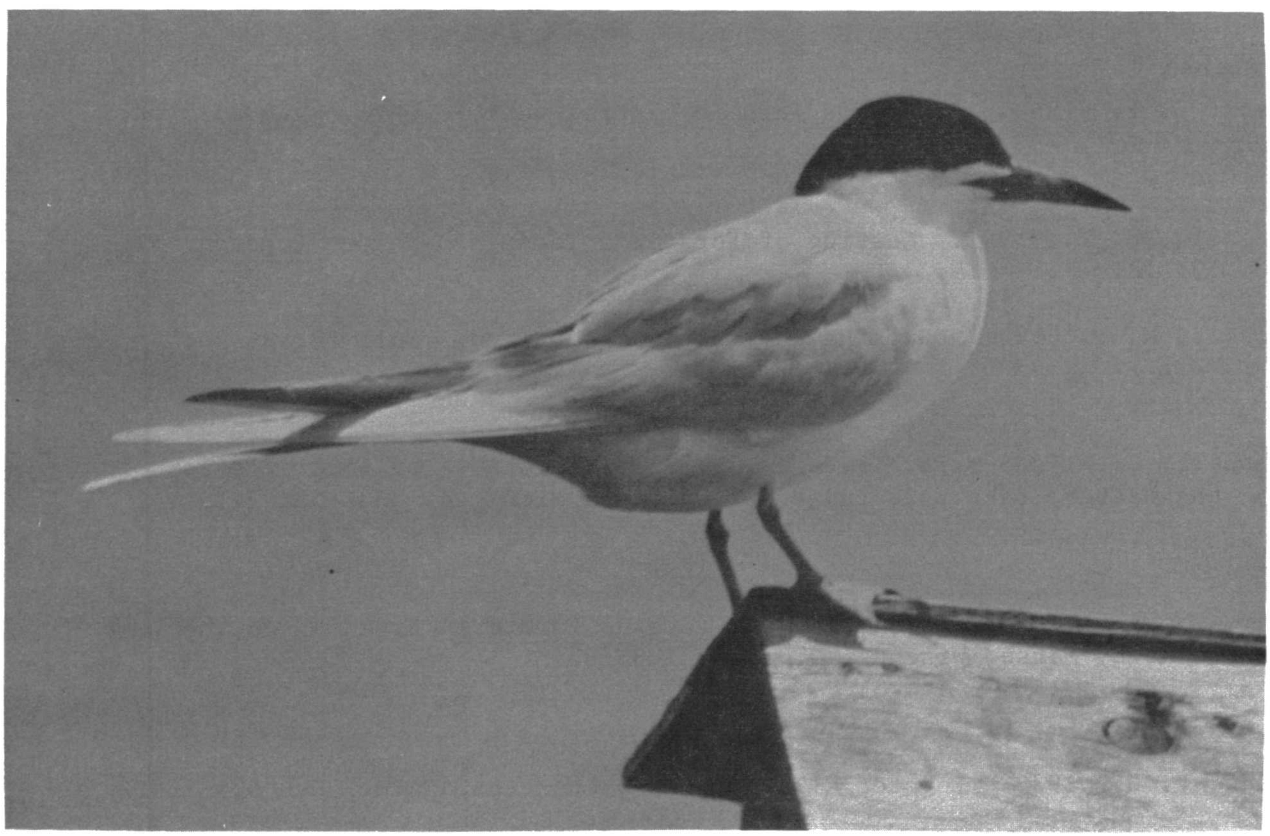
Trautman, M. B. 1928. Forster's Tern in Ohio. Auk 45: 200.

1911

Rockwell, R. B. 1911. Notes on the nesting of the Forster's and Black Terns in Colorado. Condor 13: 57-63.

1896

Peabody, P. B. 1896. A tern study. Osprey 1: 1-3.



Adult Forster's Tern in breeding plumage. Photograph by Roger B. Clapp.

LEAST TERN

(Sterna antillarum)

[DA: Dvaergterne, DU: Dwergzeezwaluw, Dwergstern; EN/US: Little Tern, FI: Pikkutiira, FR: Sterne naine, GE: Zwergseeschwalbe, IC: Dvergderna, IT: Fraticello, JA: Ko-ajisashi, NW: Dvergterne, PO: Rybitwa bialoczelna, SP: Charran minimo, Charrancito; SW: Smatarna]

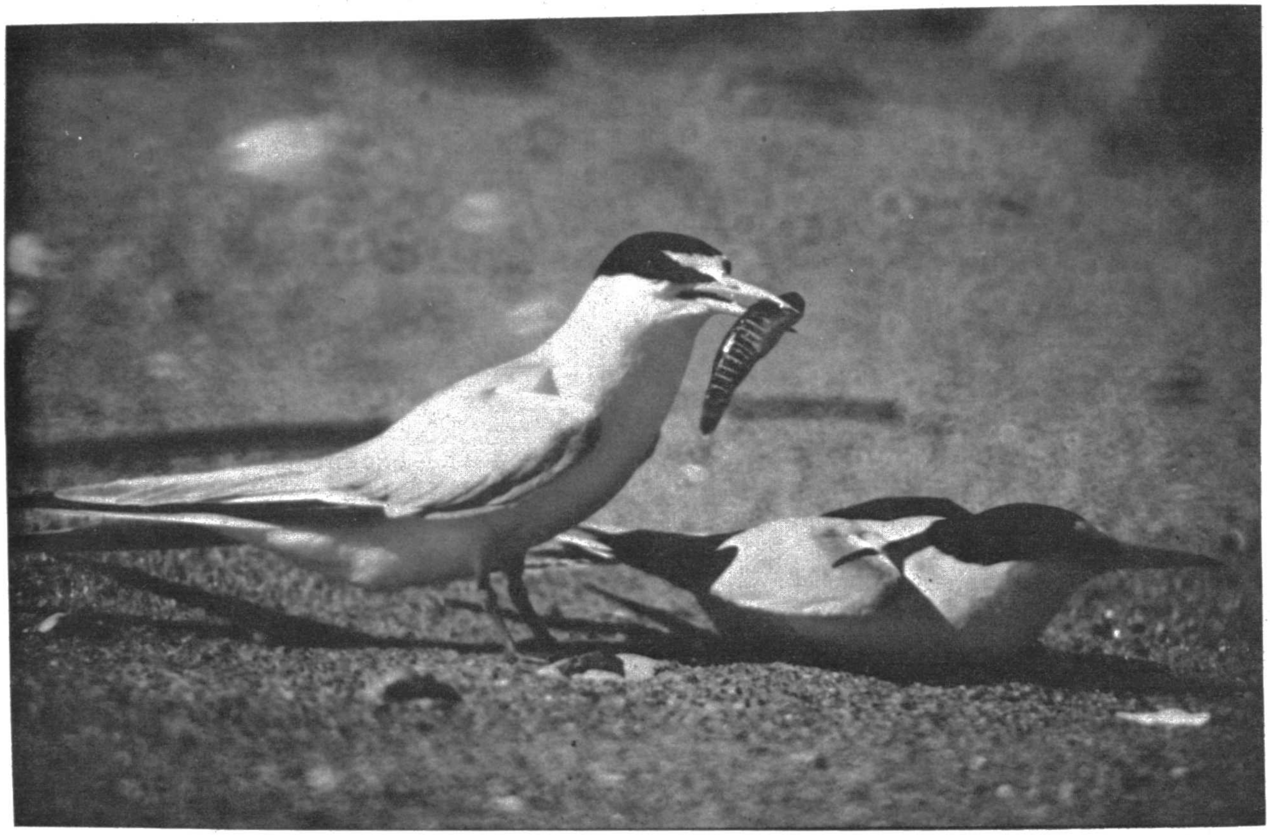
GENERAL DISTRIBUTION

North America Least Terns do not occur in Canada except as stragglers (Godfrey 1966) and most of the population breeds within the contiguous United States (Voous 1966). Within the United States there are two disjunct areas of concentration, one along the Pacific coast and the other in the interior and along the Atlantic and Gulf coasts. Along the Pacific coast these terns breed from the vicinity of Monterey County, California south to Baja California, Sonora, and Sinaloa, in extreme southeastern Chiapas (Small 1974, Blake 1977), and possibly elsewhere. In the central United States Least Terns breed along interior river systems from Nebraska south to New Mexico and east to northwestern Ohio and western Tennessee, thence south through northeastern Texas and central Louisiana (AOU 1957, Hubbard 1970). Along the Atlantic coast these terns breed locally from southwestern Maine south to the Florida Keys (Dry Tortugas) and west along the Gulf coast to at least Texas (AOU 1957, Woolfenden and Robertson 1974, Hunter 1975, Map 22).

Least Terns probably breed along the Gulf coast of Mexico as well (Paynter 1955, Selander et al. 1962), but there are few data from this area and other parts of their range in the tropics. On the Atlantic side of central America they breed off the coasts of at least Belize and Honduras (Russell 1964, Udvardy et al. 1973). They also breed in Bermuda, the Bahamas, and the West Indies (Blake 1977).

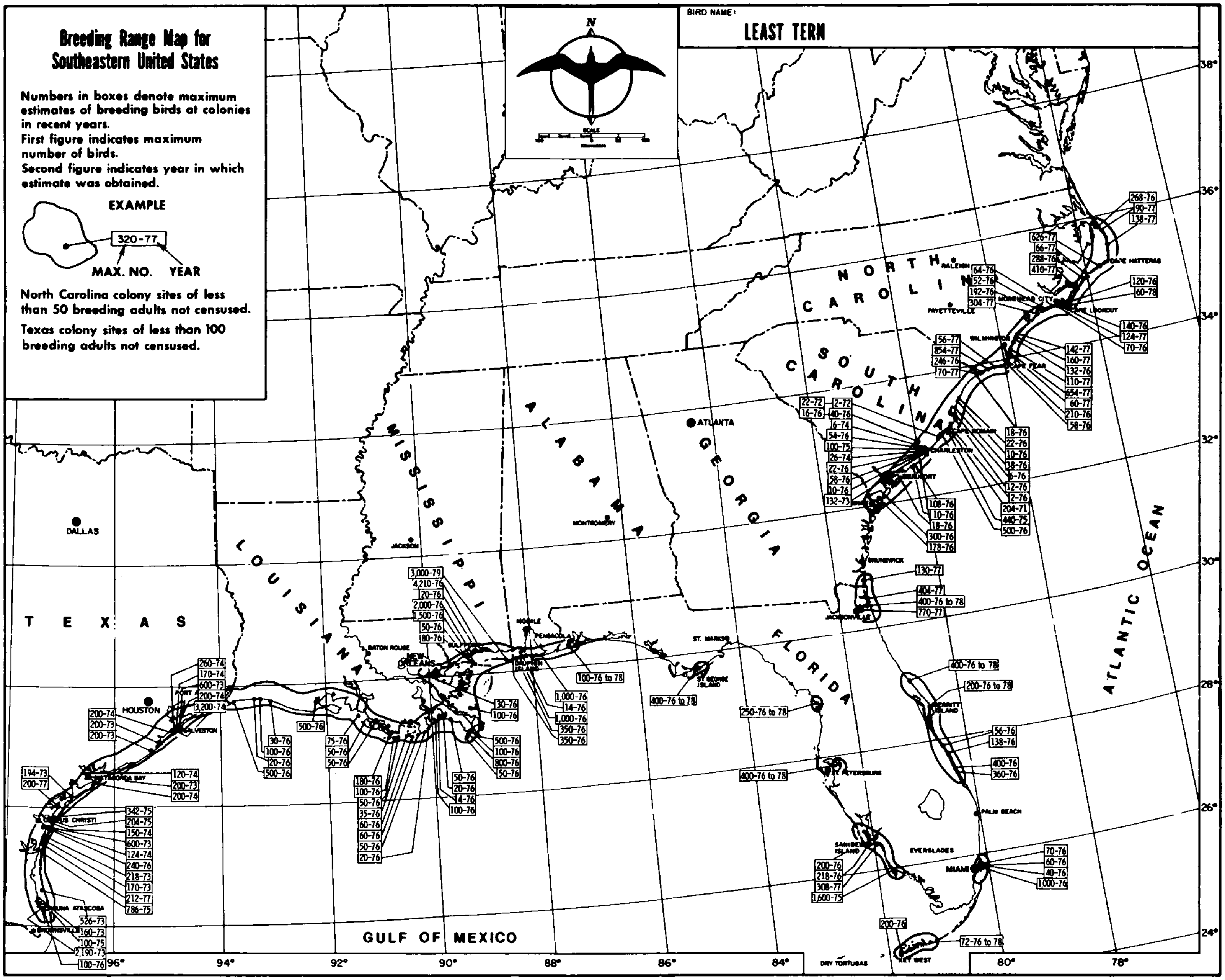
The winter range of Least Terns is poorly known but a portion of the North American population winters off the north coast of South America from Venezuela to northeastern Brazil (Blake 1977).

Taxonomic note: As a result of recent studies on vocalizations and behavior of "little" terns in the Old and New Worlds, the AOU Checklist Committee decided to treat the New World population as a distinct species. Formerly, it was considered a race of the Old World Little Tern (Sterna albifrons). Because much of the bibliographic information for this account was compiled prior to this decision, the species bibliography for the Least Tern contains a considerable amount of information dealing with the Old World species. Data on breeding biology and distribution in the present account, however, are confined to studies conducted in the New World.



Adult Least Terns in breeding plumage. Photograph by Clayton Taylor.

Adult Roseate Tern in breeding plumage. Photograph by Pat Lynch.


Breeding Range Map for Southeastern United States
Numbers in boxes denote maximum estimates of breeding birds at colonies in recent years.
First figure indicates maximum number of birds.
Second figure indicates year in which estimate was obtained.
EXAMPLE
320-77
MAX. NO.
YEAR
North Carolina colony sites of less than 50 breeding adults not censused.
Texas colony sites of less than 100 breeding adults not censused.
BIRD NAME:
LEAST TERN
N
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI
LOUISIANA
TEXAS
FLORIDA
ATLANTIC OCEAN
GULF OF MEXICO
DALLAS
HOUSTON
ATLANTA
JACKSON
MONTGOMERY
MOBILE
PENSACOLA
NEW ORLEANS
BATON ROUGE
RALEIGH
FAYETTEVILLE
CHARLESTON
JACKSONVILLE
MIAMI
KEY WEST
PALM BEACH
EVERGLADES
DRY TORTUGAS
96°
94°
92°
90°
88°
86°
84°
80°
78°
38°
36°
34°
32°
30°
28°
26°
24°

Map 22

World Distribution Least Terns also breed on islands off the coast of South America, in the Netherlands Antilles (Curacao, Aruba, Bonaire) (ffrench 1973), and on islands off Venezuela (Los Roques, Margarita) (Blake 1977).

DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

North Carolina Least Terns breed commonly along the North Carolina coast. They are most abundant there from April through October, with very few remaining in winter. Dates of arrival at Bogue Banks, 1972-1974, were 6-12 April, with most of the population present within two weeks (Moseley 1976). Egg laying has been reported from early May through mid-July (Parnell and Soots 1979 ms), but hatching noted as early as 12 May (Moseley 1976) indicates that some eggs may be laid as early as late April. Least Terns may remain at their breeding sites until late August (Parnell and Soots 1979 ms).

Knowledge of the size of Least Tern populations present in North Carolina in former years is scant. The species was nearly extirpated from the state by the feather trade at the beginning of the century but recovered to become a common resident on the coast in the 1940's (Pearson et al. 1942). Pearson et al. (1942) estimated that there were 25,000 Least Terns along the coast in 1939, a figure considered too high by Blus and Prouty (1979). Population estimates made during the early 1970's indicate populations of not much more than one or two thousand. In 1973, 2,275 were thought to occur in about 26 colonies (Downing 1973) but another report indicated a population of about 1,460 birds in 40 colonies (Soots and Parnell 1975a). The disparity between these estimates probably reflects both disparity in census methods and the difficulty with which this species is censused. In 1974, Fisk (1975) estimated that there were about 930 in 15 colonies.

Recent surveys indicate that the nesting population is considerably larger than was suggested by the earlier surveys. Portnoy et al. (1981) reported a breeding population of about 3,290 birds in 54 colonies in 1976, but Jernigan et al. (1978) reported an alternative estimate of 1,515 nests (3,030 birds) for 79 colonies for the same year. Twelve of the colonies reported by Portnoy et al. contained over 100 breeding birds and together accounted for 75.7% of the breeding population. The largest colonies were at Hatteras Inlet (562 birds) and on Portsmouth Island (283 birds). Parnell and Soots (1979 ms) found about 4,730 birds in 46 colonies in 1977. The largest colonies that year were at Monks Island (ca. 850 birds), Masonboro Inlet (650 birds), and Hatteras Inlet (630 birds).

South Carolina Sprunt and Chamberlain (1949) considered the Least Tern an abundant summer resident, found mostly from mid-March to late October. A few are seen in late December (Burton 1970), but the species is largely absent from South Carolina in winter. Most Least Terns occur along the coast, where most breeding occurs from mid-May through late July (Blus and Prouty 1979). Least Terns are seldom seen inland but on rare occasions have bred there at localities such as Lake Murray (110 mi [177 km] inland) (Burton 1970) and Lake Marion (65 mi [105 km] inland) (Post 1967).

During a study conducted in 1971-1975 (Blus and Prouty 1979) at Cape Romain NWR, eggs were found as early as 17 May and as late as 24 July. Young were recorded as early as 6 June.

Neither former or present populations are well known. At least 1,200 birds nested within 50 mi [80 km] of Charleston in 1927, and the population was probably even larger in subsequent years (Sprunt and Chamberlain 1949). Partial surveys of the South Carolina coast in 1974 and 1975 resulted in estimated populations of about 1,380 and 1,260, respectively (Fisk 1975; Fisk, pers. comm. in Blus and Prouty 1979). A census conducted in 1976 (Portnoy et al. 1981) revealed 1,186 birds breeding at 19 localities; over half the population was found in three colonies. One colony at Bird Island contained 500 birds, another on the Savannah NWR contained 178, and one on Kiawah Island contained 118. Blus and Prouty (1979) believed that populations in South Carolina have not declined since the 1940's, but they remarked that the present populations are not producing enough young to sustain themselves.

Georgia Burleigh (1958) regarded Least Terns as common in summer along the coast and only casual inland. Tomkins (1959) reported that most arrived about 18-20 April and departed by mid-September. Fresh eggs have been reported in the Savannah River delta between 5 May and 28 June (Burleigh 1958), and Tomkins (1959) reported that the first eggs are laid about 7 May.

The size of populations formerly nesting in the state is poorly known. Least Terns nested in large numbers on beaches on coastal islands prior to 1900, but by 1891 they were no longer known to breed (Burleigh 1958). About 5,000 Least Terns nested on Oysterbed Island in 1925 (Tomkins 1958), and more than 1,000 bred there in 1929, but by the early 1950's the species no longer nested there (Burleigh 1958). Tomkins (1958) attributed this decline to human modification of the environment that allowed predators access to the colonies.

Recent information on Least Tern populations in Georgia is limited, but apparently few nest in the state. Downing (1973) found four colonies in 1973. One colony on the beach at the south end of Cumberland Island had more than 200 breeding birds and another on spoil at Jekyll Island had about 120 terns. Two other small colonies, one on spoil along an interstate highway in Darien, the other on white salt flats in a marsh near Fort Pulaski, Savannah, held about 30 breeding birds between them. The following year, Fisk (1975) learned of only one colony in the state that held only two pairs. In 1976, only two colonies were found (Portnoy et al. 1981). These colonies, one at Long Point, the other at Willow Pond Beach, between them contained a total of 60 prenesting birds (Portnoy et al. 1981).

Florida - Atlantic Coast Least Terns breed along the Florida Atlantic coast but, as elsewhere in the southeast, they are largely absent during the winter. Most are present from late March or early April through mid-September and most breeding occurs from late April through July (Kale 1979 ms a). Some Florida Least Terns also breed inland at sites such as an abandoned strip mine 15 mi (24 km) inland in Jacksonville (Loftin 1973), on bare sand between canals about 60 mi (97 km) inland in Highland County (Lohrer and Lohrer 1973), and on roofs at Maitland (Fisk 1978a).

Recent numbers along the Atlantic coast are poorly known. Portnoy et al. (1981) reported three colonies with about 360 breeding birds as a result of a census of the coast in 1976, but this total seriously underestimates the total number of Least Terns breeding there. Downing (1973) estimated a minimum of 1,580 birds in 19 colonies along the Atlantic coast in 1973, and the following year Fisk (1975) reported 6,400 breeding birds in 59 colonies. In 1975, about 5,000 were found breeding in 52 colonies. About 1,200 of these nested in 16 colonies on rooftops in urban areas. Nesting on rooftops in eastern Florida has been documented at 33 different sites (Fisk 1978a).

The Least Tern is considered a "threatened" (i.e., likely to become endangered if present trends continue) species in Florida because its natural nesting habitat is rapidly being altered by development of beaches and offshore islands for human recreation and housing (Fisk 1978b).

Florida - Keys Hundreds to perhaps low thousands of Least Terns nested in the Dry Tortugas in the late 19th century and through about 1940 (Robertson 1964), but this species was not known to breed there from 1949 through 1972. The following year one fledged juvenile and two nests with eggs were found on Middle Key in early July (Woolfenden and Robertson 1974). Elsewhere in the Keys the Least Tern is a regular summer resident, but details on its status there through the years are poorly known. Least Terns in this area breed on small keys and near saltponds and are usually present from mid- or late April through late August or early September (Hundley and Hames 1960-62).

We have little information on the numbers nesting in the Keys in recent years. Downing (1973) estimated some 1,110 birds were present in 12 colonies in 1973. Most of these birds (ca. 800) were in four colonies on Key Largo and Cudjoe Key.

Florida - Gulf Coast Kale (1979 ms b) reported breeding as widespread along the west coast of Florida. Least Terns nest there in a variety of natural situations (spits, sand islands, and dunes) and on development spoil. Some also nest on rooftops in urban areas, but this adaptation is less prevalent than in the Atlantic coast population (Kale 1979 ms b).

We have poor data on populations of Least Terns breeding along the Gulf coast of Florida, but a considerable number breed there. In 1973, 2,000 or more breeding birds were present in 23 colonies (Downing 1973). Most nested on spoil resulting primarily from development of canals and other dredging activities. A few hundred birds were also reported nesting on beaches or natural dune islands. No colonies on rooftops were reported, but it seems likely that one or more existed. About six colonies were present on rooftops in St. Petersburg, Sarasota, and Pensacola in 1976, but the total number that bred in these colonies is unknown. The largest of these colonies with about 700 nesting birds was on the Longboat Key Apartment Building in Sarasota (Fisk 1978a).

Alabama Least Terns are common to abundant in summer along the Alabama coast and have been recorded there from 4 April to 11 October. Eggs and small young have been recorded from mid-May through late July (Imhof 1976b), implying a nesting season that lasts from at least April through August.

Few data exist on the total number breeding in the state. Portnoy (1977) reported 2,714 birds in five colonies in 1976. Four of these colonies were on Dauphin Island. The two largest contained about 1,000 breeding birds each.

Mississippi Least Terns are abundant breeding birds on the Mississippi coast (Map 22). They begin to return to the breeding colonies during the first ten days of April and are abundant by the middle of the month (Hays 1980). Early and late dates of egg laying during a 2-year study at the large colony at Gulfport were 28 April 1978 (Jackson and Cooley 1978b) and 15 June 1977 (Hays 1980); the mean hatching dates were very similar: 10 June 1977 and 11 June 1978 (Hays 1980). Young are present from at least late May through late August (Jackson et al. 1980), giving this species the most extended breeding season of any seabird nesting along the Mississippi Gulf coast. Birds depart for the wintering grounds beginning in late August and most have left the Gulf coast by mid- to late September (Hays 1980).

Scant historical information on the numbers breeding in Mississippi summarized by Jackson et al. (1980) suggests that Least Terns were formerly much less abundant in the state. In recent years, the bulk of the population has nested at Pass Christian and Gulfport on the Mississippi mainland. These two areas held about 2,000 nesting birds in 1975, 8,800 in 1976, and 8,400 in 1977 and 1978 (Hays 1980). During 1978, an additional 300-600 birds nested in about 10 colonies between Bay St. Louis and Biloxi (Hays 1980). Most bred on the mainland, but another 3,000 nested on spoil islands in Horn Island Pass (Jackson et al. 1980).

Louisiana In Louisiana, Least Terns are common migrants and summer residents present mostly from late March through late October (Lowery 1974). Eggs have been recorded from 23 May through 26 June (Oberholser 1938). Perhaps 1,200 Least Terns nested in the Chandeleurs in 1973 (Kennedy 1973), and 3,500 were reported on South Breton Island in 1974 (Kennedy 1974). Portnoy (1977) estimated 3,630 breeding birds in 25 colonies in a 1976 survey. Colonies on spoil ranged from 50 to 800 breeding birds (mean = 337.5); those on beaches tended to be smaller and ranged in size from 20 to 500 (mean = 87.5). At present we have neither an adequate notion of the average numbers breeding nor of the annual variation.

Texas Least Terns breed commonly along the Texas coast and uncommonly to rarely in north-central Texas. They occur only casually along the coast in winter. Most breeding occurs from early April to early August; transients are present from early March to early June, and from early July to December (Oberholser 1974).

Populations have declined rapidly in recent years. Blacklock et al. (1978 ms) considered Least Terns to be "one of the most threatened species in

Texas." Numbers recorded from 1973 through 1978 (ca. 8,610, 5,080, 3,590, 770, 730, 1,480) show an alarming decrease. Most of the population breeds on the upper and central coasts, and the upper coast shows the largest drop in numbers. Populations on the upper coast decreased about 75%, from a mean of about 4,180 birds in 1973-1974 to 1,030 in 1975-76 (Blacklock et al. 1978). During these periods, the decrease on the central and southern coasts was about 20% and 88%, respectively, but the latter area has not held a large number of breeding birds since 1973. During these years the largest colony was at Tiki Island in Galveston County. This colony contained about 3,200 breeding birds in 1974 but only 112 in 1976.

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

Breeding Least Terns breed only in the New World, nesting largely in coastal areas from Maine south to islands off northern South America in the western Atlantic and Gulf of Mexico and south from California to at least southeastern Chiapas in Mexico along the Pacific coast. Some breed or once bred in Bermuda and the Bahamas, and small numbers nest in the interior of North America.

Because Least Terns are considered threatened or endangered in many portions of their breeding range, considerable efforts have been made to census their populations. About 15,250 breeding Least Terns were censused along the U.S. North Atlantic coast from Maine to Virginia in 1977 (ca. 40 in Maine [Korschgen 1979], 3,100 in Massachusetts, 90 in Rhode Island, 240 in Connecticut, 5,770 on Long Island, New York, 3,570 in New Jersey, 330 in Delaware, 420 in Maryland, and 1,680 in Virginia [Erwin 1979a]). These figures are the result of only one survey and may not adequately represent the number of Least Terns usually breeding in each area. Different methods of censusing also may result in different totals for the same area in the same year. On Long Island, New York, for example, Buckley and Buckley (1980b) reported about 4,380 breeding Least Terns at 29 colonies in 1977, compared with Erwin's figure of ca. 5,770 for 36 colonies during the same year. Buckley and Buckley also reported a maximum population of ca. 5,260 birds in 34 colonies in 1975 and a mean breeding population of 4,500 birds for the period 1974-1978.

Only very small populations of the Interior Least Tern (*Sterna antillarum athalassos*) still remain. Downing (1980) estimated a population of 1,250 in 1974-75, based on 616 birds actually seen. The bulk of the birds actually seen were on the Mississippi (48.7%), Niobrara (13.8%), Platte (13.0%), Cimarron (6.5%), and Missouri (5.7%) Rivers. Downing (1980) indicated that the largest population, found on the Mississippi in a 150 mi (240 km) stretch between Osceola, Arkansas, and Cairo, Illinois, could be threatened by dredging activities and suggested that "the Interior Least Tern may have to be 'listed' by the Office of Endangered Species before the importance of maintaining habitat by altering dredging plans is fully appreciated by the managing agencies." He also pointed out that the Niobrara River was the only interior population not seriously threatened by habitat alteration.

Populations of the endangered California Least Tern (Sterna a. browni) are also small. About 1,550 bred in California at about 29 sites in 1977 (Atwood et al. 1977 in USNFWL 1980). Massey (1977) reported several breeding localities along the west coast of Baja California; the total number breeding there is not known but apparently is minimal. We do not know the sizes of two other populations (S. a. mexicana, S. a. staebleri) breeding in western Mexico (Blake 1977) and we lack good data on other populations.

An examination of Table 66 suggests that the southeastern United States contains at least half the total North American population. The disparity between the total estimate for 1976 and other estimates in recent years relects in part recent declines in nesting populations (e.g., in Texas) and in part the insufficiency of some recent population data.

Winter Least Terns from eastern North America winter along the coasts of South America from Venezuela to Brazil. An October band recovery in Trinidad of a juvenile banded in New Jersey (ffrench 1973) indicates that some may winter in the Caribbean. The winter range of birds that nest along the Pacific coast is uncertain (Blake 1977).

Migration Little is known of migratory routes of the Least Tern in North America. Large concentrations seen on the Gulf coast (e.g., 3,000+ at Dauphin Island, Alabama, on 31 August [Imhof 1976b]; 766 and 600+ on the Texas coast on 3 August and 15 September, respectively [Webster 1968a, 1975a]) suggest a coastal route for a proportion of the population.

HABITAT

Nesting Least Terns usually nest on beaches, sandbars, dredge spoil, or other bare areas that are covered with sand, dirt, mud, broken shells, small stones, gravel, or shingle. They prefer areas devoid of vegetation, but will nest in sparsely vegetated areas as well (Moseley 1976). Because they are particularly prone to nest in "fresh" habitats in an early stage of succession, Least Terns often colonize bare man-made habitats such as dredge-spoil islands. Jernigan et al. (1978) found that approximately 72% of all nests in North Carolina were on dredged islands.

Jernigan et al. (1978) described in detail the nesting habitats used in North Carolina in 1976. Nests were found on four different kinds of sites: dredged islands, barrier islands, mainland, and natural estuarine islands. Most nests (71.7%, n = 1,515) were on dredged islands and only a few were on estuarine islands (0.1%) or on the mainland (0.5%). Proximity to water influences nest-site selection. The distance to the nearest water ranged from 1-245 m (3-804 ft), but the mean was only 41.5 m (136 ft). Nests were more often found in less exposed areas (e.g., flats behind dunes, protected slopes). Perhaps as a result of this, the average elevation above the high tide mark for all colonies was 1.24 m (3.8 ft).

Least Terns in North Carolina show a distinct preference for certain nest-

Table 66. Recent estimates of Least Tern populations nesting in the southeastern United States.

State	Number found breeding in 1976 (a)	Percent of southeastern breeding population	Maximum number found breeding in recent years and year
North Carolina	3,290	12.9	4,730 (1977)
South Carolina	1,190	4.7	1,380 (1974)
Georgia	230	0.9	350 (1973)
Florida-Atlantic Coast (b)	3,120 ?	12.2	6,400 (1975)
Florida-Keys (b)	270 ?	1.1	1,100 (1973)
Florida-Gulf Coast (b)	1,570 ?	6.1	2,000 (1973)
Alabama	2,710	10.6	2,710 (1976)
Mississippi (c)	8,800	34.4	11,000 (1979)
Louisiana	3,630	14.2	3,630 (1976)
Texas	760	3.0	8,620 (1973)
	25,570		

(a) Numbers rounded to the nearest 10.
(b) We have no adequate data available for 1976 for Florida and as a crude estimate have used individual colony estimates for 1976 and 1976-78 as presented on Map 22. These "totals" probably underestimate the populations breeding in these areas in 1976.
(c) A survey conducted by Portnoy (1977) in 1976 resulted in an estimate of about 7,960 breeding birds in six colonies. We use the figure given by Hays (1980), which agrees closely with the total population of about 8,500 birds suggested by Jackson et al. (1980).

ing substrates. Fifty-three percent of all colonies were found in areas where large, whole shells were on sand (Jernigan et al. 1978). Another 40% were dominated by medium-sized shells, by shell fragments and sand, or by small shells and sand. Areas dominated by small pebbles or which were pure sand were avoided, probably because such exposed sites offered little protection to incubating birds. Vegetation in the North Carolina colonies was sparse. More than 80% of the colonies had from 0 to 9% cover, with a maximum of 40%. Plants were characteristically short, with heights up to 40 cm (16 in) and averaged 7 cm (3 in). Species of plants most commonly found in the Least Tern colonies include: *Oenethera humifusa* (most common in 22% of the colonies examined), *Conyza canadensis* (18%), *Heterotheca subaxillaris* (15%), and *Uniola paniculata* (9%).

Most of the Least Terns breeding in South Carolina in 1976 nested on coastal islands (44.0%), barrier beaches (25.4%), and on marsh sites (21.8%), but 104 birds (8.8%) were found nesting in two colonies on rooftops in Charleston. Ten out of 19 colonies were on barrier beaches, 5 were in marshes, and 4 were on coastal islands (Portnoy et al. 1981).

Habitat requirements in Mississippi are similar to those elsewhere in the southeast. Hays (1980) stated that suitable habitat consists of flat, open, unvegetated areas of sand or shell, near the water but above high tide and with sparse vegetation or flotsam to provide shelter for chicks after they leave the nest. In Hays' study area at Gulfport, the nesting habitat consisted of dredged-sand beach on the mainland.

A majority (55.8%, n = 3,630) of the Least Terns breeding in Lousiana in 1976 nested on spoil, but most of the colonies (72%, n = 25) were found on beaches (Portnoy 1977). In Texas Least Terns nest most commonly on beaches and shell reefs, but they also use parking lots and road shoulders (Blacklock et al. 1978 ms).

Because of wholesale destruction of their nesting habitat, Least Terns began nesting on rooftops in some areas of the southeastern United States. Such nest sites have been reported with some frequency from Florida (Fisk 1975), and are occasionally used in Louisiana (Lowery 1974; Bradburn, pers. comm. in Hays 1980), Mississippi (Weber and Jackson 1977), and South Carolina (Fisk in Blus and Prouty 1979).

Along river systems Interior Least Terns use sandbars as nest sites. The sandbars may be either in mid-stream and isolated from shore or may be spits extending out into the river (Downing 1973). Hardy (1957) implied that the occurrence on river systems of Least Terns as breeding birds depends on (1) the presence of sandbars; (2) favorable water levels during the nesting season; and (3) sufficient food.

USNFWL (1980), summarizing earlier studies, described the nesting requirements of California Least Terns as undisturbed flat areas of loose substrate with little or no vegetation. Specific sites mentioned were sandy upper beaches and open expanses of dirt or dried mud. Massey (1971 in Moseley 1976) indicated that the three requirements for successful nesting for this race are a long strip of open sand, an adjacent plentiful source of small fish, and freedom from predation and disturbance. Proximity to feeding areas is also a prerequisite for Least Terns nesting along the Atlantic coast. Jernigan et al. (1978) found that 95% of all colonies found in North Carolina were located within 100 m (330 ft) of foraging areas.

Feeding Breeding Least Terns forage primarily over shallow inshore waters near their colonies. Those breeding on Nantucket, Massachusetts, fed just beyond the breakers, but they also fed in the interior of the island in creeks and ponds in the tidal marshes, and on a freshwater pond (Burroughs 1966). Birds observed during the breeding season in Virginia preferred to feed in shallow marsh channels and inlets and were not seen at observation stations 13 and 21 km (8 and 13 mi) away from shore (Erwin 1978b). Those breeding at Bogue Banks, North Carolina, fed in Bogue Sound, 200 m (660 ft) north of the colony, in a tidal creek in a nearby Spartina marsh (50 m [160 ft] south), and in the Atlantic Ocean (750 m [2,460 ft] south) (Moseley 1976). Tomkins (1959) reported that Least Terns at Oysterbed Island, Georgia, had "a maximum range of 16,000 feet [5 km] from which they carried food to the colony." Those nesting near Gulfport, Mississippi, fed mostly in shallow gulf waters near the mainland colony, but others fed as much as 4.8-8.0 km (3.0-5.0 mi) out in the Gulf. They also occasionally fed over brackish bayous in the marshes and on a small freshwater pond (Hays 1980).

Interior Least Terns breeding at Bell Island in the Ohio River fed almost entirely in shallow waters near the colony, mostly on the mainstream side (Hardy 1957). A similar preference for feeding in shallow water has been reported for Least Terns in New York and California (D. Duffy and B. Massey in Erwin 1978b). Moseley (1976) remarked that Least Terns usually fed in water less than 4 m (13 ft) deep.

Nonbreeding and Offshore Prebreeding Least Terns at Huntington Beach, California, often roost in small flocks of 20-30 birds and forage in groups of 8-20 up to a quarter-mile (400 m) offshore (Davis 1968). Similar prebreeding flocks have also been seen in North Carolina (Moseley 1976) and elsewhere. Postbreeding birds also gather in small flocks near the breeding area and then use beaches, spits, and other roosting areas.

The few data available indicating the extent to which nonbreeding Least Terns occur offshore suggest that this species tends to remain inshore. Rowlett (1980) noted that Least Terns in the southern Chesapeake Bight usually foraged over shallow inshore waters within 20 km (12 mi) of shore. Transient birds may occur farther out at sea. Several thought to be migrating in early June and late July off Pinellas County, Florida, were 32 mi (52 km) and 65 mi (105 km) from shore, respectively (Kale 1979 ms b).

FOOD AND FEEDING BEHAVIOR

Least Terns feed by plunge-diving and by dipping. Most birds forage by flying slowly about 10-15 m (30-50 ft) above the water with the bill pointed downward. When prey is seen the tern dives vertically, plunging into the water. The entire body or only the head and bill may be immersed (Schonert 1961 in Moseley 1976). Interior Least Terns observed on the Ohio River hovered from a few to 10 ft (3 m) above the water and usually only partially submerged following a dive (Hardy 1957). Least Terns feeding over newly plowed fields in Kleberg County, Texas, hover at about 10-20 ft (3-6 m) above the ground and then dive to pick their prey (thought to be beetle larvae) from the surface while remaining in flight (McDaniel and McDaniel 1963).

Least Terns usually forage alone or in small flocks. Those in Virginia most often forage alone or in pairs. During May-July 1974, 13 of 18 observations of feeding birds involved one or two birds; the rest were of groups of 2-10 birds (Erwin 1978b). Birds feeding along the Ohio River often fed in groups of 2-4, but were never seen in large flocks (Hardy 1957). Most feeding of young at Huntington Beach, California occurred in the late morning (10-12 AM) and in the late afternoon (3-5 PM) (Davis 1968).

Least Terns feed largely on small fish, to a much lesser extent on crustaceans, and occasionally on insects. Little detailed information on the diet of Least Terns in different areas of North America is available. McAtee and Beal (1912) reported the stomach contents of 49 Least Terns collected in May and June from New Jersey to Florida, and in Louisiana. Most of the food identified was silvery anchovies (*Stolephorus*), Atlantic menhaden (*Brevoortia tyrannus*), mummichogs (*Fundulus*), and silversides (*Menidia*); a few crustacea had also been eaten. Some additional data are summarized by area below, and other information on the diet of this species can be found in the references in the species bibliography.

Massachusetts Burroughs (1966) reported that 10 of 12 fish found in one colony were mostly two species of hake (*Urophycis* spp.). Two were herring (*Clupea* sp.). Only one of these fish was longer than 1.5 in (3.8 cm). Least Terns were also seen feeding over a freshwater pond known to contain only golden shiner (*Notemigonus chrysoleucas*).

North Carolina The diet of young at Bogue Banks consisted solely of small fish about 2-7 cm (0.8-3 in) long; fish fed to newly-hatched young were smaller (2-4 cm [0.8-1.6 in]) than those (5-8 cm [2-3 in]) fed to adults during courtship (Moseley 1976). Two fish dropped by adults feeding chicks were identified as bay anchovy (*Anchoa mitchilli*) and bluefish (*Pomatomus saltatrix*) (Moseley 1976).

Mississippi Ten species were found among the 60 specimens of fishes found discarded in a Least Tern colony at Gulfport, with Gulf menhaden (*Brevoortia patronus* - 60.7%) and bay anchovy (10.0%) found most frequently (Hays 1980). No more than two specimens each were found of Atlantic bumper (*Chloroscombrus chrysurus*), spot (*Leiostomus xanthurus*), largemouth bass (*Micropterus salmoides*), bay whiff (*Citharichthys spilopterus*), inland silverside (*Menidia beryllina*), seatrout (*Cynascion* sp.) and croaker (*Micropogonias undulatus*). The only species that Hays saw Least Terns actually eating was bay anchovy.

Illinois Hardy (1957) reported that "the dominant food fish near the bar [where Least Terns nested] was the river shiner (*Notropis blennius*)."

California Fish found by Swickard (1972) discarded at Camp Pendleton suggest that these Least Terns fed on top smelt (*Atherinops affinis*), deepbody anchovy (*Anchoa compressa*), California killifish (*Fundulus parvipennis*), Pacific staghorn sculpin (*Leptocottus armatus*), and dwarf perch (*Micrometrus minimus*). Fish discarded at a colony in Huntington Beach led Massey (1974) to conclude that the principal foods there were northern anchovy (*Engraulis mordax*), shiner perch (*Cymatogaster aggregata*), and topsmelt (*Atherinops affinis*). Observations summarized by the USNFWL (1980) indicate that the California Least Tern may feed upon jacksmelt (*Atherinopsis californiensis*), California grunion (*Leuresthes tenuis*), and mosquitofish (*Gambusia affinis*).

IMPORTANT BIOLOGICAL PARAMETERS

Egg Laying Most Least Terns in the southeastern United States begin laying in May, but loss of eggs and subsequent renesting may extend laying into July. Laying elsewhere in the United States usually beings in May. Egg laying in California usually begins during the first two weeks of May and finishes within two weeks. This laying period is often followed by a more protracted period in mid-June from which young may hatch as late as August (Massey and Atwood 1981).

Mean Clutch Size Least Terns usually lay one to three eggs, but clutches of four (Hardy 1957, Swickard 1972, Toups in Hays 1980,) and five eggs (Swickard 1972) have also been reported. Mean clutch size is usually on the order of 1.8 to 2.2 (Table 67). Two-egg clutches are the most frequent in most areas (e.g., in New York [Houde 1977a], North Carolina [Moseley 1976], South Carolina [Blus and Prouty 1979], Mississippi [Hays 1980], and California [Swickard 1972, Massey 1974, Massey and Atwood 1981]). In these seven studies 53% to 83% of all clutches found contained 2 eggs.

Hardy (1957) reported that Interior Least Terns lay one to four eggs with clutches of two or three most frequent. He also suggested that Least Terns tend to lay 3-egg clutches in the northern portion of the range, and 2-egg clutches in the south. Our data (Table 67) are not sufficient to show any significant geographic variation in clutch size.

Late-nesting Least Terns in California lay smaller clutches than those that nest early (Table 67). These late birds apparently include not only terns that are renesting, but also birds breeding for the first time (Massey and Atwood 1981).

Incubation Period The incubation period of the Least Tern throughout the United States is about three weeks. Hagar (1937) reported that the usual incubation period for Least Terns in Massachusetts is normally 20-23 days and gave a range of 19-24 days (n = 33). Incubation periods at 16 nests in Mississippi averaged 21 days (Hays 1980). The incubation period at 41 nests of the California Least Tern was 21-25 days, with a peak at 22 days (Massey 1974); one exceptional incubation period was over 28 days long. Davis (1968) reported that the first egg laid at one nest at Huntington Beach, California, hatched 21 days later.

Hatching Success Hatching success varies drastically in Least Terns (Table 68), partly because of the ease with which colonies may be disrupted by environmental and human perturbations. When the weather is good and disturbance is minimal, hatching success is usually high. Some information (Table 68) suggests that hatching success is higher in 2-egg clutches than in clutches of other sizes and that late-nesting birds have a lower hatching success.

Age at Fledging Scattered evidence suggests that most young Least Terns fledge at about three weeks of age. A single chick at Nantucket Island, Massachusetts was "last captured at age 16 days and was first seen flying at age 20

Table 67. Mean clutch sizes reported for the Least Tern.

Mean clutch size		Number of clutches	Locality and year of observation	Source
1.85	(a)	109	New York, Hicks Island, 1975	Houde 1977a
1.77	(a)	35	North Carolina, Bogue Banks, 1972	Moseley 1976
2.16	(a)	56	North Carolina, Bogue Banks, 1973	Moseley 1976
2.08	(a)	49	North Carolina, Bogue Banks, 1974	Moseley 1976
1.86	(a)	35	North Carolina, Bogue Banks, 1975	Moseley 1976
1.73	(a)	396	South Carolina	Blus and Prouty 1979
1.88	(a)	77	Mississippi, Gulfport, 1977	Hays 1980
1.92	(a)	51	Mississippi, Gulfport, 1978	Hays 1980
1.90	(a)	10	Mississippi, Gulfport, 1979	Hays 1980
2.86	(b)	7	Illinois, Gallatin County, 1953	Hardy 1957
2.18	(c)	336	California, San Diego County, 1971	Swickard 1972
1.82	(c)	230	California, San Diego County, 1972	Swickard 1972
2.24	(c)	157	California, Orange County, 1970	Massey 1974
2.30	(c)	23	California, Orange County, 1971	Massey 1974
1.97	(c,d)	35	California, Venice Beach, 1980	Massey and Atwood 1981
1.93	(c,d)	29	California, Huntington Beach, 1980	Massey and Atwood 1981
2.33	(c,d)	6	California, Anaheim Bay, 1980	Massey and Atwood 1981
1.70	(c,e)	33	California, Anaheim Bay, 1980	Massey and Atwood 1981
1.70	(c,e)	10	California, Anaheim Bay, 1980	Massey and Atwood 1981

(a) _Sterna antillarum antillarum_.
(b) _S. a. athalassos_.
(c) _S. a. browni_.
(d) First nesting period.
(e) Second nesting period. The second listing is for two-year-old birds only.

days" (Burroughs 1966). Massey (1974) reported two banded juveniles first seen in flight 20 days after the first egg hatched at Huntington Beach, California. In 1980 the first eggs at Anaheim Bay, California, hatched 2 June, and the first fledglings were seen 21 June (Massey and Atwood 1981), indicating a fledging period of about 19 days. During a second wave of nesting at this colony, hatching began on 26 June and fledglings were first seen 17 July--a period of 21 days. Observations of chicks kept at the nest by wire enclosures at Bogue Banks, North Carolina, led Moseley (1976) to conclude that "fledging occurs between 21 and 23 days after hatching", but she remarked in the next paragraph that "Least Tern chicks fledge at about 19-21 days of age."

Like many other terns, Least Terns remain partially dependent on their parents for food for some time after they can fly. Moseley (1976) noted this for young fledged in North Carolina, and a juvenile was observed being fed in

Table 68. Rates of hatching success reported for the Least Tern.

Percent of eggs laid that hatched		Number of eggs	Locality and year of observation	Source
25.9	(a)	820	Massachusetts, Plymouth Co., 1936	Hagar 1937
14.4	(a)	202	New York, Hicks Island, 1975	Houde 1977a
5.0	(a)	20	New York, Hicks Island, 1975 (1-egg clutches)	Houde 1977a
16.5	(a)	170	New York, Hicks Island, 1975 (2-egg clutches)	Houde 1977a
0.0	(a)	12	New York, Hicks Island, 1975 (3-egg clutches)	Houde 1977a
65.0	(b)	20	Illinois, Gallatin Co., 1953	Hardy 1957
60.8	(c)	734	California, San Diego Co., 1971	Swickard 1972
80.0	(c)	419	California, San Diego Co., 1972	Swickard 1972
89.8	(c)	157	California, Orange Co., 1970	Massey 1974
79.2	(c)	53	California, Orange Co., 1970	Massey 1974
100.0	(c)	14	California, Anaheim Bay, 1980 (first nesting period)	Massey and Atwood 1981
81.5	(c)	54	California, Anaheim Bay, 1980 (second nesting period),	Massey and Atwood 1981

(a) *Sterna antillarum antillarum*.
(b) *S. a. athalassos*.
(c) *S. a. browni*.

the Northwestern Hawaiian Islands far from the breeding range (Clapp et al., in prep.).

Fledging Success Rates of fledging success, defined as the proportion of eggs laid that result in fledged young, are largely unavailable for the Least Tern. Estimates of production (the number of young produced per pair) are given more often (Table 69), but usually cannot be compared from study to study because of the different assumptions made in estimating how many young survived, and because the numbers that actually fledged are seldom known. Figures for young produced per nest are not comparable with those produced per pair because Least Terns often renest and the productivity of birds that fail in their first nesting attempt and nest again elsewhere is usually not known.

Mortality of Eggs and Young High winds and storm tides are often the major source of egg and nest mortality. This was considered the most severe cause of nest failure during studies conducted in Massachusetts (Burroughs 1966),

Table 69. Productivity in Least Tern colonies.

Number of young produced per pair	Locality and year of observation	Source
ca. 0.18 (a,c)	Massachusetts, Plymouth Co., 1936	Hagar 1937
0.19 (a,c,e)	Massachusetts, Cape Cod, 1978	Minsky 1980
0.51 (b,c)	California, San Diego Co., 1971	Swickard 1972
0.40 (b,c)	California, San Diego Co., 1971	Swickard 1972
1.45 (b,d)	California, Venice Beach, 1980	Massey 1981
0.94 (b,d)	California, Venice Beach, 1980	Massey 1981
0.86 (b,d)	California, Huntington Beach, 1980	Massey 1981
0.58 (b,d)	California, Bolsa Chica, 1980	Massey 1981
0.56 (b,d)	California, Anaheim Bay, 1980	Massey 1981

(a) *Sterna a. antillarum*.
(b) *Sterna a. browni*.
(c) Figure represents number of young produced per nest.
(d) Calculated as the minimum number of birds that fledged divided by the maximum number of breeding pairs present.
(e) Production severely affected by fox (*Vulpes vulpes*) predation during a portion of the nesting season.

South Carolina (Blus and Prouty 1979), and North Carolina (Moseley 1976).

Elsewhere, human disturbance is often the major factor in nest failure. Hays (1980) reported that most mortality at the large colony at Gulfport, Mississippi could be attributed to human disturbance. One or more eggs were lost in 13.9% of 237 nests monitored in 1977 and 1978 when humans collected eggs for food or otherwise vandalized the nests. Heavy rains also caused major egg loss and nest desertion, but storm tides and predators accounted for only three instances of nesting failure. Other nesting failures that have been attributed to human disturbance include young falling off roofs (Fisk 1978a), eggs being covered by fill (Fisk 1974 ms), or eggs destroyed by road graders (Webster 1977d) and other vehicles (Burroughs 1966, Swickard 1972). Another source of disturbance is domestic animals and loggerhead turtles (*Caretta caretta* [Blus and Prouty 1979]). Domestic cats (*Felis catus*) (Fisk 1978a) also prey on young; at one colony on Long Island, cats completely prevented any successful fledging (Wolk 1954). Domestic dogs (*Canis familiaris*) are also potential predators (Swickard 1972).

Other mammals are known or suspected predators of tern eggs and young. Coyote (Canis latrans) predation is apparently a continuing problem at some colonies of the Interior Least Tern on the Arkansas River (Downing 1980), and red foxes (Vulpes vulpes) are frequent predators of Least Terns nesting in areas accessible to foxes. Severe predation by this species on a colony in Massachusetts caused people to erect electric fences as a protective measure (Minsky 1980). Rats (Rattus), when present, may destroy both eggs and young (Burroughs 1966).

Other reported avian predators include Great Horned Owls (Bubo virginianus) (Minsky 1980), Burrowing Owls (Athene cunicularia) (Kale 1977, Ogden 1977), Red-shouldered Hawks (Buteo lineatus), American Kestrels (Falco sparverius) (Fisk 1978b), Laughing Gulls (Fisk 1978a), American Crows (Corvus brachyrhynchos) (Burroughs 1966), and Fish Crows (Corvus ossifragus) (Ogden 1976, Fisk 1978a).

Invertebrates also cause nest loss. Ants preyed upon pipped eggs and newly hatched young at Bogue Banks, North Carolina (Moseley 1976). Blus and Prouty (1979) believed that ghost crabs (Ocypode quadrata) may be important predators of eggs and chicks in South Carolina.

Renesting The literature contains frequent reports of Least Terns replacing clutches as a result of nest loss to inclement weather. Jernigan et al. (1978) reported that "considerable renesting" occurred in North Carolina in 1976 following cool weather and heavy rains, and Blus and Prouty (1979) indicated that Least Terns in South Carolina renested following loss of nests to flooding. No quantitative information is available, however, because few studies have been based on individually marked birds.

Age at First Breeding Some California Least Terns breed for the first time at the age of two years (Massey and Atwood 1978), but most are believed to begin breeding in their third year (Massey and Atwood 1981). Massey and Atwood (1981) also discovered that a large proportion of California Least Terns laying during a second wave of nest initiation are 2-year-old birds breeding for the first time. All the older than 2-year-old Least Terns breeding during the second wave were birds attempting to renest. Massey and Atwood's observations led them to conclude that most 2-year-old California Least Terns breed, but do so later in the season than birds that have bred previously.

Maximum Natural Longevity Massey and Atwood (1978) reported that two Least Terns lived for 21 years. They based their report on recoveries available in the Bird Banding Laboratory (BBL) through 1977. The oldest Least Tern in the BBL files through December 1981 is a juvenile banded in Cotuit, Massachusetts, in July 1929 that was found dead there in July 1950 at an estimated minimum age of 21 years, one month (Clapp et al. 1982a).

Weight Table 70 summarizes the few data available on the weight of North American Least Terns.

SUSCEPTIBILITY TO OIL POLLUTION

Few data have been gathered on the effects of oil on Least Terns, but evidence suggests that this species may be quite vulnerable to the effects of oil and petroleum development. Hays (1980) reported that bilge oil dumped from a tanker caused a slick to wash up on the shores of a colony at Gulfport, Mississippi, during the summer of 1978. Many young terns in this colony, most near fledging, became oiled and later ten oiled young and an oiled adult were found dead. The extent of oiling on the dead young ranged from traces on the abdomen and feet to complete coverage by the oil.

Secondary effects of oiling reported for the closely related Little Tern in Europe may also occur at North American colonies of Least Terns. The AMOCO CADIZ spill in March 1978 apparently increased erosion of sandy beaches and, as a result, a colony of around 30 pairs of Least Terns was displaced from its breeding area (Hope-Jones et al. 1978).

Judging from recent surveys, the southeastern United States contains the largest remaining population of Least Terns breeding in North America and a significant proportion of the entire population of the species. The species is declining in some parts of the southeast and in other portions of its North American range and is considered threatened or endangered in others. Because this species is highly vulnerable to disturbance and occurs in habitats easily destroyed by environmental manipulation and likely to be threatened by oil, we consider Least Terns among the marine bird species most at risk in the southeast from activities related to oil development.

Additional information is needed on the size of breeding populations and continued monitoring of Least Tern populations is clearly warranted. Judging from many accounts, careful management of the environment (e.g., creation and maintenance of nesting habitat, protection of important nesting areas) could maintain populations of what may currently be a vanishing species.

BIBLIOGRAPHY

1982

Atwood, J. L. and B. W. Massey. 1982. The *pikei* plumage of the Least Tern. J. Field Ornithol. 53: 47.

Clancey, P. A. 1982. The Little Tern in Southern Africa. Ostrich 53: 102-106.

Ducey, J. 1982. The 1982 Least Tern and Piping Plover breeding season on the Lower Platte River, Nebraska. Nebr. Bird Rev. 50: 68-72.

Grover, P. B. and F. L. Knopf. 1982. Habitat requirements and breeding success of charadriiform birds nesting at Salt Plains National Wildlife Refuge, Oklahoma. J. Field Ornithol. 53: 139-148.

Table 70. Weights (in grams) of Least Terns (a).

Mean Weight	Range	Number of birds	Sample and Season	Area	Source
54.3	50.5-58	2	adult males (summer)	Georgia or South Carolina	Norris and Johnston 1958
48.3	48-48.6	2	immature females (summer)	Georgia or South Carolina	Norris and Johnston 1958
46.3	42.9-50.9	11	breeding adults	Mississippi	Hays 1980
34.8	---	1	23-day-old young	Mississippi	Hays 1980
40.5	39.0-42.0	2	20-day-old young	California	Massey 1974
37.2	---	3	19-day-old young	Mississippi	Hays 1980
35.7	---	3	14-day-old young	Mississippi	Hays 1980
18.4	---	9	7-day-old young	Mississippi	Hays 1980
6.2	---	18	wet day-old chicks	Mississippi	Hays 1980
6.6	---	118	dry day-old chicks	Mississippi	Hays 1980
4.9	---	8	newly hatched chicks	Illinois	Hardy 1957
5.9	4.5-7.2	77	newly hatched chicks	California	Massey 1974
4.8	4.6-5.2	10	newly-hatched chicks	California	Davis 1968

(a) Ranges are given as the mean $\pm$ 2 S.D.

Gunter G. 1982. Heat death of Least Tern chicks on the Gulfport, Mississippi, Beach in 1980. Gulf. Res. Rep. 7: 163-166.

Holz, R. and C. Herrmann. 1982. Ackerbruten der Zwergseeschwalbe, Sterna albifrons Pallas, und die Beurteilung ihrer Habitatspruche. Mitt. Zool. Mus. Berlin 58: 77-85. [In German with English abstract.]

Hume, R. A. 1982. Mystery photographs. 65. Little Tern. Brit. Birds 75: 224.

Jackson, J. A., B. E. Rowe, M. S. Hetrick and B. J. Schardien. 1982. Site-specific nest defense behavior of Black Skimmers and Least Terns. Condor 84: 120.

Jenks-Jay, N. 1982. Chick shelters decrease avian predation in Least Tern colonies on Nantucket Island, Massachusetts. J. Field Ornithol. 53: 58-60.

Schwartz, R. and F. Sibley. 1982. Least Tern nesting at Milford Point. Conn. Warbler 2: 21.

Thompson, B. C. 1982. Distribution, colony characteristics, and population status of Least Terns breeding on the Texas coast. Ph.D. thesis, Univ. Washington/Seattle, WA. 139 pp.

Thompson, B. C. and R. D. Slack. 1982. Physical aspects of colony selection by Least Terns on the Texas coast. Colonial Waterbirds 5: 161-168.

1981

Brubeck, M. V., B. C. Thompson and R. D. Slack. 1981. The effects of trapping, banding, and patagial tagging on the parental behavior of Least Terns in Texas. Colonial Waterbirds 4: 54-60.

Davies, S. 1981. Development and behaviour of Little Tern chicks. Brit. Birds 74: 291-298.

Ducey, J. 1981. Breeding of the Least Tern and Piping Plover on the Lower Platte River, Nebraska. Nebr. Bird Rev. 49: 45-51.

Knight, R. and P. Haddon. 1981. Little Terns conservation guide. Brit. Trust Ornithol. News 114: 8.

Massey, B. W. and J. L. Atwood. 1981. Second-wave nesting of the California Least Tern: age composition and reproductive success. Auk 98: 596-605.

1980

Buckley, P. A. and F. G. Buckley. 1980b. Population and colony-site trends of Long Island waterbirds for five years in the mid 1970s. Trans. Linn. Soc. N.Y. 9: 23-56.

Downing, R. L. 1980. Survey of Interior Least Tern nesting populations. Am. Birds 34: 209-211.

Edwards, C. J. and D. L. Woodfall. 1980. Notes on breeding biology of Little Terns in Northumberland. Pp. 106-114 in A. Heavisides and M. S. Hodgson. Birds in Northumbria. 1979 Northumberland Bird Rep., Tyneside Bird Club.

Erwin, R. M. 1980b. Breeding habitat use by colonially nesting waterbirds in two mid-Atlantic U.S. regions under different regimes of human disturbance. Biol. Conserv. 18: 39-51.

Fletcher, J. 1980. Further notes on nesting Least Terns. Gosse Bird Club Broadsheet 35: 2-3.

Hays, M. B. 1980. Breeding biology of the Least Tern, *Sterna albifrons*, on the Gulf coast of Mississippi. M.S. thesis, Mississippi State Univ./Mississippi State, MS. ix and 69 pp.

Minsky, D. 1980. Preventing fox predation at a Least Tern colony with an electric fence. J. Field Ornithol. 51: 180-181.

Thompson, B. C. and R. D. Slack. 1980. Post-fledging desertion of colonies by juvenile Least Terns in Texas. (Abstract only.) Proc. 1979 Conf. Colonial Waterbird Group 3: 257.

USNFWL [U.S. National Fish and Wildlife Laboratory]. 1980. Selected vertebrate endangered species of the seacoast of the United States--California Least Tern. U.S. Fish Wildl. Serv. Biol. Serv. Progr. FWS/OBS-80/01.20. 8 pp.

1979

Atwood, J. L., R. A. Erickson, P. R. Kelly and P. Unitt. 1979. California Least Tern census and nesting survey, 1978. Calif. Dep. Fish Game Nongame Wildl. Invest. Final Rep. Job V-2.11. 35 pp.

Blus, L. J. and R. M. Prouty. 1979. Organochlorine pollutants and population status of Least Terns in South Carolina. Wilson Bull. 91: 62-71.

Dupuy, A. R. 1979. Reproduction de *Sterna fuscata* et de *S. albifrons* dans le delta du Senegal. Oiseau Rev. Fr. Ornithol. 49: 324. [In French.]

Loftin, R. W. and A. L. Thomson. 1979. An artificial nest structure for Least Terns. Bird-Banding 50: 163-164.

Lura, R. 1979. Least Tern at Austin Springs. Migrant 50: 33-34.

Moseley, L. J. 1979. Individual auditory recognition in the Least Tern (*Sterna albifrons*). Auk 96: 31-39.

Niimi, N. 1979. A completely albinistic Little Tern *Sterna albifrons* chick. J. Yamashina Inst. Ornithol. 11: 72-73.

Rittinghaus, H. 1979. Beitrage zue Okologischen Potenz einiger Seeschwalbenarten (*Sterna albifrons*, *Sterna hirundo*, *Sterna paradisaea*, *Sterna sandvicensis*). Ornithol. Mitt. 31: 73-85, 99-119. [In German.]

1978

Blodget, B. 1978a. The effect of off-road vehicles on Least Terns and other shorebirds. M.S. thesis, Univ. Massachusetts/Amherst, MA. 76 pp.

_____. 1978b. The effect of off-road vehicles on Least Terns and other shorebirds. U.S. Natl. Park Serv. Coop. Res. Unit Rep. 26, Inst. Man Environ., Univ. Massachusetts/Amherst, MA.

Duffy, D. C. 1978. Terns and skimmers in Connecticut and eastern Long Island, N.Y., 1972-76. Ibis 120: 131.

Erwin, R. M. 1978a. Population and colony site dynamics in selected Massachusetts waterbirds. Proc. 1977 Conf. Colonial Waterbird Group 1: 19-25.

_____. 1978b. Coloniality in terns: the role of social feeding. Condor 80: 211-215.

Feare, C. J. and W. R. P. Bourne. 1978. The occurrence of "Portlandica" Little Terns and the absence of Damara Terns and British Storm Petrels in the Indian Ocean. Ostrich 49: 64-66.

Fisk, E. J. 1978a. Roof-nesting terns, skimmers, and plovers in Florida. Fla. Field Nat. 6: 1-8.

_____. 1978b. Least Tern. Pp. 40-43 *in* H. W. Kale, II (ed.). Rare and endangered biota of Florida. Vol. 2. Birds. Univ. Presses of Florida, Gainesville, FL. xix and 121 pp.

_____. 1978c. The growing use of roofs by nesting birds. Bird-Banding 49: 134-141.

Grimes, L. G. 1978. Occurrence of Javan Little Tern *Sterna albifrons sinensis* in West Africa. Bull. Br. Ornithol. Club. 98: 114.

Jernigan, L. S., Jr., R. F. Soots, Jr., J. F. Parnell and T. L. Quay. 1978. Nesting habitats and breeding populations of the Least Tern (*Sterna albifrons antillarum*) in North Carolina. Univ. N.C. Contrib. Mar. Sci. 814. vii and 39 pp.

Lane, S. G. 1978. Some results from banding Little Terns at Stockton, New South Wales. Corella 2: 8-9.

Massey, B. W. and J. L. Atwood. 1978. Plumages of the Least Tern. Bird-Banding 49: 360-371.

Nadler, T. 1978. Zur Mauser der Zwergseeschwalbe (*Sterna albifrons* Pallas). [On the moult of the Little Tern (*Sterna albifrons* Pallas).] Zool. Abh. (Dres.) 35: 253-260. [In German with English summary.]

Napier, J. P. 1978. Further notes on Fairy and Little Terns breeding on Tasmania's east coast. Austr. Bird Watcher 7: 155-156.

Roche, S. M. 1978. Comparative reproductive success in the Least Tern. Bull. S.C. Acad. Sci. 40: 97.

Rypka, D. D. 1978. California Least Tern banding project, 1977. Calif. Dep. Fish Game Nongame Wildl. Invest. Final Rep. Project E-1-1, Job 2. 7 pp.

Spaans, A. L. 1978. Status of terns along the Surinam coast. Bird-Banding 49: 66-76.

Thompson, D. H. 1978. Declines in populations of colonial waterbirds nesting within the floodplain of the upper Mississippi River. Proc. 1977 Conf. Colonial Waterbird Group 1: 26-37.

1977

Atwood, J. L., P. D. Jorgensen, R. M. Jurek and T. D. Manolis. 1977. California Least Tern census and nesting survey, 1977. Calif. State Resour. Agency, Calif. Dep. Fish Game.

Bijlsma, R. 1977. Einige opmerkingen over de trek van de Dwergsterm (Sterna albifrons) over Nederland. [Some remarks upon the migration of the Little Tern (Sterna albifrons) over the Netherlands.] Watervogels 2: 147-151. [In Dutch with English summary.]

Blodget, B. G. 1977. Continuing studies of Least Terns (Sterna albifrons) at Cape Cod National Seashore, Barnstable County, Massachusetts. Natl. Park Serv. UM-NPSCRU-37. 12 pp.

Cox, J. B. and D. H. Close. 1977. Interbreeding of Little and Fairy Terns. Emu 77: 28-32.

Duffy, D. 1977b. Breeding populations of terns and skimmers on Long Island Sound and eastern Long Island: 1972-1975. Proc. Linn. Soc. N.Y. 73: 1-48.

Gochfeld, M. 1977b. Incipient distraction displays of the Least Tern. Proc. Linn. Soc. N.Y. 73: 80-83.

Houde, P. 1977a. Low productivity of terns on Hicks Island, 1975. Proc. Linn. Soc. N.Y. 73: 49-57.

_____. 1977b. Gull-tern interactions on Hicks Island, 1975. Proc. Linn. Soc. N.Y. 73: 58-64.

Jernigan, L. S., Jr. 1977. Comparison of Least Tern (Sterna albifrons antillarum) population size and nesting habitat on barrier and dredge islands in the North Carolina coastal zone. M.S. thesis, N.C. State Univ./Raleigh, NC. vi and 51 pp.

Massey, B. W. 1977. Occurrence and nesting of the Least Tern and other endangered species in Baja California, Mexico. West. Birds 8: 67-70.

Ortali, A. 1977. Il nido del Fraticello -Sterna albifrons (Pallas)- visto attraverso l'obiettivo. [Photographic study of the nest of the Least Tern Sterna albifrons.] Riv. Ital. Ornitol. 47: 93-109. [In Italian.]

1976

Beames, I. 1976. Day of the terns. Wildlife (Lond.) 18: 306-307.

Gochfeld, M. 1976. Waterbird colonies of Long Island, New York. 3. Cedar Beach ternery. Kingbird 26: 62-80.

Jackson, J. A. 1976b. Some aspects of the nesting ecology of Least Terns on the Mississippi Gulf Coast. Mississippi Kite 6: 25-35.

Massey, B. W. 1976. Vocal differences between American Least Terns and the European Little Tern. Auk 93: 760-773.

Moseley, L. J. 1976. Behavior and communication in the Least Tern. Ph.D. thesis, Univ. N.C./Chapel, Hill, NC. 164 pp.

Nadler, T. 1976. Die Zwergseeschwalbe: Sterna albifrons. Wittenberg Lutherstadt: A. Ziemsen Verlag (Die Neue Brehm-Bucherei, no. 495). 136 pp. [In German.]

Nisbet, I. C. T. 1976c. Returns from terns. Mass. Audubon Newsl. 15: 3-5.

Ringe, F. 1976. Zwergseeschwalbe (Sterna albifrons Pall.) bei Osnabruck. Vogelkd. Ber. Nieders. 8: 50.

Toups, J. 1976. A brief history of efforts to protect the Least Tern on the Mississippi coast. Mississippi Kite 6: 22-24.

1975

Blindell, R. 1975a. Doing a good tern? Brit. Trust Ornithol. News 73: 4.

_____. 1975b. Protection at Little Tern colonies. Brit. Birds 68: 250-251.

Downing, R. L. 1975. Survey of Interior Least Tern nesting populations. Unpubl. Rep., Denver Wildl. Res. Cent., U.S. Fish Wildl. Serv., Blacksburg, VA.

Fisk, E. J. 1975. Least Tern: beleaguered, opportunistic and roof-nesting. Am. Birds 29: 15-16.

Galli, J. 1975. Least Tern management program. Rec. New Jersey Birds 1: 10.

Hogstedt, G. and C. Persson. 1975. Smatarnan Sterna albifrons i Sverige 1973. [The Little Tern Sterna albifrons in Sweden in 1973.] Var Fagelvarld 34: 37-42. [In Swedish with English summary.]

Hunter, M. L., Jr. 1975. Least Tern breeding range extension in Maine. Auk 92: 143-145.

Keleman, A. and Z. Szambath. 1975. Osszehasonlito meg figyelesek a Kuszvago esa kis cser Koltesi Magatartasarol. [Comparative observations of the breeding behavior of Common Tern and Little Tern.] Aquila 82: 211-288. [In Hungarian and German.]

Lloyd, C. S., C. J. Bibby and M. J. Everett. 1975. Breeding terns in Britain and Ireland in 1969-74. Brit. Birds 68: 221-237.

Loftin, R. W. 1975. Another inland colony of the Least Tern. Fla. Field Nat. 3: 36.

Luhrs, L. 1975. Fernfunde in der Deutschen Bucht beringter Zwergseeschwalben (Sterna albifrons). Auspicium 5: 329-335.

Varza, D. 1975. The neglected tern. Underwater Nat. 9: 12-14.

Weston, J. K. 1975. Recent history of shore-line breeding birds at the Naze --with particular reference to the Little Tern. Essex Bird Rep. 1974: 76-82.

1974

Bender, K. 1974. California Least Tern population and nesting survey, 1974. Calif. Dep. Fish Game Nongame Wildl. Invest. Final Rep. Job W-54-R. 17 pp.

Brown, H. C. and B. L. Monroe, Jr. 1974. Bird records from Honduras. Condor 76: 348-349.

Davis, M. E. 1974. Experiments on the nesting behavior of the Least Tern, Sterna albifrons browni. Proc. Linn. Soc. N.Y. 72: 25-43.

Filonov, K. P., V. I. Lysenko and V. D. Siokhin. 1974. [Peculiarities of Limicolae and Lari nesting on islands of Molochny Estuary (the Sea of Azov).] Vestn. Zool. 1974: 52-58. [In Russian with English summary.]

Fisk, E. J. 1974 ms. Atlantic coast Least Tern survey. Unpubl. rep. in the files of the Museum Section, Denver Wildl. Res. Cent., Washington, DC. 27 pp.

Gochfeld, M. 1974b. Prevalence of subcutaneous emphysema in young terns, skimmers and gulls. J. Wildl. Dis. 10: 115-120.

Lindholm, C. G. 1974. Smatarnan (Sterna albifrons) pa Oland. Calidris 3: 3-7. [In Swedish.]

Massey, B. W. 1974. Breeding biology of the California Least Tern. Proc. Linn. Soc. N.Y. 72: 1-24.

Nugent, P. 1974. Least Terns in a cantaloupe patch. Chat 38: 72.

Skaar, P. D. 1974. First Least Tern in Montana. West. Birds 5: 59.

Swickard, D. K. 1974. An evaluation of two artificial Least Tern nesting sites. Calif. Fish Game 60: 88-90.

van Zurk, H. 1974. La sterna naine (Sterna albifrons). Riviera Sci. 10: 50-52. [In French.]

Wilbur, S. R. 1974. The literature of the California Least Tern. U.S. Fish Wildl. Serv. Spec. Sci. Rep. Wildl. 175. ii and 18 pp.

Wolk, R. G. 1974. Reproductive behavior of the Least Tern. Proc. Linn. Soc. N.Y. 72: 44-62.

Woolfenden, G. E. and W. B. Robertson, Jr. 1974. Least Terns nest at Dry Tortugas. Fla. Field Nat. 2: 19-20.

1973

Bender, K. 1973. California Least Tern census and nesting survey, 1973. Calif. Dep. Fish Game Nongame Wildl. Invest. Prog. Rep. W-54-R. 47 pp.

Downing, R. L. 1973. A preliminary nesting survey of Least Terns and Black Skimmers in the east. Am. Birds 27: 946-949.

Duffy, D. C. and A. Poole. 1973. The status of the Least Tern on eastern Long Island in 1972. Linn. Newsl. 27. 2 pp.

Gochfeld, M. 1973a. Least Tern colonies on Jones Beach and western Fire Island in 1972. Linn. Newsl. 27. 2 pp.

_____. 1973b. Recent status of the Least Tern (Sterna albifrons) on the south shore of western Long Island. Engelhardtia 6: 1-9.

Jackson, J. A. 1973. An observation of a Least Tern laying an egg. Mississippi Kite 3: 4-5.

Kridler, E. 1973. Observation of Least Tern on Oahu, August 8, 1973. Elepaio 34: 41.

Lincer, J. L. and D. Salkind. 1973. A preliminary note on organochlorine residues in the eggs of fish-eating birds of the west coast of Florida. Fla. Field Nat. 1: 3-6.

Loftin, R. W. 1973. Another inland colony of the Least Tern. Fla. Field Nat. 1: 21.

Lohrer, F. E. and C. E. Lohrer. 1973. Inland nesting of the Least Tern. Fla. Field Nat. 1: 3-5.

Massey, B. W. 1973. Recoveries of California Least Terns. West. Bird Bander 48: 46-48.

Mead, C. 1973. Feeling the crunch - Little Tern. Brit. Trust Ornithol. News 59: 1.

Nisbet, I. C. T. 1973b. Terns in Massachusetts: present numbers and historical changes. Bird-Banding 44: 27-55.

Sande, T. and T. Nilsen. 1973. Smastykker. 1. Dvergterne i Vestfold. [Summer observations of Little Terns at Tonsberg, Co. Vestfold.] Sterna 11: 136. [In Norwegian with English summary.]

Udvardy, M. D. F., C. S. de Beausset and M. Ruby. 1973. New tern records from Caribbean Honduras. Auk 90: 440-442.

1972

Dharmakumarsinhji, R. S. 1972. Extension of breeding range and other notes on Black-shafted Little Tern (Sterna albifrons saundersi Hume). J. Bombay Nat. Hist. Soc. 69: 420-422.

Fisk, E. J. 1972a. A search for nesting Least Terns. Cornell Lab. Ornithol. Newsl. 66: 3-4.

______. 1972b. Sparrow Hawk as a predator in a Least Tern colony. Bird-Banding 43: 288-289.

Haverschmidt, F. 1972. Further evidence of the 'portlandica' plumage phase of terns. Brit. Birds 65: 117-119.

Hilden, O. and R. A. Vaisanen. 1972. Pikkutiiran Sterna albifrons pesimisesta Siikajoella. [A northern colony of the Little Tern in Finland.] Ornis Fenn. 49: 17-19. [In Finnish with English summary.]

Massey, B. W. 1972. Breeding biology of the California Least Tern. M.S. thesis, California State Univ./Long Beach, CA. 101 pp.

Murphy, L. W. 1972. Least Tern colony at Sandy Point State Park. Md. Birdlife 28: 91-93.

Napier, J. R. 1972. Fairy and Little Terns breeding on Tasmania's east coast. Austr. Bird Watcher 4: 103-108.

Pentis, A. 1972. Who will save the Least Tern? Environ. Southwest 446: 6-8.

Swahn, B.-E. 1972. Smartarnan (Sterna albifrons) som hackfagel i Biekinge. Faglar i Biekinge 9: 176-178. [In Swedish.]

Swickard, D. K. 1972. Status of the Least Tern at Camp Pendleton, California. Calif. Birds 3: 49-58.

1971

Bankovics, A. 1971. Kiscser (Sterna albifrons) es kucsmas billegeto (Motacilla flava feldeggi) a Csaj-tavon. Allattani Kozl. 58: 160-163.

Cooper, R. P. 1971. Little Tern/Fairy Tern in East Gippsland. Austr. Bird Watcher 4: 1-4.

Craig, A. M. 1971 ms. Survey of California Least Tern nesting sites. Unpubl. rep. in the files of the Calif. Dep. Fish Game. 112 pp.

Massey, B. W. 1971. A breeding study of the California Least Tern. Wildl. Manage. Branch Admin. Rep. 71-9. Calif. State Resour. Agency, Calif. Dep. Fish Game.

Riggins, J. and H. Riggins. 1971. Least Tern in middle Tennessee. Migrant 42: 4.

Swickard, D. 1971. Terns displace tanks. Outdoor Calif. 32: 29.

1970

Anon. 1970a. Disaster for Little Terns. Habitat 6: 4.

Anon. 1970b. Least Tern. Wandering Tattler 17: 4.

Anderson, W. 1970. The California Least Tern breeding in Alameda and San Mateo counties. Calif. Fish Game 56: 136-137.

Eckert, J. 1970. An extension of the geographic and breeding range of the Little Tern. S. Austr. Ornithol. 25: 142-144.

Napier, J. R. 1970. First record of the Little Tern in Tasmania. Emu 70: 89.

Ouweneel, G. L. 1970. Broedende dwergsterns op het Hellegatsplein (Sterna albifrons). Limosa 43: 161-162. [In Dutch.]

1969

Lea, D. 1969. Little Terns. R. Soc. Protect. Birds Mag. 2: 216-217.

Longhurst, A. R. 1969 ms. The status of an endangered bird (Sterna albifrons) in San Diego County, 1969. Unpubl. rep. U.S. Bur. Commer. Fish., La Jolla, CA. 7 pp.

Norman, R. K. and D. R. Saunders. 1969. Status of Little Terns in Great Britain and Ireland in 1967. Brit. Birds 62: 4-13.

Olrog, C. C. 1969. Chlidonias niger y Sterna albifrons, dos laridos nuevos para la Argentina (Aves, Charadriiformes, Laridae). [Chlidonias niger and Sterna albifrons, two new larids for Argentina.] Neotropica 15: 7-8. [In Spanish with English summary.]

1968

Davis, M. E. 1968. Nesting behavior of the Least Tern (Sterna albifrons). M.A. thesis, Univ. Calif./Los Angeles, CA. 72 pp.

Navarro, A. 1968. Occurrence of the Blackshafted Little Tern (Sterna albifrons saundersi Hume) near Bombay. J. Bombay Nat. Hist. Soc. 65: 484.

Paige, B. B. 1968. The Least Tern in man's world. Fla. Nat. 41: 14-16.

von Schmidt, K. 1968. Note on the mating behavior of the Least Tern, Sterna albifrons. Auk 85: 694.

1967

Hitchcock, W. B. 1967. Bird in the hand. Austr. Bird Bander 5: 14.

Post, W., Jr. 1967. Least Tern nesting at Lake Marion, S.C. Chat 31: 96-97.

Walsh, F. 1967. Occurrence of the African Little Tern away from water. Bull. Nigerian Ornithol. Soc. 4(15): 14.

1966

Burroughs, R. C. 1966. A study of the breeding biology of Least Terns on Nantucket Island. M.S. thesis, Univ. Mass./Amherst, MA. v and 87 pp.

Stiefel, A. 1966. Gemeinsames ubernachten von Zwergseeschwalben (Sterna albifrons). [Communal night-time roosts of the Little Tern (Sterna albifrons).] Ornithol. Mitt. 18: 31-32. [In German.]

Taverner, J. H. 1966. The Needs Oar gullery and ternery. Hampshire Bird Rep. (1965) 23: 32-45.

1965

Deppe, H.-J. 1965. Zwergseeschwalbe (Sterna albifrons) im gebiet der Muritz. [The Little Tern (Sterna albifrons) in the Muritz Lake district.] Ornithol. Mitt. 17: 142. [In German.]

1964

Campion, C. B. 1964. Little Tern banding progress. Austr. Bird Bander 2: 23-25.

Dharmakumarsinhji, R. S. 1964. Some observations on the small Indian Pratincole (Glareola lactea Temminck) and some other waders breeding in Bhavnagar, Gujarat. Pavo 2: 1-11.

Perez Chiscano, J. L. 1964. Nidification de canasteras y charrancitos en el rio Guadiana. Ardeola 10: 37-38.

1963

Campion, C. B. 1963. Banding the Little Tern. Austr. Bird Bander 1: 125-132.

McDaniel, B. and S. McDaniel. 1963. Feeding of Least Terns over land. Auk 80: 544.

Pomarnacki, L. 1963. Stanowiska legowe rybitwy bialoozelnej i dzdzownika obroznego. [Breeding sites of Little Tern and Ringed Plover.] Przegl. Zool. 7: 265-267. [In Polish.]

Teixeira, C. 1963. Ninho de Andorinha-do-mar. Naturalia 8: 3-4. [In Portuguese.]

Voous, K. H. 1963. Tern colonies in Aruba, Curacao, and Bonaire, South Caribbean Sea. Proc. Internatl. Ornithol. Congr. 13: 1214-1216.

1962

Clement, R. C. and R. E. Woodruff. 1962. A history of the nesting gulls and terns of Rhode Island, 1889-1961. Narragansett Nat. 5: 108-111, 125-128.

Grosskopf, G. 1962. Nestplatzwechsel in einem Zwergseeschwalben brutgebiet. Oldenb. Jahrb. 61: 81-91. [In German.]

Rittinghaus, H. 1962. Die Seeschwalben auf der Insel Minsener Oldenog. Oldenb. Jahrb. 61: 93-104. [In German.]

Soikkeli, M. 1962. Pohjanlahden Sterna albifrons--populaatiosta ja sen muutonaikaisesta esiintymisesta Suomen lansirannikolla. [On the Sterna albifrons population in the Gulf of Bothnia and its migration along the west coast of Finland.] Ornis Fenn. 39: 60-67. [In Finnish with English summary.]

1961

Hanstrom, B. 1961. Smatarnan. in K. Curry-Lindahl (ed.). Vara faglar i Norden Bd. 3. Stockholm 1976. [In Swedish.]

Schonert, C. 1961. Zur Brutbiologie und Ethologie der Zwergseeschwalbe (Sterna albifrons albifrons Pallas). Pp. 131-187 in H. Schildmacher (ed.). Beitragzur Kenntnis deutscher Vogel. Jena, Gustav Fischer Verlag. [In German.]

1960

Hocken, A. G. 1960. Rubber band in Little Tern's stomach. Brit. Birds 53: 574.

Storr, G. M. 1960. Migration and breeding season in Sterna nereis and S. albifrons. Emu 60: 135-137.

Ytreberg, N. J. 1960. Dvergterne (Sterna albifrons Pall.) i Kurefjorden i Ostfold. Fauna 13: 162-167.

1959

Hitchcock, W. B. 1959. A review of "Least" Terns in Australian waters. S. Austr. Ornithol. 22: 87-106.

Howell, T. R. 1959. A field study of temperature regulation in young Least Terns and Common Nighthawks. Wilson Bull. 71: 19-32.

Sefton, A. R. 1959. Tern display flights. Emu 59: 130.

Tompkins, I. R. 1959. Life history notes on the Least Tern. Wilson Bull. 71: 313-322.

1958

Christmas, J. Y. 1958. An observation of luminosity in marine birds. Auk 75: 234.

1957

Hardy, J. W. 1957. The Least Tern in the Mississippi Valley. Publ. Mus. Mich. State Univ. Biol. Ser. 1: 1-60.

McKenzie, H. R. and R. B. Sibson. 1957. Does the Little Tern (_Sterna albifrons_) reach New Zealand? Notornis 7: 174-182.

1954

Brewer, R. 1954. Nesting of the Least Tern in Illinois. Wilson Bull. 66: 223.

Wolk, R. G. 1954. Some preliminary observations on the reproductive behavior of the Least Tern (_Sterna albifrons antillarum_ Lesson). M.S. thesis, Cornell Univ./Ithaca, NY.

1953

Kobayashi, K. 1953. Occurrence of _Sterna albifrons sinensis_ and _Sterna hirundo longipennis_ at Osaka Bay, Honshu, Japan. Emu 53: 146-148.

Moore, J. C. and W. E. Dilley. 1953. Tern counts at Dry Tortugas 1950, 1951, and 1952. Fla. Nat. 26: 75-81.

1952

Eisenmann, E. 1952. Copulatory behavior in the Least Tern. Proc. Linn. Soc. N.Y. 58-62: 71.

1951

Matousek, B. 1951. Hnizdeni rybaka maleho (_Sterna albifrons_ Pall.) na Slovensku. [Nesting of the Least Tern (_Sterna albifrons_ Pall.) in Slovakia.] Sylvia 13: 86-88. [In Czechloslovakian with French summary.]

Moller, D. 1951. Dvergterne (_Sterna a. albifrons_) i Vest-Agder. Fauna 4: 199-200.

Rittinghaus, H. 1951. Der Starals Nahrungsschmarotzer der Zwergseeschwalbe (_Sterna albifrons_). Vogelwarte 16: 15-17.

Seibert, H. C. 1951. Least Tern in Southeastern New Mexico. Condor 53: 204.

1949

Moller, H. and D. Moller. 1949. Iakttagelser av dvergterne, stork, stilliss og bokesanger i Sondre Vestfold. Fauna 2: 129-132.

1947

Hannerz, E. 1947. Smatarna hackande i Norrbottens skargard. Var Fagelvarld 6: 163. [In Swedish.]

Roberts, E. L. 1947. Clutch size of Little Tern. Brit. Birds 40: 284-285.

Taber, W. 1947. Northward extension of the breeding range of the Least Tern. Auk 64: 629-630.

1944

Heinemann, L. D. 1944. Nesting of the Piping Plover and Least Tern in Cass County. Nebr. Bird Rev. 12: 9-10.

1943

Alexander, W. B. 1943. The Little Tern breeding in Egypt. Ibis 85: 519-520.

Mayfield, H. 1943. Least Tern in southeastern Michigan. Wilson Bull. 55: 245.

1942

Burleigh, T. D. and G. H. Lowery, Jr. 1942. An inland race of *Sterna albifrons*. La. State Univ. Mus. Zool. Occ. Pap. 10: 173-177.

Tomkins, I. R. 1942. Least Tern watering eggs: Gideon Mabbett's query. Auk 59: 308.

1940

Moser, R. A. 1940. The Piping Plover and Least Tern nesting in Omaha. Nebr. Bird Rev. 8: 92-94.

Niethammer, G. 1940. Zum Brutvorkommen der Zwergseeschwalbe in der Ostmark. Ornithol. Monatsber. 48: 109-112. [In German.]

1939

Abdulali, H. 1939. The sun as a mortality factor among young birds. J. Bombay Nat. Hist. Soc. 41: 433-434.

Stiles, B. F. 1939. The Least Tern in Iowa. Iowa Bird Life 9: 19-21.

1938

Murray, J. J. and J. Grey. 1938. Late nesting date for Least Tern. Chat 2: 64.

Sharland, M. S. R. 1938. Two small terns (*Sterna albifrons* and *Sterna nereis*). Emu 38: 1-7.

Stiles, B. F. 1938. Nesting of the Least Tern in Iowa. Wilson Bull. 50: 61.

1937

Haecker, F. W. 1937a. The Eastern Least Tern breeding in Thurston County. Nebr. Bird Rev. 5: 9.

_____. 1937b. The Eastern Least Tern breeding in Burt County. Nebr. Bird Rev. 5: 110.

Hagar, J. 1937. Least Tern studies--1935 and 1936. Bull. Mass. Audubon Soc. 21: 5-8.

Page, G. W. 1937. Breeding habits of the Least Tern. Chat 1: 5.

1935

Campbell, L. W. 1935. Least Tern taken near Toledo, Ohio. Auk 52: 87.

Jung, C. S. 1935. Occurrence of the Least Tern (*Sterna a. antillarum*) in Wisconsin. Auk 52: 87.

1934

Hoogerwerf, A. 1934. Bij het nest van *Sterna albifrons sinensis*. Trop. Nat. Weltvreden 23: 151-153.

1932

Shelley, L. O. 1932. Least Tern on the New Hampshire coast in July. Auk 49: 477-478.

Weil, R. 1932. The history of the Least Terns of the Atlantic Coast. Heron 2: 10-14.

1931

Bannerman, D. A. 1931. [A new race of *Sterna*.] Bull. Br. Ornithol. Club 51: 70-71.

Sprunt, A., Jr. 1931. Abnormal sets of heron eggs in coastal South Carolina. Auk 48: 594.

1930

Ganier, A. F. 1930. Breeding of the Least Tern on the Mississippi River. Wilson Bull. 42: 103-107.

Loyd, L. R. W. 1930. Nesting of the Little Tern. Oologists' Rec. 10: 60-64.

Youngworth, W. 1930. Breeding of the Least Tern in Iowa. Wilson Bull. 42: 102-103.

1929

Austin, O. L., Jr. 1929. Contributions to the knowledge of the Cape Cod Sterninae. Bull. N.E. Bird-Banding Assoc. 5: 123-140.

Sprunt, A., Jr. 1929. Some abnormal breeding records from the South Carolina coast. Auk 46: 555-556.

Ticehurst, C. B. 1929. [Remarks on the races of Sterna albifrons.] Bull. Br. Ornithol. Club 49: 65-67.

1928

Baker, E. C. S. 1928. [Note on the races of Sterna albifrons.] Bull. Br. Ornithol. Club 49: 37-38.

Nicholson, D. J. 1928. Actions of a young Wilson's Plover. Wilson Bull. 40: 200-201.

1926

Collinge, W. E. 1926. An investigation of the food of terns at Blakeney Point, Norfolk. Trans. Norfolk Norwich Nat. Soc. 12: 35-52.

Danforth, S. T. 1926. The Least Tern (Sternula antillarum antillarum) in Grenada, Lesser Antilles. Auk 43: 363.

1922

Lamb, C. C. 1922. A unique breeding colony of Least Terns. Condor 24: 182.

Smith, J. N. D. 1922. On the nest-building of the Little Tern. Brit. Birds 16: 94-98.

1921

Glegg, W. E. 1921. The nesting of the Little and Common Tern, and other species, on the Essex coast. Essex Nat. 19: 238-241.

Hoffman, R. 1921. A mating performance of the Least Tern. Auk 38: 596-597.

Smith, J. N. D. 1921. Notes on the Little Tern and young. Brit. Birds 15: 50-56.

1920

Lewis, T. 1920. Notes on the breeding habits of the Little Tern (Sterna a. albifrons). Brit. Birds 14: 74-82.

1916

Mearns, E. 1916. Description of a new subspecies of the American Least Tern. Proc. Biol. Soc. Wash. 29: 71.

1915

Sechrist, E. E. 1915. Least Tern. Oologist 32: 18.

1909

Shepardson, D. I. 1909. Notes on the Least Tern. Oologist 26: 152.

1908

Chambers, W. L. 1908. The present status of the Least Tern in southern California. Condor 10: 237.

1902

Kelsey, F. W. 1902. The Least Tern at San Diego. Condor 4: 144.

Smith, H. M. 1902. A supposed new colony of Least Terns on Martha's Vineyard. Auk 19: 76.

1901

Strong, R. M. 1901. Notes on terns. *Sterna hirundo*, *S. dougalli* and *S. antillarum*. Wilson Bull. 13: 69-70.

1899

McCormick, A. I. S. 1899. Breeding habits of the Least Tern in Los Angeles County, California. Bull. Cooper Ornithol. Club 1: 49.

1897

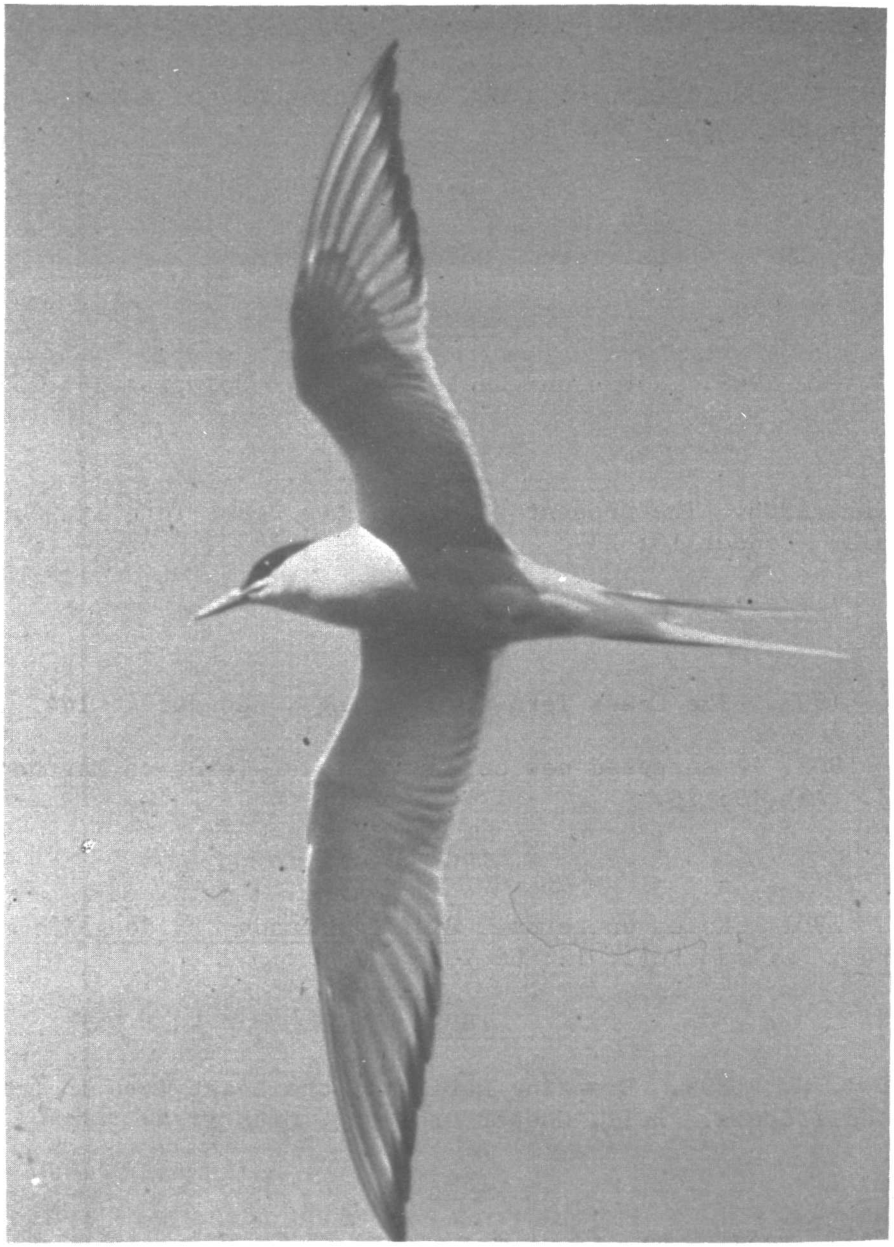
Howe, R. H., Jr. 1897b. The Least Tern breeding on Martha's Vineyard Island, Massachusetts. Auk 14: 402.

1890

Mabbott, G. 1890. A query in regard to the Least Tern. Auk 7: 410-411.

1884

Holterhoff, G. 1884. Occurrence of the Least Tern at San Diego, Cal. Auk 1: 294.



Adult Arctic Tern in breeding plumage. Photograph by H. R. Spendelow.

Adult Black Skimmers in breeding plumage. Photograph by Cherry Keller.

BRIDLED TERN

(Sterna anaethetus)

[DA: Brilleterne, DU: Brilstern, FR: Sterne bridee, GE: Braunzugelseeschwalbe, IC: Taumperna, IT: Beccapesci fuligula, JA: Mamijiro ajisashi, SP: Charran monja, Gaviota monja, Charran sombrio collarino; SW: Brunvingad sottarna, US: Brown-winged Tern, Panayan Tern]

GENERAL DISTRIBUTION

North America On the Atlantic side of Central America Bridled Terns breed locally off the coast of Belize and at many colonies in the West Indies (AOU 1957, Vaurie 1965, Bond 1971). Outside the breeding season this tropical species ranges widely at sea, occurring with some regularity as far north as North Carolina on the Atlantic coast. They are also widespread in the Gulf of Mexico and are common offshore in the northern Gulf. Stragglers have wandered as far north as Newfoundland (Godfrey 1966) and as far south as Cape Horn (Blake 1977).

World Distribution Off South America Bridled Terns breed on Las Aves and Los Roques Islands off Venezuela and have bred on Aruba (Blake 1977). They have bred (and may still breed) on Smith and Little Tobago Islands off Tobago (ffrench 1973). In Africa Bridled Terns breed in Mauritania (Banc d'Arguin, Rio de Oro), in the Gulf of Guinea on Principe, Sao Tome, and Annobon (Watson 1966), and on islets in the Red Sea to the Gulf of Aden (White 1965). They also breed in the Mid-East in the Persian Gulf (BOU 1971) and in the Indian Ocean from the Seychelles, Mauritius, and the Laccadive and Maldive Islands to islands off the coast of western India (Vaurie 1965, BOU 1971). West of there, Bridled Terns breed through the Sunda Archipelago to Australia, and from New Guinea north to southeastern China, the Philippines, Taiwan (Vaurie 1965), and Japan (Abe and Mano 1980). In the Pacific they wander north to Palau and the Marshall Islands, to the Ryukyu and Volcano Islands, and to Marcus Island (Vaurie 1965).

DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

North Carolina Bridled Terns were not recorded from North Carolina until 40 (25 in one flock) were seen offshore in 1962. With an increased amount of offshore observation since then, there are now at least 37 records for the state and it has become apparent that the species occurs regularly in small numbers off the coast. Lee and Booth (1979) reported that these terns were "rather common" in summer. Bridled Terns probably occurred rather regularly in the past along the North Carolina coast but were overlooked because of their pelagic distribution. More than 175 Bridled Terns were seen along the this coast following Hurricane David in September 1979 (Fussell and Allen-Grimes 1980, LeGrand 1980a).

1962	13 Sep.	40	seen 22-25 mi E Hatteras Inlet	Grant 1963
1971	3 Oct.	1	female found dead on bridge at Oregon Inlet	Browne et al. 1976
1972	8 Jan.	1	found long-dead (coll.) on Highway 12 at Oregon Inlet	Grant 1973
1972	19 Aug.	1	seen off Morehead City	Teulings 1973a
1972	8 Oct.	1	seen off Hatteras	Teulings 1973a
1973	19 May	9	seen, 1 coll., off Hatteras	Teulings 1973c
1973	26 May	8	seen off Morehead City	Teulings 1973c
1973	3 June	1	seen off Morehead City	Teulings 1973c
1973	25 July	3+	seen off Cape Hatteras	Teulings 1973d
1973	28 July	5	seen off Morehead City	Teulings 1973d
1973	29 July	12	seen off Hatteras	Teulings 1973d
1973	18 Aug.	4	seen off Morehead City	Teulings 1974d
1973	2 Sep.	11	seen off Hatteras	Teulings 1974d
1973	5 Sep.	8	seen at Diamond Shoal Light	Teulings 1974a
1973	16 Sep.	7	seen off Hatteras	Teulings 1974d
1974	3 Aug.	5	seen off Hatteras	Teulings 1975a
1974	4 Aug.	5	seen off Hatteras	Teulings 1975a
1974	9 Aug.	2	seen off Hatteras	Teulings 1975a
1974	18 Aug.	3	seen off Morehead City	Teulings 1975a
1974	1 Sep.	14	seen off Hatteras	Teulings 1975a
1974	13 Sep.	2	seen off Morehead City	Teulings 1975a
1974	14 Sep.	16	seen off Wrightsville Beach	Teulings 1975a
1975	31 Aug.	57	seen in Gulf Stream off Hatteras	Teulings 1976a
1975	7 Sep.	7	seen off Cape Lookout	Teulings 1976a

1976	25 June	1	seen off Beaufort Inlet	LeGrand 1976
1976	1 Aug.	1	seen off Cape Hatteras	LeGrand 1976
1976	5 Sep.	3	seen off Oregon Inlet	Teulings 1977a
1976	6 Sep.	22	seen off Hatteras	Teulings 1977a
1976	10 Oct.	2	seen off Hatteras	Teulings 1977a
1977	29 June	15-20	seen off Oregon Inlet	LeGrand 1977b
1977	3 Sep.	59	seen off Cape Hatteras	Teulings 1978b
1977	4 Sep.	64	seen off Cape Hatteras	Teulings 1978b
1978	17 Apr.	2	coll. off North Carolina	Lee and Booth 1979
1978	20 Aug.	19	seen off Oregon Inlet	LeGrand 1979a
197?	17 May	1(?)	coll. off North Carolina	Lee and Booth 1979
197?	12 Oct.	1(?)	seen off North Carolina	Lee and Booth 1979
1979	5 Sep.	120+	seen at Wrightsville Beach	LeGrand 1980a

South Carolina Sprunt and Chamberlain (1949) considered the Bridled Tern an accidental summer visitor along the South Carolina coast, and listed only six records for the state. There now are only 11 records, but we consider it likely that Bridled Terns are no less common off South Carolina than off North Carolina. The disparity in records may be the result of the more intensive offshore observations in North Carolina.

1885	25 Aug.	1	young male coll. at Frogmore, St. Helena Island	Brewster 1886
1912	12 Sep.	1	coll. 35 mi NE Tybee Island, Georgia	Rossignol 1913
1926	2 Aug.	1	found dead on Isle of Palms beach	Dingle 1927
1928	20 Sep.	1	found long-dead on Isle of Palms beach	Chamberlain 1933
1932	17 Jun.	1	female (coll.) inland at Orangeburg	Chamberlain 1933

1935	7 Sep.	1	found dead on Isle of Palms	Sprunt and Chamberlain 1949
1950	8 Sep.	1	imm. female found dead, coll.	Dingle 1955
1952	31 Aug.	1	found dead (coll.) on Sullivan's Island beach	Sprunt and Sprunt 1952
1973	25 July	1	seen 55 mi SE Charleston	Teulings 1973e
1978	4 Aug.	8	seen off Charleston	LeGrand 1979a
1979	Sep.	a few	seen off coastal S. Carolina	LeGrand 1980a

Georgia In Georgia, the Bridled Tern was recently considered rare offshore in summer and fall (Denton et al. 1977). We have seven records for the state, but believe that it is more common offshore than the paucity of records indicates.

1950	1 Oct.	2	found mummified on Tybee Island	Burleigh 1958
1964	10 Sep.	several	present (3 coll.) in Savannah after hurricane	Parnell 1965a
1976	15 Aug.	1(?)	Tybee Island	Denton et al. 1977
1976	21 Aug.	1(?)	off Cumberland Island	Denton et al. 1977
1979	2 Sep.	12	seen out from Jekyll Island	LeGrand 1980a
1979	Sep	a few	reported in coastal Georgia after hurricane	LeGrand 1980a
1979	5 Oct.	1	seen at Cumberland Island	LeGrand 1980a

Florida - Atlantic Coast The Bridled Tern occurs regularly in some numbers off the Atlantic coast of Florida. Kale (1979 ms a) considered it "Probably the most frequently observed tern in offshore waters." Peak numbers are present in late April and May, and again in August and September. Two records mentioned by Howell (1932) lack sufficient information to be included in the following list.

1888	29 Aug.	1	coll. at Cape Canaveral	Howell 1932
1945	Oct.	1	found dead at Cape Canaveral Light	Sprunt 1954
1949	Apr.	1	coll. at Daytona Beach	Bond 1950

1950	4 Sep.	1	imm. found dead at Neptune (Jacksonville area)	Grimes 1951
1955	10 July	1	found dead at Palm Beach	Stevenson 1955c
1957	late Apr.	seen	ca. 15 mi off Cocoa Beach	Robertson and Stevenson 1957
1957	1 May	14	seen ca. 15 mi off Cocoa Beach	Robertson and Stevenson 1957
1957	10 Aug.	6	seen off Elliott Key (1 coll.)	Stevenson 1957c
1957	18-20 Aug.	a number	seen 15-20 mi off Cocoa	Stevenson 1958a
1959	18 Apr.	18-20	seen off Miami	Stevenson 1959b
1959	23 Dec.	1	exhausted (coll.) off Cocoa	Stevenson 1960b
1960	14 July	1	seen 15-20 mi off Cocoa Beach	Stevenson 1960d
1960	5 Aug.	2	seen off Cocoa Beach	Stevenson 1960d
1960	10 Sep.	6	seen flying over canal, Miami Beach	Robertson and Paulson 1961
1960	10 Sep.	1	seen between Boynton Inlet and Lantana Beach	Knight 1961
1960	10 Sep.	5	seen near Franjo feeding over flooded farmland	Robertson and Paulson 1961
1960	10 Sep.	7	seen on parking lot, Miami	Robertson and Paulson 1961
1960	10 Sep.	1	captured, released, at Port Everglades	Robertson and Paulson 1961
1960	10-12 Sep.	30-32+	seen in Merritt Island area	Robertson and Paulson 1961
1961	19 May	2	seen E of Miami Beach	Abramson 1961
1961	25 May	25	seen E of Miami Beach	Abramson 1961
1961	20 May	2	seen 1 mi off Miami Beach	Abramson 1961
1962	13 Apr.	seen	off Miami	Paulson and Stevenson 1962

Bridled Tern

1963	24 Sep.	900+	seen at Playalinda Beach	Cunningham 1964a
1963	25 Sep.	1	imm. hit by car near Cocoa	Cunningham 1964a
1964	9 Sep.	24	seen at Rockledge	Cunningham 1965a
1964	10 Sep.	17	seen roosting on Guano Dam	Cunningham 1965a
1965	7,8 Sep.	1,3	seen at Boynton Inlet	Stevenson 1966a
1967	Sep.	seen	off Canaveral	Robertson and Ogden 1968
1968	26 Apr.	3	seen off Canaveral	Robertson 1968
1968	4 June	(1?)	seen at Sebastian Inlet	Stevenson 1968b
1968	16 June	12	seen over St. Johns River near Otter Bluff	Ellis 1969
1968	7 July	30	seen feeding over Lake Poinsett	Ellis 1969
1968	3 Sep.	15	seen feeding in surf, Playalinda Beach, E of Titusville	Ellis 1969
1968	4 June	1	seen on Indian River, St. Lucie County	Pantelidis and Pantelidis 1969
1971	14 Aug.	12	seen 15-25 mi off Cocoa	Ogden 1971
1971	5 Oct.	seen	off Brevard County	Robertson 1972
1971	21 Apr.	seen	off Canaveral	Kale 1971
1972	17 Jan.	1	coll. at Ponce Inlet, Volusia County	Carleton 1972
1972	last wk. Feb.	1	subad. found dead (coll.) between Turtle Mound and Cape Canaveral	Anderson 1972
1972	26 Aug.	6+	seen off Cocoa	Stevenson 1973
1972	9 Sep.	seen	off Cocoa	Stevenson 1973
1972	20 Aug.	seen	30 mi off Jacksonville	Stevenson 1973
1973	2 May	32	seen 16 mi E of Cape Canaveral	Kale 1973
1973	9 Sep.	2	seen 23 mi off Mayport	Edscorn 1974
1974	24 Apr.	1	seen E of Canaveral	Kale 1974

1974	20 May	6	seen E of Canaveral	Kale 1974
1975	31 Mar.	2	seen off Canaveral	Stevenson 1975
1975	Jul. to Oct.	seen	off Canaveral	Edscorn 1976
1975	22 Aug.	107	seen off Canaveral	Edscorn 1976
1975	1 Dec.	2	seen off Canaveral	Stevenson 1976
1976	29 Apr.	7	seen off Miami Beach	Kale 1976
1976	8 May	3	seen off Miami Beach	Kale 1976
1976	13 Dec.	1	found dead in Palm Beach Co.	Stevenson 1977
1979	27 Apr.	35	seen off Pompano Beach	Kale 1979
1979	3 May	12	seen off Ponce Inlet	Kale 1979
1979	13 May	several	seen off Ft. Pierce Inlet	Kale 1979
1979	Sep.	at least 50	seen at various points	Atherton and Atherton 1980

Florida - Keys Bridled Terns are regular and relatively common off the Florida Keys. Most of the records fall from April to July, but this may only reflect the periods during which the Dry Tortugas have been visited most often.

1938	9 July	1	exhausted bird coll. at Marquesas Keys	Russell 1939
1940	2 Oct.	1	imm. caught, banded at Florida Bay, Monroe County	Sprunt 1941
1946	21 June	1	seen on New Ground Shoal, 25 mi E Tortugas	Sprunt 1947a
1949	6 Sep.	1	coll. at Ft. Jefferson, Dry Tortugas	Sprunt 1950
1952	17 Sep.	1	imm. seen between Garden and Logger-head Keys, Dry Tortugas	Sprunt 1954
1953	1 June	1	seen at Dry Tortugas	Stevenson 1953b
1954	6 June	seen	at Key West	Stevenson 1954b
1954	3 July	seen	at Key West	Stevenson 1954b
1954	25 July	1	found moribund at Little Duck Key	Christensen 1955

1957	15 June	fair numbers	seen in Straits of Florida	Stevenson 1957c
1957	1 July	fair numbers	seen in Straits of Florida	Stevenson 1957c
1959	27 June	2	seen 6 mi off Marathon	Stevenson 1959c
1960	6 May	at least 12	seen 8 mi off Marathon	Stevenson 1960c
1960	17 May	at least 12	seen 8 mi off Marathon	Stevenson 1960c
1960	11 Sep.	2	seen off Islamorada	Robertson and Paulson 1961
1961	2 Sep.	found	"in appreciable numbers" off Islamorada	Stevenson 1962a
1964	20 June	2	seen on island off Key West	Stevenson 1964b
1964	23 Sep.	1	seen off Key Largo	Cunningham 1965a
1967	22 Apr.	1	seen between Key West and Dry Tortugas	Stevenson 1967b
1967	18 June	4	seen 5 mi off Marathon	Stevenson 1967c
1970	16 Apr.	2	seen S of Marathon	Kale 1970
1970	July	several	seen in Florida Straits	Ogden 1970
1970	4 Aug.	5	seen between the Marquesas Keys and Dry Tortugas	Ogden 1970
1971	4 Apr.	2	seen off Marathon	Kale 1971
1971	2 May	seen	near the Dry Tortugas	Kale 1971
1971	10 May	2	seen off Marathon	Kale 1971
1971	31 May	5	seen E of Islamorada	Kale 1971
1971	late June	1	seen in Florida Straits between Key West and Dry Tortugas	Ogden 1971
1971	25 July	5	seen in Florida Straits	Ogden 1971
1972	22 Apr.	2	seen 10 mi SW Marquesas Keys	Kale 1972
1972	13 Sep.	seen	at Molasses Reef	Stevenson 1973
1975	ca. 17-21 Jan.	1	seen at Key West	Stevenson 1975

1978	22 Feb.	3	seen in Dry Tortugas	Stevenson 1978
1979	9 May	75	seen off Islamorada	Kale 1979

Florida - Gulf Coast Bridled Terns are seen relatively infrequently off the Florida Gulf coast and are probably less abundant there than off the Atlantic coast. They are probably more abundant offshore than the records indicate. As on the Atlantic coast, these terns are most common in early fall.

1938	10 Apr.	1	found dead on W Bay Bridge, Panama City	Sprunt 1954
1945	29 Dec.	1	found dead on Pensacola Bay Bridge	Weston and Pate 1954
1950	31 Aug.	6	seen at Alligator Point, near St. Marks	Sprunt 1954
1965	19 June	1	seen 20 mi off Panama City	Stewart 1965
1966	9 June	1	seen at Mullet Key	Stevenson 1966b
1976	25 Sep.	3	seen off Clearwater	Edscorn 1977
1977	16 Apr.	3	seen 65 mi W Clearwater	Kale 1977
1977	31 July	1	seen off Clearwater	Edscorn 1978
1977	9 Sep.	7	seen off Clearwater	Edscorn 1978

Alabama As recently as 1977, the Bridled Tern was seen rarely in Alabama and was regarded as an accidental species. Since then, Duncan and Havard (1979 ms) have demonstrated that it occurs regularly and perhaps commonly in waters off Alabama. Duncan and Havard (1979 ms) did not report all their observations of Bridled Terns off Alabama but implied that they have also been seen in May and August.

1932	2 Sep.	6	seen and 1 found dead at Gulf Shores	Edwards 1933
1960	2 July	1	seen 80-90 mi S of entrance to Mobile Bay	Imhof 1960
1978	11 June	2	seen ca. 50 km S Sand Island Light	Duncan 1978
1978	22 July	2	seen off Orange Beach at 100 fathoms	Duncan 1978
1978	2 Sep.	1(?)	seen S of Dauphin Island	Purrington 1979
1978	17 Sep.	1(?)	seen S of Dauphin Island	Purrington 1979

1979	mid-Apr.	seen	off Alabama	Duncan and Havard 1979 ms
1979	June	14	seen in one flock off Alabama	Duncan and Havard 1979 ms
1979	July	25	seen in one day off Alabama	Duncan and Havard 1979 ms

Mississippi We know of only two records for Mississippi. The carcass of an adult was collected at Mississippi City 26 May 1979 (Hays 1979) for the first state record and an adult was seen inland at the Hattiesburg sewage lagoons on 13 September 1979 (Gates and Fairley 1979). Recent observations off Alabama suggest that Bridled Terns may occur with some regularity off the Mississippi coast as well.

Louisiana We know of two records for Louisiana. One was found dead at West Holly Beach, Cameron Parish on 16 September 1961 and another was seen over the campus of Louisiana State University at Baton Rouge on 10 September 1965 (Lowery 1974).

Texas Bridled Terns have seldom been seen in Texas. As in other states bordering the Gulf of Mexico, they are probably more common offshore than the meager records might suggest.

1961	9 Sep.	5	seen off and S of Galveston	Webster 1962a
1961	10 Sep.	8	seen off and S of Galveston	Webster 1962a
1961	10 Sep.	1	seen in Galveston	Webster 1962a, Oberholser 1974
1961	11 Sep.	1	seen off and S of Galveston	Webster 1962a
1961	13 Sep.	1	seen off and S of Galveston	Webster 1962a, Oberholser 1974
1961	13 Sep.	1	seen in Galveston Bay	Webster 1962a
1971	16 May	5	ad. seen ca. 25 mi off Galveston (near large belt of sargassum)	Oberholser 1974

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

Breeding Bridled Terns occur and breed around the world in warm waters with the exception of the Pacific Ocean where they are largely absent. They do not breed within the borders of the United States but are widespread in the Caribbean. Details of their distribution and abundance there are poorly known. At least eleven colonies have been reported from the U.S. Virgin Islands (Dewey and Nellis 1980), but we do not know the number of breeding birds.

Migration and Winter Bridled Terns are highly pelagic during the nonbreeding season. Information is scanty on their pelagic distribution, movements, and dispersal from the breeding colonies. Only in the last several years has this tern been recognized as a common bird offshore of the southeastern United States. They are apparently much more abundant from mid- or late April through September (Tables 71, 72) in the Gulf and along the Atlantic coast than at other times, but this may reflect a bias in the times of year that observations have been made. Few observations have been made from October through March and it may be that Bridled Terns are more abundant, at least in warmer waters, in these months than present information indicates.

HABITAT

Nesting Bridled Terns are birds of tropical and subtropical waters that usually nest in small scattered colonies, often on small rocky islands (Diamond 1976), on substrates ranging from rock ledges to shingle to sandy beaches (Serventy et al. 1971). The nests are placed under cover of bushes, rock ledges, or boulders (Serventy et al. 1971, Diamond 1976), or the floor of a cave (Warham 1958). In the Caribbean, eggs have been found in the entrances of burrows abandoned by Audubon's Shearwater (Bonhote 1903 in Murphy 1936). Bridled Terns breeding on islands usually nest under vegetation. At Los Roques Island, off Venezuela, most nested under dense mats of saltwort (*Batis maritima*), but some nested among coral rubble (LeCroy 1976). Those breeding on Las Aves Island, also off Venezuela, were found nesting among a dense cover of a low herb (*Sesuvium portulacastrum*) around a saltwater pool (van der Werf et al. 1958). At both localities the birds had tunneled through and under the vegetation to the nest site, which was a simple depression in the sand. Tunnels to the nest were "of varying length" at Los Roques (LeCroy 1976) and about 40 cm (16 in) long at Las Aves (van der Werf et al. 1958).

Feeding Breeding birds were commonly seen feeding inshore at Cousin Island in the Seychelles, often in mixed flocks with Brown Noddies and Black Noddies (*Anous minutus*) (Diamond 1976). Those breeding at Los Roques Island, off Venezuela, fed out of sight of land (LeCroy 1976).

Nonbreeding and Offshore Outside the breeding season, Bridled Terns are found primarily in warm tropical and subtropical waters and, like Sooty Terns, are strongly pelagic. Until recently Bridled Terns were considered accidental or vagrant in most of the southeastern United States; a large proportion of the records were from birds blown to shore or inland by severe storms. Recent exploration of waters off the Atlantic coast and Gulf of Mexico revealed their regularity in these waters, but they are usually found well offshore. In North Carolina, most birds were seen 20 mi (32 km) or more offshore and along the western edge of the Gulf Stream (Lee and Booth 1979). Off Alabama, Bridled Terns were always seen in association with lines of sargassum weed, usually well offshore, but once as close as 2 km (1.2 mi) (Duncan and Havard 1979 ms).

Table 71. Approximate number of Bridled Terns recorded by month for the coastal southeastern United States (a).

	Months										
State/region	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	DEC
North Carolina	-	-	-	2	18	17	20	97	374+	4	-
South Carolina	-	-	-	-	-	1	1	11	3	-	-
Georgia	-	-	-	-	-	-	-	2	17	1	-
Florida- Atlantic Coast	1	-	2	68	98	14	32	138	1068	2	3
Subtotal-ATLANTIC COAST	1	-	2	70	116	32	53	248	1462	7	3
Florida - Keys	1	3	-	7	107	15	11	5	8	1	-
Florida - Gulf Coast	-	-	1	3	-	2	1	6	10	-	-
Alabama	-	-	-	1	x(b)	16	30	1	8	-	-
Mississippi	-	-	-	-	1	-	-	-	1	-	-
Louisiana	-	-	-	-	-	-	-	-	2	-	-
Texas	-	-	-	-	5	-	-	-	17	-	-
Subtotal-GULF COAST	-	-	1	4	6	18	31	7	38	-	-
Total-ALL AREAS	2	3	3	81	229	65	95	260	1508	8	3

(a) Birds found dead within the first 10 days of a month are arbitarily assigned to the preceding month; those obviously long dead are not included in this table. Where the number seen was not specified, we have assumed that one bird was seen. If more than one bird was known to have been seen but the number was not specified, we have assumed that two birds were seen.

(b) Probably seen but no specific information available.

FOOD AND FEEDING BEHAVIOR

Very little is known of the diet of the Bridled Tern. Diamond (1976) did a preliminary analysis of regurgitated food, mostly from adults, at Cousin Island in the Seychelles. Most of the food consisted of small fish, crustaceans, and water striders (Halobates sp.). Nearly all fish measured were less than 4 cm (1.6 in) long. Two fish regurgitated by young Bridled Terns at Los Roques Island were a flying fish too small to be identified and a flying gurnard (Dactylopterus volitans) (LeCroy 1976).

Bridled Terns feed primarily by surface-dipping (Serventy et al. 1971), i.e., by hovering over the water and picking food either from the surface or

Table 72. Dates of occurrence for Bridled Terns in the coastal southeastern United States.

State	Number of occurrences	Dates of occurrence (a)
North Carolina	37+	17 May - 12 Oct.
South Carolina	10	17 June - 12 Sep.
Georgia	7	15 Aug. - 5 Oct.
Florida- Atlantic Coast	58+	31 Mar. - 5 Oct. (1 Dec.-17 Jan.)
Florida- Keys	34+	4 Apr. - 2 Oct. (17 Jan.-22 Feb.)
Florida- Gulf Coast	9	16 Apr. - 9 Sep.
Alabama	9+	mid-Apr. - 17 Sep.
Mississippi	2	13 Sep.
Louisiana	2	10-16 Sep.
Texas	7	16 May - 13 Sep.

(a) Unusual dates are listed in parentheses. Birds found dead are excluded from the table, but the total number of occurrences known to us is listed.

slightly beneath it. LeCroy (1976) suggested that these birds feed at night, particularly on moonlit nights.

IMPORTANT BIOLOGICAL PARAMETERS

Egg Laying The time of nesting varies greatly over the large tropical range of this species. Watson (1966) reported egg laying in May and June on islets off Venezuela, and Bent (1921) mentioned nesting records from mid-April to late June in the Bahamas. On the south coast of Western Australia, the peak of nesting is in November (Warham 1958). In the Seychelles, Bridled Terns lay at intervals of seven and eight months (Diamond 1976), so that nesting may occur any time of the year.

Mean Clutch Size Bridled Terns lay only one egg.

Incubation Period Hulsman (1980) lists the incubation period for this species as 28-30 days.

Hatching Success In studies done on One Tree Island on the Great Barrier Reef of Australia, 93.3% of 60 eggs hatched in 1973-74, as did 96.2% of 53 eggs in 1974-75 (Hulsman 1977a).

Age at Fledging Diamond (1976) reported that Bridled Terns in the Seychelles had a fledging period of about nine weeks and that adults fed young for several weeks thereafter. Hulsman (1980) reported a fledging period of 61-62 days.

Fledging Success Hulsman (1977a) reported a fledging success of 96% of the chicks, or 90% of the eggs laid, in the 1973-74 season, and 100% of the chicks or 96% of the eggs in 1974-75.

Mortality of Eggs and Young At One Tree Island on the Great Barrier Reef, nesting success was high in two breeding seasons but very low in another (1975-1976). In the latter breeding season, only about 9 of 51 eggs fledged young. The primary source of egg loss was a cyclone that flooded part of the colony and later led to starvation for some of the remaining young (Hulsman 1977a). Another source of loss is human predation. According to Cott (1953 in Warham 1958), this species is one of those most persecuted for its eggs. Diamond (1976) reported that skinks (*Mabuya wrightii* and *M. sechellensis*) would take unprotected eggs in the Seychelles. A Yellow-crowned Night-Heron (*Nycticorax violaceus*) was seen eating a Bridled Tern chick at Los Roques Island (LeCroy 1976); other observations suggest that these herons also feed on the eggs.

Renesting It is not known whether Bridled Terns will renest soon after the loss of an egg. The subannual breeding cycle in the Seychelles makes it unlikely that it occurs in that area.

Age at First Breeding Unknown.

Maximum Natural Longevity An Australian bird reached an age of at least 14 years and 6 months (Anon. 1978).

Weights Calculations based on data of Diamond (1976) yield an average weight of 95.6 g (0.21 lb) for 69 adults from Cousin Island in the Seychelles. Two newly hatched young at Los Roques Island off Venezuela weighed 16.0 g (0.56 oz) and 19.5 g (0.69 oz) (LeCroy 1976). Six eggs from the Seychelles averaged 19.8 g (0.70 oz) (Diamond 1976).

SUSCEPTIBILITY TO OIL POLLUTION

LeCroy (1976) mentioned that two birds at Los Roques Island had been oiled. One had only a spot on the bill, but the other had "its face and vent well fouled by crude oil." Strongly pelagic during the nonbreeding season, Bridled Terns are apparently reluctant to settle on the surface of the sea, and will instead choose to perch on any drifting object (Smith 1951, Warham 1958, contra Murphy 1936). This habit, the widespread pelagic distribution, and the apparent tendency toward little or no diving should make this species less vulnerable to oiling than many other terns.

Although no satisfactory estimates of pelagic populations can be derived at this time, recent observations have shown that Bridled Terns are considerably more abundant both off the Atlantic coast and in the Gulf of Mexico than was previously thought. If a substantial number occur in the southeastern United States, oil pollution may have a greater impact on the species than we might now expect.

BIBLIOGRAPHY

1982

Holman, D. J. 1982. Mystery photographs. 69. Bridled Tern. Brit Birds 75: 422-423.

van den Berg, A. B., C. A. W. Bosman and F. G. Rozendaal. 1982. Mass movement of Bridled Terns *Sterna anaethetus* and Wilson's Petrels *Oceanites oceanicus* off Colombo, Sri Lanka. Ardea 70: 81-82.

1981

Hulsman, K. 1981. Width of gape as a determinant of size of prey eaten by terns. Emu 81: 29-32.

Neelakantan, K. K. 1981. The Brownwinged Tern (*Sterna anaethetus*): an addition to the birds of Kerala. J. Bombay Nat. Hist. Soc. 78: 167-168.

1980

Abe, N. and T. Mano. 1980. The first breeding record of the Bridled Tern *Sterna anaethetus* in Japan. J. Yamashina Inst. Ornithol. 12: 183-191.

Hulsman, K. 1980. Feeding and breeding strategies of sympatric terns on tropical islands. Proc. Internatl. Ornithol. Congr. 17: 984-988.

1979

Gates, L. and T. Fairley. 1979. Bridled Tern: first observation of a live bird in Mississippi. Mississippi Kite 9: 40-41.

Hays, M. B. 1979. First record of the Bridled Tern in Mississippi. Mississippi Kite 9: 39.

Rowlett, R. A. 1979. A first record of the Bridled Tern off Virginia. Raven 50: 11-12.

1978

Duncan, C. D. 1978. Bridled Tern and Audubon's Shearwater in Alabama. Ala. Birdlife 26: 16-17.

Wingate, D. B. 1978. A summer record of the Bridled Tern: a potential new breeder? Mon. Bull. Bermuda Dep. Agric. Fish. 48: 85-86.

1977

Hulsman, K. 1977a. Breeding success and mortality of terns at One Tree Island, Great Barrier Reef. Emu 77: 49-60.

Nicholls, G. H. 1977. Studies of less familiar birds. Bridled Tern. Bokmakierie 29: 20-23.

Rowlett, R. A. 1977. A non-storm-blown Bridled Tern and other observations from a late September pelagic trip off Maryland. Md. Birdlife 33: 31-33.

1976

Browne, M. M., D. L. Hughes and G. M. Williamson. 1976. A Bridled Tern from North Carolina. Chat 40: 95.

Diamond, A. W. 1976. Subannual breeding and moult cycles in the Bridled Tern *Sterna anaethetus* in the Seychelles. Ibis 118: 414-419.

LeCroy, M. 1976. Bird observations in Los Roques, Venezuela. Am. Mus. Novit. 2599. 30 pp.

1975

Hulsman, K. 1975. The skimming behaviour of terns. Sunbird 6: 41-43.

Mitchell, R. C. 1975. Departure date of the Bridled Tern in Shark Bay. West. Austr. Nat. 13: 66.

Sinclair, J. C. 1975. A sight record of the Bridled Tern from Natal. Ostrich 46: 120.

1974

Hulsman, K. 1974. Notes on the behaviour of terns at One Tree Island. Sunbird 5: 44-49.

1973

Grant, G. S. 1973. Second Bridled Tern specimen from North Carolina. Chat 37: 23-24.

McKean, J. L. and D. Gray. 1973. Unusual seabird records from the Northern Territory. Emu 73: 184.

1972

Carlton, G. 1972. Unusual larids in Volusia County. Fla. Nat. 45: 94.

Griffin, A. C. M. 1972. Bridled, Sooty and Common Terns at Townsville. Sunbird 3: 39.

Lovell, R. H. 1972. Bridled Tern on Troubridge Island. S. Austr. Ornithol. 26: 36.

1971

Peterson, R. T. and G. E. Watson. 1971. Franklin's Gull and Bridled Tern in southern Chile. Auk 88: 670-671.

1970

Stranger, R. H. 1970. Bridled Tern perching on buoys. West. Austr. Nat. 11: 145.

1969

Bonnin, M. 1969. Breeding of the Bridled Tern in South Australia. Emu 69: 243.

Ellis, L. 1969. Bridled Terns (*Sterna anaethetus*) along the East Coast. Fla. Nat. 42: 40.

Pantelidis, N. and V. Pantelidis. 1969. Terns seen during and after passage of Hurricane Abbey at Fort Pierce, June 4-5, 1968. Fla. Nat. 42: 40.

1968

Bonnin, M. 1968. The Bridled Tern breeding in South Australia. S. Austr. Ornithol. 25: 18, 22.

1964

Dickinson, E. C. and J. A. Tubb. 1964. Notes on terns nesting in the Gulf of Thailand. Nat. Hist. Bull. Siam Soc. 20: 321-324.

1963

Grant, R. H. 1963. Bridled Terns off the North Carolina coast. Chat 27: 21-22.

Voous, K. H. 1963. Tern colonies in Aruba, Curacao, and Bonaire, South Caribbean Sea. Proc. Internatl. Ornithol. Congr. 13: 1214-1216.

1961

Knight, R. 1961. Donna's Tern displacements. Fla. Nat. 34: 43.

1960

Wright, M. A. 1960. Bridled Tern in Somerset. Brit. Birds 53: 32.

1958

van der Werf, P. A., J. S. Zaneveld and K. H. Voous. 1958. Field observations on the birds of the islas Las Aves in the southern Caribbean Sea. Ardea 46: 37-58.

Warham, J. 1958. Photographic studies of some less familiar birds. XCI. Bridled Tern. Brit. Birds 51: 303-308.

1955

Christensen, M. D. 1955. Bridled Tern, *Sterna anaethetus*, at Little Duck Key. Fla. Nat. 28: 60.

Dingle, E. von S. 1955. A 1950 Bridled Tern record for South Carolina. Chat 19: 87.

Kennedy, P. G. 1955. Bridled Tern in Dublin. Brit. Birds 48: 89-90.

Salmon, H. M. 1955. Bridled Tern in Glamorgan. Brit. Birds 48: 90.

1954

Weston, F. M. and L. E. Pate. 1954. Bridled Tern, *Sterna anaethetus*, in winter at Pensacola. Fla. Nat. 27: 60, 64.

1952

Sprunt, A., Jr. and A. Sprunt, IV. 1952. Bridled Tern on the South Carolina coast. Chat 16: 98-99.

1951

Smith, K. D. 1951. Notes on the Bridled Tern in the Red Sea. Brit. Birds 44: 325-326.

1950

Bond, J. 1950. A Florida record of Bridled Tern. Fla. Nat. 23: 68.

Sprunt, A., Jr. 1950. Bridled Tern, *Sterna a. melanoptera*, taken at Dry Tortugas. Auk 67: 514.

Tomkins, I. R. 1950. Unusual bird records after the Labor Day storm. Oriole 15: 39-40.

1947

Sprunt, A., Jr. 1947a. The Bridled Tern again in south Florida waters. Auk 64: 141-142.

1941

Sprunt, A., Jr. 1941. Bridled Tern in Florida Bay. Auk 58: 259-260.

1939

Hoogerwerf, A. 1939. Enkele bijzonderheden van de op het Vulkaaneiland Goenoeng Api (Banda Zee, N. O. I.) levende Oceaanvogels. Limosa 12: 141-165. [In Dutch.]

Russell, J. C. 1939. Bridled Tern on Marquese Islands. Fla. Nat. 12: 44.

1933

Chamberlain, E. B. 1933. Bridled Tern in South Carolina. Auk 50: 104-105.

Edwards, H. M. 1933. Bridled Tern, a new bird for Alabama. Auk 50: 105.

Gowanloch, J. N. 1933. A new bird is discovered in Louisiana. La. Conserv. Rev. 3: 32.

1927

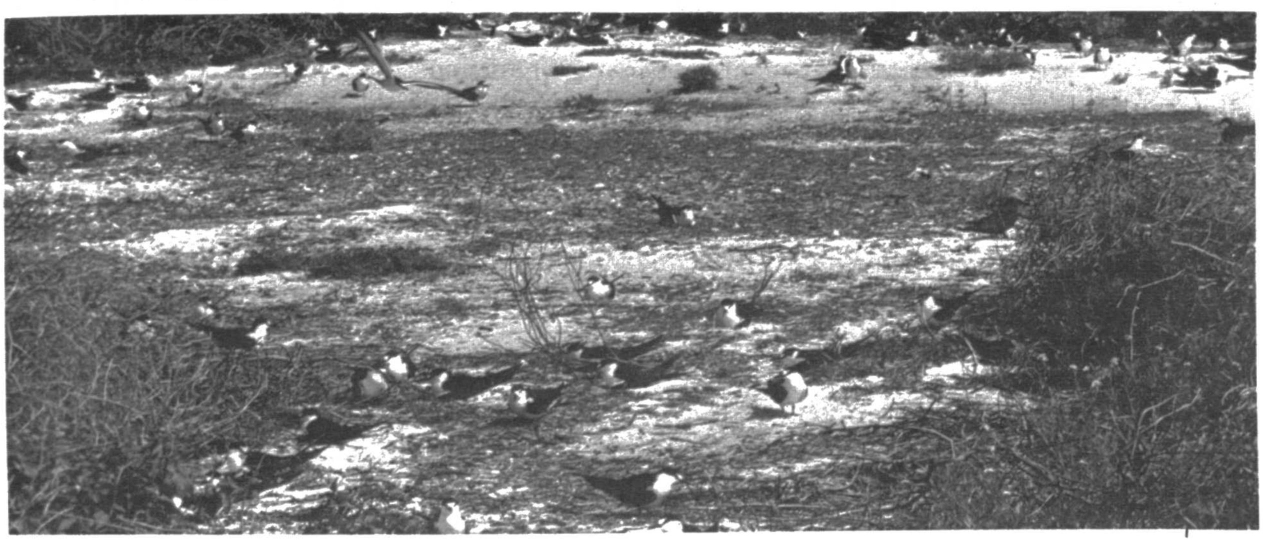
Dingle, E. von S. 1927. Sooty Tern (Sterna fuscata) and Bridled Tern (Sterna anaetheta) on the South Carolina coast. Auk 44: 93-94.

1913

Rossignol, G. R., Jr. 1913. Another Bridled Tern for South Carolina. Auk 30: 105.

1886

Brewster, W. 1886. The Bridled Tern (Sterna anaethetus) in South Carolina. Auk 3: 131.



Sooty Tern colony at Bush Key, Florida. Photograph by Roger B. Clapp.

SOOTY TERN

(Sterna fuscata)

[DA: Sodfarvet Terne, DU: Bonte Stern, EN: Wideawake, FR: Sterne fuligineuse, GE: Russseeschwalbe, IC: Mottultherna, IT: Rondine di mare scura, JA: Seguro ajisashi, NW: Svartryggterne, PO: Rybitwa czarnogrzbietna, PR: Anorinha do mar, SP: Charran oscuro, Charran sombrio, SW: Sottarna]

GENERAL DISTRIBUTION

North America In the United States, Sooty Terns breed primarily in Florida at Bush Key in the Dry Tortugas. They also breed in very small numbers on the Chandeleur Islands in Louisiana and on islands along the Gulf coast of Texas. Breeding was attempted in 1978 in North Carolina (Fussell et al. 1981, Map 23).

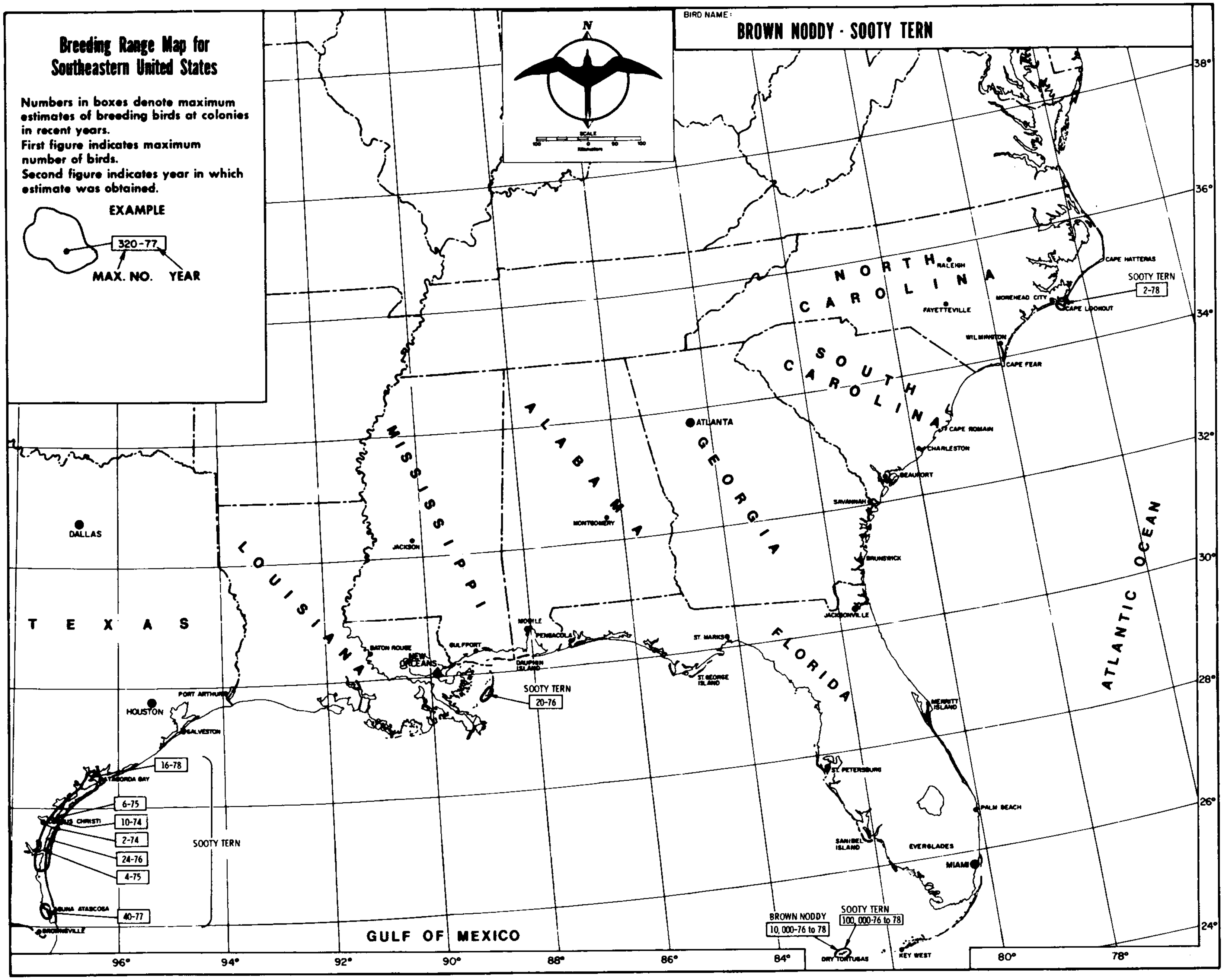
In the southern Gulf of Mexico, Sooty Terns breed on Isla Perez, Alacran Reef, possibly on Cayos Arcas and Isla Mujeres (Paynter 1955), and perhaps elsewhere, but little is known about these colonies. They breed widely in the Caribbean (Ashmole 1963a, Bond 1971), but details of distribution and population size are not known. In addition, the little information that does exist often is based only on observations that were made several decades ago.

On the Atlantic side of Central America, Sooty Terns nest off Belize (Blake 1977) and possibly off Honduras (Monroe 1968). On the Pacific side they nest on islands off Mexico (Revilla Gigedos, Tres Marias, Clipperton and Isabella Islands off Nayarit) and off Panama on the Islas Frailes del Sur (Wetmore 1965, Blake 1977).

Birds leave the nesting areas at the end of the breeding season to spend the nonbreeding period at sea. Details of dispersal are known for only a few breeding areas. Adults from the Florida colony disperse to the Gulf of Mexico and other nearby waters. Young birds, on the other hand, move across the Atlantic to the Gulf of Guinea off West Africa (Robertson 1969). Both adults and young from central Pacific populations disperse primarily to the west with little or no intermixing between northern and southern populations (Gould 1974).

World Distribution On the Atlantic side of South America, Sooty Terns breed on offshore islands including Margarita Island off Venezuela; islets off Trinidad and Tobago; and on Rocas, Fernando Noronha, Trindade, and Martin Vas off Brazil (Watson 1966). On the Pacific side they breed on Wenman and Culpepper Islands in the northwest Galapagos Islands and on San Felix Island off Chile (Ashmole 1963a).

Sooty Terns also breed in the tropical eastern Atlantic, including Ascension and St. Helena Islands (Watson 1966), and probably in the Gulf of Guinea on Principe or its offshore islets (Fry 1961). Records of breeding at other


Breeding Range Map for
Southeastern United States
Numbers in boxes denote maximum estimates of breeding birds at colonies in recent years.
First figure indicates maximum number of birds.
Second figure indicates year in which estimate was obtained.
EXAMPLE
320-77
MAX. NO.
YEAR
N
SCALE
BIRD NAME:
BROWN NODDY - SOOTY TERN
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI
LOUISIANA
TEXAS
FLORIDA
ATLANTIC OCEAN
GULF OF MEXICO
RALEIGH
FAYETTEVILLE
MOREHEAD CITY
CAPE LOOKOUT
CAPE HATTERAS
SOOTY TERN
2-78
WILMINGTON
CAPE FEAR
CAPE ROMAIN
CHARLESTON
BEAUFORT
SAVANNAH
BRUNSWICK
JACKSONVILLE
ATLANTA
MONTGOMERY
JACKSON
MOBILE
PENSACOLA
GULFPORT
BATON ROUGE
NEW ORLEANS
DAUPHIN ISLAND
SOOTY TERN
20-76
ST. MARKS
ST. GEORGE ISLAND
MERRITT ISLAND
ST. PETERSBURG
PALM BEACH
SANIBEL ISLAND
EVERGLADES
MIAMI
BROWN NODDY
10,000-76 to 78
SOOTY TERN
100,000-76 to 78
DRY TORTUGAS
KEY WEST
DALLAS
HOUSTON
PORT ARTHUR
GALVESTON
16-78
6-75
10-74
2-74
24-76
4-75
40-77
SOOTY TERN
LAGUNA ATASCOSA
BROWNSVILLE
38°
36°
34°
32°
30°
28°
26°
24°
96°
94°
92°
90°
88°
86°
84°
80°
78°

Map 23

localities in this area (in the Azores, Cape Verde Islands, and the northwestern African coast) are doubtful (W. Robertson, pers. comm.). A pair reported nesting off Gambia (ca. 13°40' N) (de Naurois 1969) should be regarded as an instance of extralimital breeding (W. Robertson, in litt.).

Off the west coast of Africa Sooty Terns breed at least in the Gulf of Aden and off Tanzania (White 1965). They commonly nest in the Indian Ocean and breeding has been reported from the Seychelles, the Amirantes, the Iles Glorieuses, Cargados Carajos, on islets off Mauritius, off Malagasy and the west coast of India, in the Laccadive and Maldive Islands, the Chagos Archipelago, the Andaman Islands, and North Keeling Island (Ashmole 1963a). Sooty Terns breed east of these areas in Indonesia, the Philippines, on many islands off Northern Australia; and from the Abrolhos Islands in Western Australia east to the Cairns area of Queensland (Ashmole 1963a, Serventy et al. 1971).

Sooty Terns also breed abundantly on the islands of the Pacific. They breed from Easter Island in the southeast to the Hawaiian Islands in the northeast, thence west to the Bonin Islands and Palau to New Caledonia and the Kermedec Islands. Within this area they have been recorded breeding at every island group except the New Hebrides and Solomon Islands (King 1967).

DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

North Carolina Pearson et al. (1942) considered Sooty Terns rare stragglers in North Carolina. These authors and Wray and Davis (1959) listed only seven records from the state between them. We found another 12 records (listed below) involving about 17 birds for the period between Wray and Davis' publication and through July 1979.

1963	3 Aug.	2	ad. seen passing from 37.5 mi ESE to 47.75 mi E of Cape Lookout	Sykes 1963
1968	8 June	1	found inland at Chimney Rock (in the mountains)	Duchein 1968
1969	7 Sep.	1	ad. seen 55 mi off Morehead City	Browne and Grant 1970
1971	28 Aug.	1	seen near Morehead City	Teulings 1972a
1972	17 July	1	seen at Shackleford Banks	Teulings 1972d
1973	24 June	1	ad. seen roosting on beach at Cape Hatteras	Teulings 1973d
1975	7 Sep.	2	seen off Cape Lookout	Teulings 1976a
1976	3 July	2	or more seen onshore near Cape Lookout	LeGrand 1976

1977	1 June	2	seen off Oregon Inlet	LeGrand 1977b
1979	1 May	1	seen onshore at Cape Hatteras	LeGrand 1979c
1979	29 June	1	seen at Morgan Island	LeGrand 1979d
1979	20 July	2	seen offshore Morehead City	LeGrand 1979d

Potter el al. (1980) regarded this species as an uncommon but regular summer visitor along the coast from June through September. Lee and Booth (1979) summarized offshore observations and found only 21 records for the state, more than a third of them associated with tropical storms. More recent observations (Fussell and Grimes 1980; LeGrand 1980a, 1980b, 1981a) consist of at least 20 records of well over a thousand birds, most of them seen after Hurricane David in September 1979. W. Robertson (in litt.) believes that none of these birds were from the Dry Tortugas because no banded birds were found. He suggested that they may have come from the Bahamas. Extreme dates of occurrence for the state are 16 March (Pearson et al. 1942) and 2 November (LeGrand 1980b).

In 1978 a pair of Sooty Terns attempted to nest at Morgan Island in the estuary north of Cape Lookout. A nest with an egg was found 16 June beneath a clump of Spartina patens, but only fragments of the egg remained on 25 June (Fussell et al. 1981). Sooty Terns may have attempted to nest in North Carolina on several previous occasions. Two birds were observed acting as if defending nest sites on Morgan Island 21 June and 10 July 1959 (Joyner 1959, Fussell et al. 1981) and an adult was "hovering" over a group of bird banders at the same place in late June 1961 (Davis 1961).

South Carolina Sprunt and Chamberlain (1949) considered the Sooty Tern a casual summer visitor along the coast, seen mostly during or after tropical storms. Nineteen records were listed by Sprunt and Chamberlain and by Burton (1970). We know of another three records through July 1979. Several were seen at Charleston from 28 August through 4 September 1949 (Denton and Chamberlain 1950a), one was seen on nearby Deveaux Bank 30 June 1970 (Teulings 1970b), and another was seen at Bull's Island 22 July 1979 (LeGrand 1979d). Subsequent observations involve about a dozen records of live, moribund, and dead birds following Hurricane David in the fall of 1979. Dates of occurrence for the state for live birds range between 6 June and 20 October (Burton 1970).

Georgia Burleigh (1958) regarded the Sooty Tern as casual both on the coast and inland and knew of only five records for Georgia. Denton et al. (1977) considered this bird an occasional offshore visitor during the summer and fall, and mentioned two other records. We found only three other records which is surprising in view of the numbers recently reported to the north in the Carolinas. A bird banded at the Dry Tortugas was found dead at Sea Island 20 September 1966 (Robertson 1967 ms a). Another was seen 27 July 1973 and for a month thereafter at Kiawaw Island (Teulings 1975a) and two, one of them an immature, were seen inland at Claxton on 14 September 1976 following a storm (Teulings 1977a). Records range from 4 June (Denton et al. 1977) to 27 September (Burleigh 1958).

Florida - Atlantic Coast Sooty Terns occur frequently off the Florida Atlantic coast and are most often often seen following hurricanes. As many as several hundred may be seen at once, but usually far fewer are reported. Most are seen from late summer through early fall (Kale 1979 ms a).

Florida - Keys The Dry Tortugas has one of the larger and more successful Sooty Tern colonies in the New World. The population there in the early 1800's was probably no more than 50,000 pairs and decreased to as few as 5,000 adults in 1903 as a result of commercial egging. Subsequent peak populations were recorded in 1919 (110,000 adults), 1944 (130,000), and 1950 (over 190,000) (Voous 1966). Robertson (1978b, pers. comm.) indicated that the breeding population on Bush Key in recent years has consisted of about 80,000 adults.

Sooty Terns returning to breed at Bush Key are first heard over the colony at night in January. They continue to fly over the colony area for about two months, land in late March or early April, and immediately begin to lay eggs (Robertson 1978b). The time of departure from the the colony varies but occurs mostly during a period of two to six weeks. Mass departures have occurred between 9 August and 25 September (Robertson 1964). "Departure of successful breeders and fledged young now begins at least as early as mid-July", with only a few remaining until 1 September (W. Robertson, in litt.).

Over the years, this breeding cycle has been beginning earlier and earlier. The average date birds first landed at the colony was 27 April from 1943 to 1952, and 14 April for 1953-62 (Robertson 1964). At the time of Robertson's report the earliest landing known (28 March 1964) was also the most recent. More recently, birds have been heard over the colony as early as 28 December (1981), and eggs have been laid as early as 6 March (1978). Since then the first eggs have been laid in the final third of March (W. Robertson, in litt.).

Florida - Gulf Coast Sooty Terns are commonly seen in the Gulf near the breeding area in the Tortugas. They are seen much less frequently along the coast to the north where most records have followed tropical storms (Kale 1979 ms b).

Alabama Imhof (1976b) listed 11 records for Sooty Terns in Alabama and regarded them as rare visitors throughout the year both along the coast and inland. Duncan and Havard (1980) considered Sooty Terns casual inland and offshore except in winter. We found six records through July 1979 in addition to those listed by Imhof (1976b). The paucity of recent records as well as the small numbers found offshore by Duncan and Havard (1980) indicate that Sooty Terns are still uncommon or unusual visitors in Alabama. Sooty Terns have been seen in Alabama from 10 April to 24 September, but beach-washed specimens have been found at other times (Imhof 1976b).

1970	28 June	1	seen at Gulf Shores	Stewart 1970
1974	12 Oct.	1	found dead at Dauphin Island	Purrington 1975

1975	24 Sep.	1	seen at Gulf Shores, after Hurricane Delia	Purrington 1976
1979	5 July	5	seen offshore Dauphin Island	Jackson and Cooley 1979
1979	10 July	25	seen at Dauphin Island	Jackson and Cooley 1979
1979	11 July	30	seen at Dauphin Island after Hurricane Bob	Purrington 1980
1979	July	"hundreds"	seen from Dauphin Island after Hurricane Bob	Duncan and Havard 1980

Mississippi The Sooty Tern is rare in Mississippi (Jackson et al. 1978) and has only been recorded there six times (below). One bird photographed at Horn Island, 14 October 1978 (Jackson et al. 1978), was actually a Black Tern in winter plumage. Three birds seen the following day by the same observers may have been Sooty Terns. Duncan and Havard (1980) stated that a single nest found on the Petit Bois Island spoil banks in June 1976 constituted the only breeding record for Mississippi. Stewart (1976), evidently referring to the same record, mentioned only that one bird had been seen there on 10 June. The breeding record for Mississippi is inadeqautely documented, but we suspect that the species is more common offshore than is suggested by the few records listed below.

1943	28 July	1	bird banded at the Tortugas found dead at Pascagoula	Robertson 1967 ms a
1957	20 Sep.	1	female coll. at Canton, Madison Co.	Gandy and Turcotte 1970
1958	17 June	1	found dead at Petit Bois Island	Newman 1956b
1961	12 Sep.	1	bird banded at the Tortugas found dead in Abbeville	Robertson 1967 ms a
1978	15 Oct.	3	seen feeding in Gulf S of Horn Island	Jackson et al. 1978
1979	summer	19	seen (14 ad., 5 imm.) at Bellefontaine Beach and Ocean Spring	Jackson and Cooley 1979

Louisiana Sooty Terns are regular visitors offshore and breed regularly but in very small numbers on the Chandeleur Islands (Lowery 1974). Reports from Louisiana other than from the Chandeleurs are few. We found only three records since the publication of Lowery's book. One was seen from the Lake Ponchartrain Causeway 30 September 1977 following Hurricane Anita (Purrington 1978), two were seen 75 miles SSW of Grand Isle 21 July 1979, and one was found on the east campus of the University of New Orleans 11 July 1979 (Jackson and Cooley 1979).

This paucity of records probably represents more a lack of observation than a lack of birds. Judging from banding records (Lowery 1974; H. H. Jeter, pers. comm. in W. Robertson, in litt.), many if not most of the birds in Louisiana are from the colony in the Dry Tortugas. Extreme dates of occurrence for the state are 6 April and 15 December, but most records are from May through September (Lowery 1974). The number breeding in the Chandeleurs varies year to year (Table 73), but is always under 100 adults.

Texas Sooty Terns are seen regularly in small numbers on the Texas coast from 26 March to 4 October. They breed sparingly and irregularly from late April to early July (Oberholser 1974) along the central and lower coasts (Blacklock et al. 1978), and have bred at least once near Galveston on the upper coast (Oberholser 1974). W. Robertson suggested (in litt.) that colonies in Texas were formerly much larger and noted that the Chicago Field Museum has a trayful of breeding birds that were collected in Texas about 1915.

The mean number of Sooty Terns counted on the Texas waterbird census from 1973 to 1976 was 24 birds; figures for the next two years were 6 and 32 birds, respectively (Blacklock et al. 1978 ms). Chaney et al. (1978) indicated that six pairs were present during 1977, four on dredge spoil islands, and the other two on natural sites. Principal breeding areas in recent years are listed in Table 74.

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

Breeding Sooty Terns have a pantropical distribution in the tropical and subtropical seas of the world. They are one of the world's most abundant seabirds, and almost certainly the most abundant in tropical waters. Ashmole (1963a) provided a summary of what was currently known of breeding colonies throughout the range. Desnoeufs Island in the Amirantes, Indian Ocean had a population of about 1,210,000 pairs in 1955 (Ridley and Percy 1958), and Christmas Island in the Pacific Ocean holds what may be the world's largest breeding population of Sooty Terns--perhaps as many as 14 million birds (Schreiber and Ashmole 1970).

In the southeastern United States, there is one large colony (ca. 80,000) at Bush Key in Florida. A number of small colonies in Louisiana and Texas total less than 100 breeding birds. Breeding has also been attempted in North Carolina (Map 23).

The number and size of Sooty Tern colonies outside of U.S. waters in the Caribbean and southern Gulf of Mexico is unknown. On the basis of anecdotal reports Boswall (1978) reported that they still nest by the thousands on Isla Perez, Alacran Reef, in the Gulf. W. Robertson (in litt.) suggested that Isla Perez and some Bahamian colonies have populations as large or larger than the one in the Dry Tortugas, but adequate data on these populations are not avail-

Table 73. Numbers of Sooty Terns found breeding in the Chandeleur Islands.

Date		Locality	Evidence of breeding	Number of adults seen	Source
1933	5 June	Curlew Island	1 nest	?	Lowery 1974
1960's		Curlew, Stake Islands	nesting	?	Lowery 1974
1962	7 June	Stake Island		2	Stewart 1962
1963	25-26 June	"lower Chandeleurs"		1-2	Stewart 1963
1964	10 June	Curlew Island	1 egg (2nd nesting)		Stewart 1964
1967	31 May	Stake Island	5 eggs, 3 young	ca. 20	Stewart 1967
1968	22 May	Stake Island	2 nests,	7	Purrington 1969
	6 June	Curlew Island	1 egg	2	Eyster 1968,
	12 Aug.	near Stake and Curlew Islands			Purrington 1969
1969	1 Aug.	Stake Island	1 juvenile, 1 chick	ca. 20	Stewart 1969
1971	11-12 June	"main" island	19 nests	34	Lowery 1974, Stewart 1971
1972	17 June	not given	no nests seen	3	Stewart 1972
1973	21-23 June	not given	1 chick	15-19	Lowery 1974, Kennedy 1973
1975	.....	not given	6 eggs, 2 young	16+	Stewart 1975
1976	1 July	Curlew Island	8 active, 1 abandoned nest	20	Stewart 1976
1977	18-19 June	Curlew Island	eggs present	?	W. Robertson, in litt.
1978	24-25 June	Curlew Island	eggs and young present	?	W. Robertson, in litt.
	12 Aug.	not given	27 juveniles seen	?	Jackson and Cooley 1978b

Table 73. Concluded.

Date		Locality	Evidence of breeding	Number of adults seen	Source
1979	20 May	not given	?	45	Imhof 1979
	?	not given	100 ± adults and young		Purrington 1980
1981	19-21 June	Curlew Island	eggs and young present	?	W. Robertson, in litt.

Table 74. Recent breeding sites of Sooty Terns along the Texas coast (a).

Locality	Coordinates	Number of breeding birds
Pelican Island, Neuces Co.	28° 55' N, 98° 11' W	2 (1974), 6 (1975)
Shamrock Island, Neuces Co.	28° 45' N, 97° 10' W	10 (1974), 8 (1975), 4 (1976)
Marker 2-17 spoil islands, Neuces Co.	ca. 27° 40' N, 97° 14' W	2 (1973)
Island S of South Bird Island, Kleberg Co.	27° 29' N, 97° 19' W	2 (1973), 24 (1976), 2 (1977)
Island in Baffin bay, Kleberg Co.	27° 18' N, 97° 24' W	2 (1974), 4 (1975)
Three Island spoil islands, Cameron Co.	26° 13-17' N, 97° 16' W	20 (1973), 14 (1975)

(a) Data for 1973-1976 are from Blacklock et al. (1978); data for 1977 are from Chaney et al. (1978). Data for the 1977 nesting are listed for the island south of South Bird Island since the coordinates given by Blacklock et al. (1978) and Chaney et al. (1978) are the same.

able. Dewey and Nellis (1980) reported that Sooty Terns nest at Saba, Flat, and Frenchcap Islands in the U.S. Virgin Islands, but they did not state the size of the populations. The breeding population at Saba is at least in the low thousands judging from the number of eggs taken there in 1977 by fishermen (Dewey and Nellis 1980).

Nonbreeding and Offshore Flocks of Sooty Terns are found occasionally on the nesting grounds after the breeding season (e.g., on Bird Island in the Seychelles in November [Ridley and Percy 1958], and on Laysan Island in the central Pacific in September [Clapp, pers. observ.]) but such occurrences are unusual. Most nonbreeding Sooty Terns are found at sea far from the breeding colonies, but details of their travels are poorly known. Adults from Bush Key in Florida are found over a wide expanse of the tropical Atlantic beyond the Continental Shelf (Dinsmore 1972), but they are found mainly in the southern Gulf and western Caribbean (Robertson 1978b). Young fledging from this colony follow the Yucatan Channel south along the coast of Central America, probably following the Continental Shelf (W. Robertson, in litt.), cross the extreme southern Caribbean, follow the coast of the Guianas, and thence to the Gulf of Guinea off Africa where they remain for several years (Robertson 1969). These birds apparently follow warm currents north to waters just south of Cap Vert during the northern summer, withdrawing seasonally south to the Gulf. They follow a similar movement south during the austral summer, which is again followed by a retreat to the Gulf of Guinea (W. Robertson, in litt.). The dispersal of Sooty Terns from other nesting areas is poorly known. Banded birds from central Pacific colonies have been found over a wide expanse of the central and western Pacific, but they apparently winter largely in the Philippine Sea (Gould 1974, Clapp 1980).

Sooty Terns have been recorded infrequently in many of the southeastern United States, but they occur there more often than published records suggest. W. Robertson (in litt.) has records of Sooty Terns banded in the Dry Tortugas and recovered in virtually all of the southeastern states. He noted that there are quite a few records from Louisiana, many of them of birds found breeding on the Chandeleur Islands (H.H. Jeter, pers. comm.) and that perhaps as many as 50 recoveries had been made inland and along the coast of Texas and in northern Mexico.

Most Sooty Tern records for many of the southeastern states have occurred after tropical storms when these birds may be seen in large numbers (e.g., following Hurricane David in the late summer of 1979 [Fussell and Allen-Grimes 1980, cf. Table 75]). Recent observations (e.g., Lee and Booth 1979, Duncan and Havard 1980) show that Sooty Terns may occur regularly if uncommonly in the waters offshore several southeastern states. They are probably no less common off states where few observations have been made in pelagic waters (e.g., Georgia, Mississippi). Most breeding birds in the southeast apparently do not range far from their nesting areas and are commonly seen at sea near these sites.

HABITAT

Nesting Sooty Terns use a wide variety of habitats for nesting. Ridley and Percy (1958) stated that Sooty Terns in the Seychelles prefer to nest in areas "not covered with too much vegetation" and avoid areas of very thick vegetation. The preferred nest site was "the edge of a small isolated bush." On Manana Island off Oahu, Hawaii, Sooty Tern nest substrates include rock, dirt or sand with greatest nesting densities (2.76-3.68 eggs/sq m) in areas of "partially consolidated sandy substrate just above the loose beach sand" (Brown 1976c). Robertson (1978b) remarked that the primary nesting requirements of Sooty Terns are the absence of ground predators and vegetation thin enough to allow the birds to reach bare ground. At Bush Key, Sooty Terns prefer to nest in low and open vegetation, but some birds nest under heavy cover including mangroves (*Rhizophora mangle*, *Laguncularia racemosa*) and bay cedar (*Suriana maritima*) that is open at ground level (Dinsmore 1972, Robertson 1978b).

Feeding Breeding birds at the Dry Tortugas usually feed within 50 km (30 mi) of the colony over current upwellings, but may forage as far as 130 km (80 mi) away during stormy weather (Robertson and Stoneburner 1980, Robertson and Stoneburner in Stoneburner and Harrison 1981). Breeding birds in the central Pacific are most abundant within a few miles of their colonies but may forage as much as 300 mi (420 km) away (Gould 1974). Ashmole and Ashmole (1967) suggested that Sooty Terns could forage as much as 700 mi (1,130 km) from their breeding colonies and indicated that birds breeding at Christmas Island often feed far out at sea.

Nonbreeding and Offshore Nonbreeding birds are usually well dispersed in pelagic waters. Gould (1974) remarked that Sooty Terns can be found over almost any part of the ocean at any time of year within their range in the tropical and subtropical Pacific. He noted that the density of these terns is greatest where food is regularly available (e.g., along the Equatorial Countercurrent). Prebreeding birds and nonbreeding adults sometimes visit their natal colonies late in the breeding season (W. Robertson, in litt.).

FOOD AND FEEDING BEHAVIOUR

Sooty Terns feed primarily by flying over the ocean and surface-seizing small fish and other items at the water's surface. A fish may be seized either from the air as it jumps above the surface or from the surface itself. Sooty Terns occasionally dive to the surface to seize food but never plunge into the water because their feathers become soaked and the birds may drown. Foraging Sooty Terns in the central Pacific usually remain 10-20 m (30-70 ft) above the surface, descend as a group when food is driven to the surface by fish or other predators, and wheel and circle erratically as they seize their prey. Birds in one part of a large feeding flock may be high in the air as they search for food, while others remain low and feeding (Gould 1974).

Sooty Terns often feed in large flocks in association with other seabirds. Of all Sooty Terns seen during pelagic surveys of the central Pacific, 77% were

Table 75. Peak concentrations of Sooty Terns in the coastal southeastern United States (a).

Date seen		Number seen	Locality	Source
			NORTH CAROLINA	
1979	28 Aug.	159	in 143 mi cruise off Cape Lookout to Cape Fear	Fussell and Allen-Grimes 1980
1979	5 Sep.	100	resting on rock jetty near Fort Fisher	Fussell and Allen-Grimes 1980
1979	5-6 Sep.	80+	Wrightsville Beach	Fussell and Allen-Grimes 1980
1979	5-6 Sep.	90+	Morehead City	Fussell and Allen-Grimes 1980
1979	5-6 Sep.	110+	in Southport area	Fussell and Allen-Grimes 1980
1979	8 Sep.	245	in 77 mi traveled SE to SW of Cape Lookout in Gulf Stream	Fussell and Allen-Grimes 1980
1979	9 Sep.	668	in 116 mi traveled off Core Banks	Fussell and Allen-Grimes 1980
			FLORIDA - ATLANTIC COAST	
1971	4 Apr.	14	7 mi E of Marathon	Kale 1971
1974	9 Oct.	250+	off Canaveral	Edscorn 1975
			FLORIDA - GULF COAST	
1928	19-20 Sep.	1,000's	in Gainesville (inland)	Sprunt 1954
			ALABAMA	
1979	July	100's	off Dauphin Island	Duncan and Havard 1980
1979	12 Sep.	50 or more	Dauphin Island just before Hurricane Frederic	Purrington 1980
			LOUISIANA	
1970	19 June	28	off South Pass	Lowery 1974
1971	26 Aug.	12	20-30 mi SE South Pass	Lowery 1974
1970	3 Sep.	18	38 mi out of South Pass	Stewart 1970

(a) This table does not include concentrations seen near breeding sites.

assocated with one or more other seabirds. Typical feeding flocks in this area contain 30-100 birds. The largest ever seen contained over 3,000 Sooty Terns, about 4,300 birds of eight other species, and was about 3 mi (5 km) across. The birds were feeding in a flock over about 8-12 fin whales (Balaenoptera physalus) and about 200 porpoises (Gould 1974). Most feeding occurs by day, but Sooty Terns also feed at night (Morzer Bruyns and Voous 1965, Gould 1967).

The diet of Sooty Terns feeding in the waters of southeastern United States is probably similar to the diet elsewhere. Robertson (1978b) reported that more than 75 species of food items are found in the diet of Sooty Terns at the Dry Tortugas; most of the food consists of fish and squid up to about 6 in (15 cm) long. Other reports indicate that flying fish (Exocoetidae) and squid are the principal food. According to Ashmole (1968), flying fish are the most important food on Christmas Island in the Pacific, but tuna (Scombridae) are almost as important. Most fish and squid taken there were 2-8 cm (0.8-3 in) in body length or mantle length.

At Manana Island, Hawaii, regurgitations from both chicks and adults consisted of 46% fish and 54% squid (by weight) (Brown 1975b). The mean length of 149 fish was 6.9 cm (2.7 in), and the mean length of 207 squid was 5.7 cm (2.2 in). Fish of the families Exocoetidae, Holocentridae, Carangidae, and Mullidae made up 99.5% of the fish diet; carangids made up 43% of the total diet. All squid identified belonged to the family Ommastrephidae and all of these identified further were in the genus Symplectoteuthis. Fish from several other families (Chaetodontidae, Tetraodontidae, Scombridae) were also eaten. Brown (1975b) concluded that the species eaten was unimportant, and remarked that Sooty Terns "will capture whatever fish surface with tuna and fall roughly into a certain size class." Harrison and Hida (1980), who gave preliminary results of a food habits study conducted in the Northwestern Hawaiian Islands, ranked in order the fish families most important in the diet of the Sooty Tern as Mullidae, Exocoetidae, Holocentridae, Gempylidae and Carangidae.

IMPORTANT BIOLOGICAL PARAMETERS

Egg Laying Sooty Terns have perhaps the most variable laying regime of any seabird. Eggs may be being laid in one colony or another throughout the world on any given day. Birds in the southeastern United States have been recorded laying eggs mostly from April through May. Presently, the peak of egg laying is in March at the Dry Tortugas (W. Robertson, in litt.), and in June in the Chandeleurs (Jeter fide Robertson). Those in the Hawaiian Islands lay during the spring and early summer, but the breeding season becomes progressively later from east to west. On Oahu (to the east), peak laying occurs in the last week of March or the first week of April, while at Kure, the westernmost of the islands, egg laying begins in May (Gould 1974). Irregular or semiannual laying occurs at some of the Line and Phoenix Islands in the central Pacific. At Christmas Island, in the former group, Sooty Terns that successfully raise young breed again a year later, while those that fail renest only six months later (Ashmole 1965). Sooty Terns at Ascension Island in the Atlantic breed at 9-10 month intervals (Ashmole 1963a). More extensive data on egg laying around the world are summarized by Ashmole (1963a).

Mean Clutch Size Sooty Terns usually lay only one egg, but two eggs are occasionally found in a single nest. Watson (1908) reported that 25 of several thousand nests at the Dry Tortugas contained two eggs. Brown (1975a) found that 10 of 91 clutches at Manana Island, Hawaii, contained two eggs, but presented data supporting the idea that two-egg clutches are laid by two different females. He concluded that at the most only a small proportion of Sooty Terns lay two eggs, but expressed doubt that any actually do so. Similarly, two-egg "clutches" observed at the Dry Tortugas, Florida, are believed to be the work of two females. Mary Robertson (pers. comm.) thinks that the extra eggs in such clutches are laid by the females of pairs that mate but fail to secure territories.

In most instances, only one egg of a two-egg "clutch" results in fledged young. However, Watson (1908) noted one instance in which two young were hatched and fledged from the same nest. Two-egg "clutches" at the Dry Tortugas seldom produce fledged young and few eggs even hatch (W. Robertson, in litt.).

Incubation Period Mean incubation periods from different areas vary from 28 to 29 days, with a range of 26 to 32 days (Table 76).

Table 76. Incubation periods (in days) reported for the Sooty Tern.

Mean	Number of eggs	Range	Locality	Source
28.1	30	26-31	Kure Atoll, NW Hawaiian Islands	Woodward 1972
29	151	27-32	Sand Island, Johnston Atoll, Central Pacific	Amerson and Shelton 1976
28.6 (a)	175	27.5-30.7	Manana Island, ca. 1 km off Oahu, Hawaiian Islands	Brown 1977
28.1	234	26-32	Bird Island, Seychelles, Indian Ocean	Feare 1976b
--	33	28.3-30.3	Ascension Island, Atlantic Ocean	Ashmole 1963a
29.5	16	28.9-30	Bush Key, Dry Tortugas, Florida	Dinsmore 1972

(a) Data given in hours in cited source.

Hatching Success Hatching success varies from locality to locality, from year to year, from one area of a colony to another (Table 77), and within areas of a colony depending on when laid (M. Robertson, pers. comm.). Predation on eggs, ectoparasitism, and poor feeding conditions for adults (resulting in desertion) seem to be major factors in reducing hatching success.

Table 77. Rates of hatching success reported for the Sooty Tern.

Percent of eggs laid that hatched	Number of eggs	Locality and year of observation	Source
53.5	80	Kure Atoll, NW Hawaiian Islands, 1965	Woodward 1972
49.1	39	Kure Atoll, NW Hawaiian Islands, 1966	Woodward 1972
74.5 (a)	141	Kure Atoll, NW Hawaiian Islands, 1967	Woodward 1972
28.5 (b)	5,537	Raoul Island, Kermadec Islands, Pacific Ocean, 1966	R. Taylor 1979
82.7	202	Desnoeufs Island, Amirantes, Indian Ocean, 1973	Ridley and Percy 1958
75.2 (c)	310	(colony center) Bird Island, Seychelles, Indian Ocean, 1973	Feare 1976b
9.7 (c)	56	(colony edge) Bird Island, Seychelles, Indian Ocean, 1973	Feare 1976b
64.2 (c)	372	(all areas) Bird Island, Seychelles, Indian Ocean, 1973	Feare 1976b
79.1	43	Ascension Id., Atlantic Ocean, 1958-59	Ashmole 1963a

(a) Greater hatching success than in preceding years was attributed to reduced predation by the Polynesian rat (Rattus elegans).
(b) Twenty percent of the failure was attributed to rat (Rattus spp.) predation.
(c) Data calculated from Table 1 of cited source.

Age at Fledging Brown 1976(a) reported that the mean age of fledging for 22 chicks at Manana Island, Oahu, was 57.3 days (SD = 3.2 days). A fledgling was defined as a bird that could fly for 10 or more feet when arising from the ground or when tossed into the air. Although Sooty Terns may achieve first flight at about two months, like other species of terns they may remain dependent or partially dependent on their parents for food for a longer period of time.

Young Sooty Terns at Bush Key, Florida, fly when they are 8-10 weeks old but remain at the nest to be fed by their parents for several more weeks (Robertson 1978b). Young at Bird Island, in the Seychelles, Indian Ocean, also can fly at 8-10 weeks but remain in the colony for an average of 17 days more before leaving (Feare 1975). Ashmole (1963a) noted that young Sooty Terns at Ascension Island in the Atlantic remain at or near the breeding grounds for a week or so after they can first fly. Brown (1976d) believed that Sooty Tern young that had been fledged for about a week at Manana Island spend the day at sea. He observed that these birds are fed by their parents at the colony at night. He also noted one young bird that eventually left the island still present 21 days after it could fly.

Fledging Success Like hatching success, fledging success may vary considerably from colony to colony. Ashmole (1963a) estimated that only 1.7% of 6,500 eggs laid resulted in fledged young during one nesting attempt at Ascension Island. Woodward (1972) estimated that 1.8%, 24.2%, 26.6%, and 60.0% of the eggs laid at Kure Atoll resulted in fledged young during the four years from 1965 to 1968.

Mortality of Eggs and Young Human use of Sooty Tern eggs for food has long been a source of considerable nesting failure. Eggs "are exported in thousands, probably tens of thousands, each year ..." from Isla Perez in the southern Gulf of Mexico (Boswall 1978). Ridley and Percy (1958) indicated that decreases in breeding populations in the Seychelles were largely due to egging. Egging has also been a significant cause of nest loss in Atlantic (Ascension) and Caribbean colonies (e.g., Jamaica [Murphy 1936], and Saba in the Virgin Islands [Dewey and Nellis 1980]), and caused declines in the population breeding in Florida (Robertson 1964).

Other forms of disturbance by humans may also prevent successful nesting. Ridley and Percy (1958) noted that very young birds were killed by adults when they strayed from where they were hatched into territories of neighboring birds. The tendency of adults to attack young was greater in areas where nests were densely congregated and attacks were aggravated by human disturbance. Ashmole (1963a) also reported considerable mortality at Ascension Island from the attacks of adults and remarked that such mortality was "increased enormously by any human disturbance of the colony."

Introduced animals cause considerable nesting losses. Domestic cats are often a significant cause of nesting failure and in some areas are the likely cause of significant reduction or elimination of nesting populations. Ridley and Percy (1958) suggested that introduced cats nearly extirpated the Sooty Terns on Aride Island in the Seychelles and noted that elimination of the cats led to a steady increase in the number of nesting birds. Cats also caused significant mortality at Raoul Island in the Kermadecs (R. Taylor 1979) and at Starbuck Island in the Line Islands (Clapp, pers. observ.). Cats may have been a major factor in causing signficant declines in the numbers breeding at other colonies in the Phoenix and Line Islands in the central Pacific.

Sooty Terns are often the last seabirds to disappear from islands on which cats or rats are present. This was evidently the case for Raoul Island in the Kermadecs (R. Taylor 1979), Ascension Island in the Atlantic (Stonehouse 1962), and Starbuck Island in the Line Islands. Stonehouse (1962) suggested that

Sooty Tern colonies survive better than those of other species because of the extremely large size of the colonies and because of the tendency of Sooty Terns to breed en masse. W. Robertson (in litt.) points out that successful Sooty Tern colonies are well buffered against such predation by the large numbers of adults that may not be breeding during any given breeding season.

Inclement weather can be a significant cause of nesting failure. White et al. (1976) reported that about one-quarter of the young at Bush Key were killed even before Hurricane Agnes reached its peak during its passage in June 1972. They suggested that most of the mortality in this instance resulted from exposure to cold and rain. They also suggested that disturbed seas some distance from the colony might secondarily reduce breeding success by interfering with feeding.

Mass desertion of eggs or young results in the failure or near failure of a Sooty Tern colony. One such desertion at Bird Island in the Seychelles was attributed to the effect of virus-infected ticks (Ornithodoros capensis) (Feare 1976a). Elsewhere, as in the Central Pacific, such desertions may be the result of food shortages.

On some islands, reptiles pose a hazard to nesting birds. Ridley and Percy (1958) considered skinks (Mabuya sechellensis and M. wrightii) the worst predators on Sooty Terns on Aride Island in the Seychelles; the latter species also cause considerable damage on Recif and Mamelle Islands. Some invertebrates also occasionally prey on the eggs. H. Savy (in Ridley and Percy 1958) stated that Coconut Crabs (Birgus sp.) eat Sooty Tern eggs on Cosmoledo Atoll in the Indian Ocean.

Plants are occasionally significant causes of mortality. Ridley and Percy (1958) reported that the string-like stems of the creeping plant Liane sans fin caused the death of many Sooty Terns on Bird Island in the Seychelles. In one instance they found 20 dead adults in 50 sq yds (42 sq m). The long-winged adults were more caught more frequently, but young were also caught by their feet.

Sooty Tern chicks are sometimes eaten by frigatebirds. C. Harrison (pers. comm.) reported that chicks are eaten (uncommonly) by Great Frigatebirds (Fregata minor) on Laysan Island in the Northwestern Hawaiian Islands. Magnificent Frigatebirds (F. magnificens) feed on young Sooty Terns at Bush Key in Florida (Robertson 1964) but are not an important source of mortality. On the other hand, Lesser Frigatebirds (F. aquila) at Ascension Island are serious predators of young and eggs (Ashmole 1963a). Frigatebird predation is evidently only rarely a significant cause of mortality because many observers (e.g. Ridley and Percy 1958, White et al. 1976) witnessed no predation by these birds.

Predation by native animals other than humans may also cause nesting failure in Sooty Terns. Buff-backed Herons (= Cattle Egret, Bubulcus ibis) fed on both eggs and newly hatched young at Bird Island in the Seychelles and were considered the worst predator there (Ridley and Percy 1958). This species has also been reported (Harrington 1974) hunting recently hatched chicks at Bush Key in Florida. Other waterbirds are also known or suspected predators of eggs or young. Ridley and Percy (1958) suggested that both Green-backed Herons (= Green Herons, Butorides striatus) and Waterhens (= Common Gallinules, Gallinula chloropus) occasionally eat eggs, but they thought that little harm was done by these birds. The Purple Gallinule (Porphyrula martinica) has been seen breaking and eating eggs at Bush Key (Dinsmore 1972). Predation by Laughing Gulls (Larus atricilla) and Great White Herons (Ardea herodias occidentalis) has also been reported there (Robertson 1964). Other avian predators include Short-eared Owls (Asio flammeus) that prey on chicks (Hoffman et al. 1979) and Ruddy Turnstones (Arenaria interpres) that feed on eggs (Crossin and Huber 1970, Dinsmore 1972).

Renesting Ridley and Percy (1958) investigated the incidence of relaying in Sooty Terns deprived of egg or young at Desnoeufs Island in the Seychelles. Figures for relaying are only approximate because of a number of factors elaborated on by the authors. The proportion relaying varied from 9.1 to 29.0% for eggs that were fresh to several days old to 6.0% for eggs near hatching. Overall, about 16.5% of the pairs were known to relay. The interval between first and second eggs averaged 13 to 14 days and ranged from 10 to 25 days; Ridley and Percy (1958) concluded that there was no significant difference in time to relay for eggs at different stages of incubation. All birds with fresh eggs, and most with well-incubated eggs, that later renested, nested near their original sites. Those with eggs in intermediate stages of incubation tended to nest at the perimeter of the colony where most birds were newly laying eggs. A small number deserted their original colony and renested in colonies elsewhere in the Seychelles.

Sooty Terns lay for a third time only rarely if the second egg is lost. Ridley and Percy (1958) found only nine birds that had undoubtedly laid a third egg. The interval between loss of the second egg and relaying of a third ranged from 11-19 days (n = 8, mean = 15.25). At Ascension Island, Ashmole (1963a) found that only 13% of the birds from which eggs were taken relaid. W. Robertson (in litt., 1978b) believes that relaying occurs very rarely in mature, successful colonies.

Age at First Breeding Young terns fledged at Bush Key in Florida first return to the natal colony at about three years of age, but few breed before they are six years old (Robertson 1978b; W. Robertson, in litt.). W. Robertson (in litt.) remarked that most cohorts of young fledged at Bush Key first breed at eight to ten years. Young birds returning to Johnston Atoll in the central Pacific breed no earlier than at four years of age; most breed for the first time at six to eight years. A few may not breed until they are ten years old (Harrington 1974).

Maximum Natural Longevity The oldest known Sooty Terns are two birds banded at Bush Key in the Dry Tortugas and recaptured breeding there 32 years later (W. Robertson, in litt.).

Weight Our data on weights of Sooty Terns are given in Table 78.

Table 78. Weights (in grams) of Sooty Terns.

Mean Weight	Range	Number weighed	Sample and season	Area	Source
185	147-267	67	males, July-Aug.	Central Pacific	Clapp in prep.
174	143-257	47	females, July-Aug.	Central Pacific	Clapp in prep.
171	139-229	33	males, Oct.-Nov.	Central Pacific	Clapp in prep.
165	134-214	46	females, Oct.-Nov.	Central Pacific	Clapp in prep.
189	150-275	99	males, Mar.-Apr.	Central Pacific	Clapp in prep.
177	141-240	95	females, Mar.-Apr.	Central Pacific	Clapp in prep.
192	140-264	107	males, May-June	Central Pacific	Clapp in prep.
184	134-249	101	females, May-June	Central Pacific	Clapp in prep.
173	----	964	adults	Christmas Island	Ashmole and Ashmole 1967
155.9	----	5	adults, August	Manana Island, off Oahu	MacMillen et al. 1977
149.4	----	3	fledged immatures, August	Manana Island, off Oahu	MacMillen et al. 1977
----	17.9-32.0	--	newly hatched young	Ascension Is., Atlantic	Ashmole 1963a
34.2	28.5-39.0	33	fresh eggs, 1972	Manana Island, off Oahu	Brown 1976b
36.2	----	117	fresh eggs, 3 June 1973	Bird Island, Seychelles	Feare 1976b
34.0	----	149	fresh eggs, 22 June 1973	Bird Island, Seychelles	Feare 1976b
35.0	----	80	fresh eggs, 5 July 1973	Bird Island, Seychelles	Feare 1976b
31.8	----	74	fresh eggs, 10 July 1973	Bird Island, Seychelles	Feare 1976b

SUSCEPTIBILITY TO OIL POLLUTION

Because Sooty Terns feed by dipping or plunging to the water's surface, seldom sit on the water, and disperse widely in pelagic waters after the breeding season, this species may be little affected by oil pollution. Robertson and Robertson (1978 ms) believed that "...the behavior of the Sooty Tern makes it one of the seabirds least susceptible to oil pollution."

Their useful and detailed account (Robertson and Robertson 1978 ms) provides much information on the effects of low-level oil pollution on Sooty Terns at the Dry Tortugas from 1962 to 1977. We summarize below a few of their findings. They examined over 45,000 recaptured adults of which 2.63% had been oiled. Most oiled Sooty Terns were only slightly contaminated, but about 14% of the oiled birds were moderately to heavily oiled. The Robertsons compared weights and return rates of oiled and unoiled birds and found no significant difference between the two groups and noted that transfer of oil to eggs from the plumage of oiled birds was extremely rare. They concluded that chronic low-level oiling had no significantly adverse affect on the oiled birds. However, they noted an increased incidence of oiling in recent years (3.17% and 3.36% in 1976 and 1977, respectively) and expressed some concern that increasing pollution off the Keys might increase adult mortality. Since the Robertson's report was prepared, a few badly oiled Sooty Terns have been seen at the Tortugas (W. Robertson, in litt.). These birds were considerably more oiled than any terns seen there previously and included one bird so oiled that it could not fly.

The scarcity of this species in much of the southeastern United States and the paucity of records of oiling suggest that this species is unlikely to be badly affected by oil in this area. The primary area of vulnerability is in the Dry Tortugas and vicinity: pollution of these waters may threaten the only significant breeding concentration of this species in the southeast.

BIBLIOGRAPHY

1982

Dathe, H. 1982. Russseeschwalbe, *Sterna fuscata* L., an der ostseekuste der DDR. [Sooty Tern, *Sterna fuscata* L., on the Baltic Sea coast of East Germany.] Beitr. Vogelkd. 28: 316-317. [In German.]

Flint, E. N. and K. A. Nagy. 1982. Metabolic rate during flight and incubation in the Sooty Tern (*Sterna fuscata*). (Abstract only.) Pac. Seabird Group Bull. 9: 71.

Habraken, A. 1982. Sooty Terns on Auckland's west coast. Notornis 29: 150.

Shea, R. E. 1982. Some aspects of nest site selection by Sooty Terns at Midway Islands. (Abstract only.) Pac. Seabird Group Bull. 9: 71.

1981

Ash, J. S. and A. A. Karani. 1981. Roseate and Sooty Terns Sterna dougallii and fuscata breeding on islets in southern Somalia. Scopus 5: 22-27.

Flint, E. N. 1981. Age-related aggregation behavior in Sooty Tern chicks. (Abstract only.) Pac. Seabird Group Bull. 8: 94-95.

Fussell, J. O., III, T. L. Quay and R. J. Hader. 1981. Sooty Tern nest found near Cape Lookout, N.C. Am. Birds 35: 236.

Ricklefs, R. E. and S. C. White. 1981. Growth and energetics of chicks of the Sooty Tern (Sterna fuscata) and Common Tern (S. hirundo). Auk 98: 361-378.

Stoneburner, D. L. and C. S. Harrison. 1981. Heavy metal residues in Sooty Tern tissues from the Gulf of Mexico and North Central Pacific Ocean. Sci. Total Environ. 17: 51-58.

1980

Clapp, R. B. 1980. Occurrence of Central Pacific Blue-faced Booby and Sooty Tern in southeast Asia. Tori 29: 95-96.

Dewey, R. A. and D. W. Nellis. 1980. Seabird research in the U.S. Virgin Islands. Trans. N. Am. Wildl. Nat. Resour. Conf. 45: 445-452.

Parker, S. A. 1980. An early breeding record of the Sooty Tern from Kangaroo Island. S. Austr. Ornithol. 28: 139-140.

Robertson, W. B., Jr. and D. L. Stoneburner. 1980. Radio-tracking of nesting Sooty Terns (Sterna fuscata). (Abstract only.) Proc. 1979 Conf. Colonial Waterbird Group 3: 260.

Stoneburner, D. L., P. C. Patty and W. B. Robertson, Jr. 1980. Evidence of heavy metal accumulation in Sooty Terns. Sci. Total Environ. 14: 147-152.

1979

Dupuy, A. R. 1979. Reproduction de Sterna fuscata et de S. albifrons dans le delta du Senegal. Oiseau Rev. Fr. Ornithol. 49: 324. [In French.]

Fales, J. H. 1979. Sooty Tern in Calvert County. Md. Birdlife 35: 87.

Johnston, D. W. 1979. The uropygial gland of the Sooty Tern. Condor 81: 430-432.

Taylor, R. H. 1979. Predation on Sooty Terns at Raoul Island by rats and cats. Notornis 26: 199-202.

1978

Jackson, J. A., C. D. Cooley and B. J. Schardien. 1978. Sooty Terns on Horn Island, Mississippi. Mississippi Kite 8: 42.

Numme, G. 1978. Sotterne Sterna fuscata, en ny art for Norge. [Sooty Tern Sterna fuscata, a new species for Norway.] Cinclus 1: 5-7.

Robertson, M. J. and W. B. Robertson, Jr. 1978 ms. Occurrence and effects of chronic, low-level oil contamination in a population of Sooty Terns (Sterna fuscata). Unpubl. ms. in files of S. Fla. Res. Cent., Everglades Natl. Park, Fla. 42 pp.

Robertson, W. B., Jr. 1978b. Species of special concern. Sooty Tern. Pp. 89-90 in H. W. Kale, II (ed.). Rare and endangered biota of Florida. Vol. 2. Birds. Univ. Presses of Florida, Gainesville, FL. xix and 121 pp.

1977

Brown, W. Y. 1977. Temporal patterns in laying, hatching and incubation of Sooty Terns and Brown Noddies. Condor 79: 133-136.

Clancy, P. A. 1977b. Data from Sooty Terns from Natal and Zululand. Ostrich 48: 43-44.

Ednie, A. P. 1977. Sooty Tern and Swallow-tailed Kite--new birds for Delaware. Delmarva Ornithol. 12: 2.

Joubert, S. C. J. 1977. Avian marine vagrants to the Kruger National Park. Koedoe 20: 185.

MacMillen, R. E., G. C. Whittow, E. A. Christopher and R. J. Ebisu. 1977. Oxygen consumption, evaporative water loss, and body temperature in the Sooty Tern. Auk 94: 72-79.

1976

Brown, W. Y. 1976a. Growth and fledging age of Sooty Tern chicks. Auk 93: 179-183.

_____. 1976b. Egg specific gravity and incubation in the Sooty Tern and Brown Noddy. Auk 93: 371-374.

_____. 1976c. The breeding of Sooty Terns and Brown Noddies on Manana Island, Hawaii. Condor 78: 61-66.

_____. 1976d. Prolonged parental care in the Sooty Tern and Brown Noddy. Condor 78: 128-129.

Feare, C. J. 1976a. Desertion and abnormal development in a colony of Sooty Terns _Sterna fuscata_ infested by virus-infected ticks. Ibis 118: 112-115.

_____. 1976b. The breeding of the Sooty Tern _Sterna fuscata_ in the Seychelles and the effects of experimental removal of its eggs. J. Zool. (Lond.) 79: 317-360.

Hart, R. A. 1976. Feeding habits of Sooty Terns in compact flocks. Sea Swallow 25: 49-50.

Schreiber, R. W. and D. A. Hensley. 1976. The diets of _Sula dactylatra_, _Sula sula_, and _Fregata minor_ on Christmas Island, Pacific Ocean. Pac. Sci. 30: 241-248.

White, S. C., W. B. Robertson, Jr. and R. E. Ricklefs. 1976. The effect of Hurricane Agnes on growth and survival of tern chicks in Florida. Bird-Banding 47: 54-71.

1975

Brown, W. Y. 1975a. Artifactual clutch size in Sooty Terns and Brown Noddies. Wilson Bull. 87: 115-116.

_____. 1975b. Parental feeding of young Sooty Terns (_Sterna fuscata_ (L.)) and Brown Noddies (_Anous stolidus_ (L.)) in Hawaii. J. Anim. Ecol. 44: 732-742.

_____. 1975c. Incubation shifts of Sooty Terns _Sterna fuscata_ on Manana Island, Hawaii. Ibis 117: 527-529.

Converse, J. D., H. Hoogstraal, M. I. Moussa, C. J. Feare and M. N. Kaiser. 1975. Soldado virus (Hughes group) from _Ornithodorus_ (_Alectorobius_) _capensis_ (Ixodoidea: Argasidae) infesting Sooty Tern colonies in the Seychelles, Indian Ocean. Am. J. Trop. Med. Hyg. 24: 1010-1018.

Feare, C. J. 1975. Post-fledging parental care in Crested and Sooty Terns. Condor 77: 368-370.

Ricklefs, R. E. and S. C. White. 1975. A method for constructing nestling growth curves from brief visits to seabird colonies. Bird-Banding 46: 135-140.

1974

Gould, P. J. 1974. Sooty Tern (_Sterna fuscata_). Pp. 6-52 _in_ W. B. King (ed.). Pelagic studies of seabirds in the central and eastern Pacific Ocean. Smithson. Contrib. Zool. 158.

Harrington, B. A. 1974. Colony visitation behavior and breeding ages of Sooty Terns (_Sterna fuscata_). Bird-Banding 45: 115-144.

Mathew, D. N. and E. A. A. Shukkur. 1974. Sooty Tern (Sterna fuscata nubilosa Sparrman) collected near Calcutta. J. Bombay Nat. Hist. Soc. 71: 144-145.

Oreel, G. J. 1974b. Sooty Terns Sterna fuscata off the coast of West Africa: a correction. Ardea 62: 133-134.

1973

Brown, W. Y. 1973. The breeding biology of Sooty Terns and Brown Noddies on Manana or Rabbit Island, Oahu, Hawaii. Ph.D. thesis, Univ. Hawaii/Honolulu, HI.

Feare, C. J. 1973. Research on Sooty Terns in Seychelles. Biol. Conserv. 5: 236-238.

Gill, C. 1973. Sooty Tern in Coffin Bay. S. Austr. Ornithol. 26: 133.

McKean, J. L. and D. Gray. 1973. Unusual seabird records from the Northern Territory. Emu 73: 184.

1972

Austin, O. L., Jr., W. B. Robertson, Jr. and G. E. Woolfenden. 1972. Mass hatching failure in Dry Tortugas Sooty Terns (Sterna fuscata). (Abstract only.) Proc. Internatl. Ornithol. Congr. 15: 627.

Dinsmore, J. J. 1972. Sooty Tern behavior. Bull. Fla. State Mus. 16: 129-179.

Dinsmore, J. J. and W. B. Robertson, Jr. 1972. Sooty Terns feeding on moths. Auk 89: 440.

Griffin, A. C. M. 1972. Bridled, Sooty and Common Terns at Townsville. Sunbird 3: 39.

Robertson, J. S. 1972. Sooty Tern--storm wreck. Sunbird 3: 84-86.

Woodward, P. W. 1972. The natural history of Kure Atoll, Northwestern Hawaiian Islands. Atoll Res. Bull. 164. xxi and 318 pp.

1971

Ake, R. L. 1971. Sooty Tern on Fisherman Island. Raven 42: 60-61.

Grant, G. S. 1971. Sooty Terns in Virginia. Raven 42: 61.

Mead, C. 1971. Bang go the eggs. Brit. Trust Ornithol. News 44: 6.

1970

Abdulali, H. 1970. On the distribution of Sterna fuscata Linnaeus in Indian limits--a correction. J. Bombay Nat. Hist. Soc. 67: 110-111.

Browne, M. M. and G. S. Grant. 1970. Sooty Tern and Audubon's Shearwaters off North Carolina in September. Chat 34: 102-103.

Crossin, R. S. and L. N. Huber. 1970. Sooty Tern egg predation by Ruddy Turnstones. Condor 72: 372-373.

Jenner, J. 1970. In Camille's wake a Wide-a-wake. Kingbird 20: 13-14.

Potthoff, T. and W. J. Richards. 1970. Juvenile Bluefin Tuna, Thannus thannus (Linnaeus), and other scombrids taken by terns in the Dry Tortugas, Florida. Bull. Mar. Sci. 20: 389-413.

Purrington, R. D. 1970. Nesting of the Sooty Tern in Louisiana. Auk 87: 159-160.

Simmons, K. E. L. 1970. Aerial drinking and bathing by some tropical seabirds. Brit. Birds 63: 212.

1969

Austin, O. L., Jr. 1969. Extra toes on a Sooty Tern chick. Auk 86: 352.

Burckhalter, D. L. 1969. Orientation and communication of Sooty Tern chicks. M.S. thesis, Univ. Arizona/Tucson, AZ.

Meitzen, T. C. 1969. Nesting of terns along the Texas coast. Bull. Tex. Ornithol. Soc. 3: 24.

Robertson, W. B., Jr. 1969. Transatlantic migration of juvenile Sooty Terns. Nature 223: 632-634.

Valentine, J. M., Jr. 1969. Royal and Sandwich Terns of the Chandeleur Islands. La. Ornithol. Soc. News 51: 3-4.

1968

Ashmole, M. J. and N. P. Ashmole. 1968. The use of food samples from sea birds in the study of seasonal variation in the surface fauna of tropical oceanic areas. Pac. Sci. 22: 1-10.

Ashmole, N. P. 1968. Body size, prey size, and ecological segregation in five sympatric tropical terns (Aves: Laridae). Syst. Zool. 17: 292-304.

Coleman, R. H. 1968. Notes from Mrs. Coleman. Chat 32: 62-63.

Duchein, A. 1968. Sooty Tern at Chimney Rock, N.C. Chat 32: 98-99.

King, W. B. 1968. A million Sooty Terns. Pac. Bird Obs. 8: 1-2.

Monroe, B. L., Jr. 1968. A distributional survey of the birds of Honduras. AOU Ornithol. Monogr. 7. 458 pp.

Ridley, Viscount. 1968. The Sooty-Tern in Seychelles. J. Seychelles Soc. 6: 11-16.

1967

Gould, P. J. 1967. Nocturnal feeding of _Sterna fuscata_ and _Puffinus pacificus_. Condor 69: 529.

Lane, S. G. 1967. Sooty Tern recovery in the Philippines. Austr. Bird Bander 5: 57.

Mathewson, C. C. 1967. Sooty Terns breeding on Palmyra. Pac. Bird Obs. 7: 6-8.

Robertson, W. B., Jr. 1967 ms. a. Distant recoveries (i.e., more than 100 miles) of Sooty Terns (_Sterna fuscata_) banded at Dry Tortugas, Florida. Unpubl. ms. in files of S. Fla. Res. Cent., Everglades Natl. Park, FL. 11 pp.

_____. 1967 ms. b. Known occurrence of Sooty Terns in and around the Gulf of Guinea. Unpubl. ms. in files of S. Fla. Res. Cent., Everglades Natl. Park, FL. 3 pp.

_____. 1967 ms. c. Occurrence of Sooty Terns in the Atlantic (excluding the Gulf of Guinea) and connecting seas to the east. Unpubl. ms. in files of S. Fla. Res. Cent., Everglades Natl. Park, FL. 5 pp.

1966

Amerson, A. B., Jr. 1966. _Ornithodoros capensis_ (Acarina: Argasidae) infesting Sooty Tern (_Sterna fuscata_) nasal cavities. J. Parasitol. 52: 1220-1221.

Harrison, G. 1966. A Sooty Tern _Sterna fuscata_ in Malawi. Bull. Brit. Ornithol. Club 86: 160.

Stimson, L. A. 1966. Feigned death. Fla. Nat. 39: 153.

Voous, K. H. 1966. The terns of the Dry Tortugas. Auk 83: 145-146.

1965

Ashmole, N. P. 1965. Adaptive variation in the breeding regime of a tropical sea bird. Proc. Natl. Acad. Sci. U.S.A. 53: 311-318.

Haverschmidt, F. 1965b. Inland records of Sooty Terns (Sterna fuscata) in Surinam. Ardea 53: 235-236.

Meeth, P. 1965. Sooty Tern (Sterna fuscata) in southern Spain. Ardea 53: 235.

Morzer Bruyns, W. F. J. and K. H. Voous. 1965. Night-feeding by Sooty Tern (Sterna fuscata). Ardea 53: 79.

Robertson, W. B., Jr. 1965. Migrations of Sooty Terns. Nigerian Field 30: 190-191.

Smart, J. B. 1965. A breeding record for the Sooty Tern in Kenya. J. East Afr. Nat. Hist. Soc. Natl. Mus. 25: 69-70.

1964

Chamberlain, B. R. 1964. Sooty Terns driven to land by Hurricane Cleo. Chat 28: 138.

Mason, C. R. 1964a. Sooty Tern reaches central Florida. Fla. Nat. 37: 24.

Meeth, P. 1964. Observacion de Charran Sombrio (Sterna fuscata) en Andalucia. Ardeola 10: 65-66.

Robertson, W. B., Jr. 1964. The terns of the Dry Tortugas. Bull. Fla. State Mus. 8: 1-94.

1963

Ashmole, N. P. 1963a. The biology of the Wideawake or Sooty Tern Sterna fuscata on Ascension Island. Ibis 103b: 297-364.

_____. 1963b. Molt and breeding in populations of the Sooty Tern Sterna fuscata. Postilla 76: 1-18.

Kuroda, N. 1963. [A trip to Florida.] Misc. Rep. Yamashina Inst. Ornithol. 3: 287-301. [In Japanese with English summary.]

Sykes, P. W., Jr. 1963. Some observations off the North Carolina coast. Chat 27: 77-78.

1962

Cullen, J. M. 1962. The pecking response of young Wideawake Terns, Sterna fuscata. Ibis 103b: 162-170.

Howell, T. R. and G. A. Bartholomew. 1962. Temperature regulation in the Sooty Tern Sterna fuscata. Ibis 104: 98-105.

Jenkins, J. A. F. 1962. Sooty Tern off Cape Reinga. Notornis 9: 295.

Williams, L. E., Jr. 1962b. A summer visit to the Chandeleurs. La. Ornithol. Soc. News 31: 2-3.

1961

Cobb, M. 1961. Sooty Tern seen at Key West. Fla. Nat. 34: 94.

Davis, H. T. 1961. Bird banding, 1961. Chat 25: 63-64.

Fry, C. H. 1961. Notes on the birds of Annobon and other islands in the Gulf of Guinea. Ibis 103a: 267-276.

1959

Chapin, J. P. and L. W. Wing. 1959. The Wideawake calendar, 1953 to 1958. Auk 76: 153-158.

Joyner, J. W. E. 1959. Sooty Terns at Cape Lookout, N.C. Chat 23: 66.

1958

Ridley, M. W. and R. Percy. 1958. The exploitation of sea birds in Seychelles. Colon. Res. Stud. 25: 1-78.

Sefton, A. R. 1958. The Sooty Tern--New South Wales records. Emu 58: 63-64.

Turcotte, W. H. 1958. A first record for Mississippi. Miss. Ornithol. Soc. Newsl. 2: 4.

1957

Ferguson-Lees, I. J. 1957. Photographic studies of some less familiar birds. LXXXIII. Sooty Tern. Brit Birds 50: 385-389.

Kowalsky, S. 1957. 3e record de la Sterne fuligineuse (Sterna fuscata fuscata Linne 1766) en France. Oiseau Rev. Fr. Ornithol. 27: 96. [In French.]

Lenz, J. and P. Meesenburg. 1957. Russseeschwalbe, Sterna fuscata (L.), auf Scharhorn. J. Ornithol. 98: 470-472.

Woolfenden, G. E. 1957. Specimens of three birds uncommon in New Jersey. Wilson Bull. 69: 181-182.

1956

Chamberlain, B. R. 1956c. Shearwaters, terns, and other hurricane victims. Chat 20: 17.

1955

Balfour, E. 1955. Sooty Tern (*Sterna fuscata*) in Orkney. Scott. Nat. 66: 190.

Nicholson, D. J. 1955. Sooty Terns heard and seen at Neptune Beach. Fla. Nat. 28: 29, 32.

1954

Chapin, J. P. 1954. The calendar of Wideawake Fair. Auk 71: 1-15.

1953

Jouanin, C. 1953. Note sur la *Sterna fuscata* L. en Polynesis francaise. Oiseau Rev. Fr. Ornithol. 23: 149-150. [In French.]

Kuroda, N. 1953a. [On the subspecific name of the Sooty Tern of Marcus I.] Misc. Rep. Yamashina Inst. Ornithol. 2: 55-59. [In Japanese.]

Moore, J. C. and W. E. Dilley. 1953. Tern counts at Dry Tortugas 1950, 1951, and 1952. Fla. Nat. 26: 75-81.

1951

Dickinson, J. C., Jr. 1951. A twelve-year-old Sooty Tern in Arkansas. Bird-Banding 22: 79.

1950

Ford, E. R. 1950. Sooty Terns as guests. Fla. Nat. 23: 46.

Hutchinson, G. E. 1950. Marginalia: Wideawake Fair. Am. Sci. 38: 613-616.

Nicholson, D. J. 1950. New nesting ground and extension of the breeding range of the Sooty Tern. Fla. Nat. 23: 71-72.

1949

Harllee, H. L. 1949. Sooty Tern and Northern Horned Lark in South Carolina. Auk 66: 206.

Sprunt, A., Jr. 1949a. Tern colonies of the Dry Tortugas Fort Jefferson National Monument--1948. Fla. Nat. 22: 9-16.

1948

Sprunt, A., Jr. 1948a. The tern colonies of the Dry Tortugas Keys. Auk 65: 1-19.

Sprunt, A., Jr. 1948b. Population survey, tern colonies of the Dry Tortugas, Fort Jefferson National Monument, 1947 (concluded). Fla. Nat. 21: 25-31.

1946

Chapin, J. R. 1946. Wideawake Fair invaded. Nat. Hist. 55: 313-319.

Sprunt, A., Jr. 1946a. Survey of the tern colonies of the Dry Tortugas season of 1945. Fla. Nat. 19: 26-32.

_____. 1946b. Population survey of the tern colonies of the Dry Tortugas Fort Jefferson National Monument 1946. Fla. Nat. 20: 1-8.

1945

Cooke, M. T. 1945. Longevity of the Sooty Tern. Bird-Banding 16: 106.

1944

Beven, G. 1944. Record of Sooty Tern at St. Lucia. Ostrich 15: 140.

1943

Vinten, C. R. 1943. The Noddy and Sooty Tern colonies of the Dry Tortugas Fort Jefferson National Monument: a summary of the records. Fla. Nat. 16: 53-61.

1941

Dickinson, J. C., Jr. 1941. Noddy and Sooty Terns nesting on bare ground. Auk 58: 259.

Riemann, E. J. 1941. The Sooties of Shark Island. Oologist 58: 50-52.

Stoner, D. 1941. Historical data on a specimen of Sooty Tern from Oswego, New York. Auk 58: 258-259.

1939

Barkalow, F. S., Jr. 1939. Records of the Sooty Tern and Swallow-tailed Kite in Alabama. Wilson Bull. 51: 121.

Beard, D. B. 1939. Man-o'-war-birds prey on eastern Sooty Terns. Auk 56: 327-329.

Betts, F. N.. 1939. The breeding of the Indian Sooty Tern in the Laccadive Islands. J. Bombay Nat. Hist. Soc. 40: 763-764.

Ritchie, J. 1939. Sooty Tern in Stirlingshire. Brit. Birds 33: 197-198.

1938

Beard, D. B. 1938. The 1938 count of Noddy and Sooty Terns at the Dry Tortugas. Fla. Nat. 12: 7-10.

1935

Alexander, H. G. 1935. Sooty Tern seen in Kent. Brit. Birds 29: 187.

Greene, E. R. 1935. Two rare birds from Georgia. Auk 52: 98-99.

Saunders, C. 1935. Sooty Terns seen in Dorset. Brit. Birds 29: 86-87.

Wing, J. S. 1935. Sooty Tern in Norfolk. Brit. Birds 29: 187.

1933

Gowanloch, J. N. 1933. New bird is discovered in Louisiana. La. Conserv. Rev. 3: 32.

1932

Tomkins, I. R. 1932b. A Sooty Tern from Georgia. Auk 49: 219.

1931

Kuerzi, J. F. 1931. Notes on the occurrence of *Ajaia ajaja* and some other species in Florida. Auk 48: 114-116.

1929

Doak, W. C. 1929. The Sooty Tern (*Sterna fuscata*) at Stone Harbor, N.J. Auk 46: 224.

Lunau, C. 1929. Die Russbraune Seeschwalbe *Sterna fuscata fuscata* L., in Holstein erlegt. Ornithol. Monatsber. 37: 182-183.

Muller, V. H. 1929. Sooty Tern on Staten Island, N.Y. Auk 46: 102.

Wilcox, L. 1929a. Sooty Tern (*Sterna fuscata*) on Long Island, New York. Auk 46: 101.

_____. 1929b. Notes from Long Island, New York. Auk 46: 247-248.

1928

Lavauden, L. 1928. Notes d'ornithologie malgache. 1. Une nouvelle acquisition pour le faune de Madagascar. (Sterna fuscata L. 1766). Rev. Fr. Ornithol. 20: 194-195.

1927

Dingle, E. von S. 1927. Sooty Tern (Sterna fuscata) and Bridled Tern (Sterna anaetheta) on the South Carolina coast. Auk 44: 93-94.

Nicholson, D. J. 1927. Florida notes. Auk 44: 115.

1926

Brimley, H. H. 1926. The Sooty Tern in North Carolina. Auk 43: 535.

Johnson, I. H. 1926. Sooty Tern (Sterna fuscata) in West Virginia. Auk 43: 535-536.

Sprunt, A., Jr. 1926b. The Sooty Tern (Sterna fuscata) at Charleston, S.C. Auk 43: 535.

Wayne, A. T. 1926. The Sooty Tern and Audubon's Shearwater in South Carolina. Auk 43: 534-535.

1915

Lashley, K. S. 1915. Notes on the nesting activities of the Noddy and Sooty Terns. Publ. Carnegie Inst. 7: 61-83.

Watson, J. B. and K. S. Lashley. 1915. On homing instinct of Sooty and Noddy Terns. Carnegie Inst. Bull. 7: 9-104.

1910

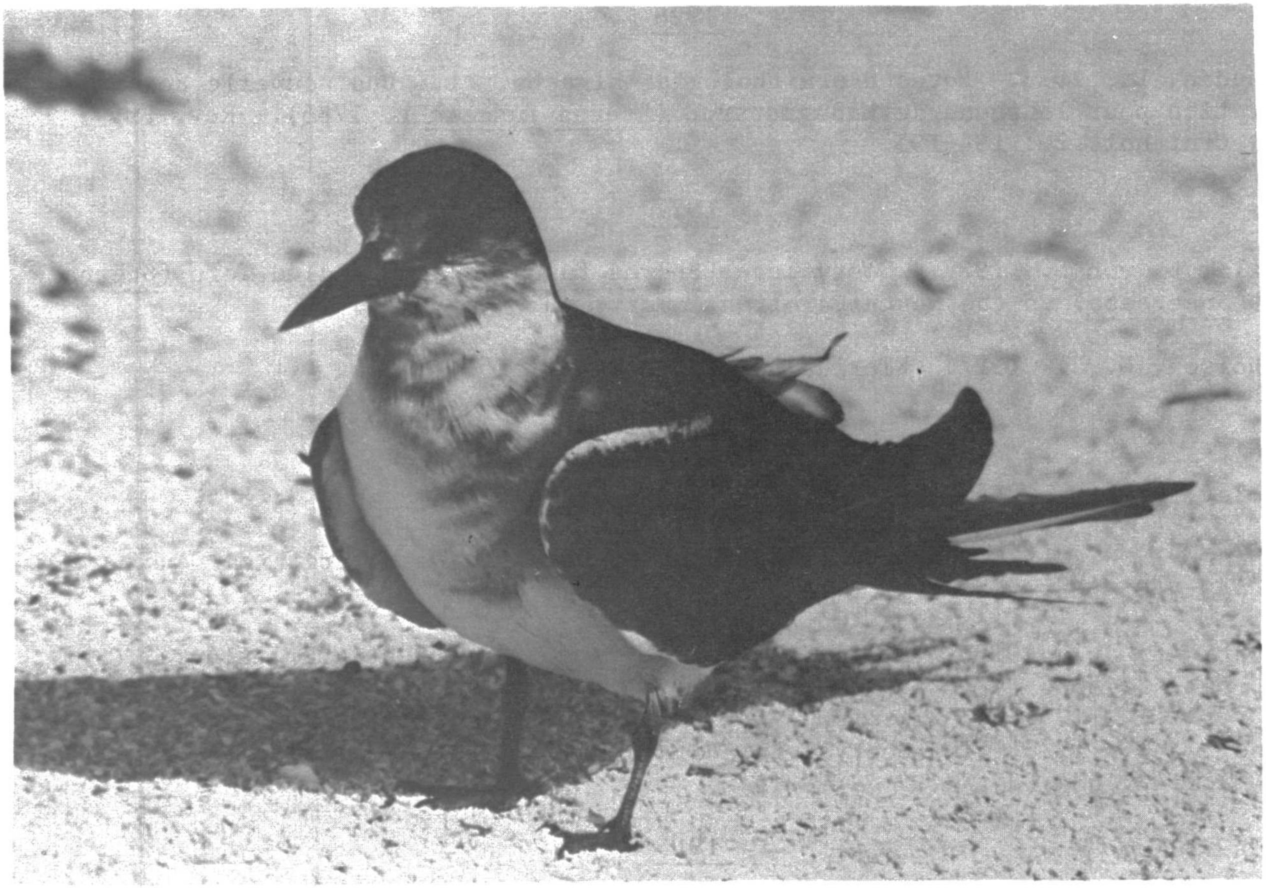
Watson, J. B. 1910. Further data on the homing sense of Noddy and Sooty Terns. Science (N.Y.) 32: 470-473.

1908

Watson, J. B. 1908. The behavior of Noddy and Sooty Terns. Publ. Carnegie Inst. 2: 189-255.

1907

Watson, J. B. 1907. Report of John B. Watson on the condition of the Noddy and Sooty Tern colony on Bird Key, Tortugas, Florida. Bird-Lore 9: 307-316.



Oiled Sooty Tern at Bush Key, Florida. Photograph by Roger B. Clapp.

Adult Sooty Tern incubating egg. Photograph by Roger B. Clapp.

BLACK TERN

(*Chlidonias niger*)

[DA: Sortterne, DU: Zwarte Stern, FI: Mustatiira, FR: Guifette noire, Guifette epouvantail; GE: Trauerseeschwalbe, IC: Sotderna, IT: Mignattino, NW: Svartterne, PO: Rybitwa czarna, PR: Gaivina, Ferreirinha; SP: Charran negro, Fumarel comun; SW: Svarttarna]

GENERAL DISTRIBUTION

North America The Black Tern is a Holarctic species that nests in freshwater marshes. In Canada, the species is most common in the Prairie Provinces. They breed in interior and southern British Columbia (rarely in the southwestern portion [Campbell 1970]), in extreme south-central Mackenzie, in most of Alberta (except the extreme northwest), and from central and southern Saskatchewan east through Manitoba and Ontario to southwestern Quebec and, very locally, in southern New Brunswick (Godfrey 1966). In the United States, Black Terns breed from the Canadian border south to south-central California, northern Utah and Nevada, Colorado, Nebraska, Missouri, Ohio, Pennsylvania, western New York, northwestern Vermont, and Maine (AOU 1957).

North American Black Terns winter from Panama to Surinam on the Atlantic coast and from Panama to Peru on the Pacific coast (Blake 1977). Large wintering populations occur in the Pacific off western South America. Migrants are common along both coasts, and are commonly found at sea. Immense numbers follow the Gulf coast south to Central America. In the United States Black Terns are common migrants as far south as North Carolina, but are less common along the Atlantic coast of Florida and rare in the West Indies (AOU 1957, Bond 1971).

World Distribution Old World Black Terns breed in western Eurasia from southern Sweden and France north to Lake Ladoga in north-central Russia, and east to the upper Yenisei in central Siberia. They breed south to southern Portugal, eastern and southern Spain, northern Italy, Bulgaria, the Black Sea, northern Caucausas in the U.S.S.R., the Caspian and Aral Seas, and Turkestan (Vaurie 1965, BOU 1971). Birds from these populations winter primarily along the coasts of tropical Africa south to Angola and Tanzania (Voous 1960, Vaurie 1965) and are particularly abundant in the Gulf of Guinea (Watson 1966).

Black Terns wander as far west and southwest as the Galapagos (Harris 1975), Hawaii (Berger 1972), Australia (Bell 1959, Rogers 1969a, Miller and Lalas 1974, Jacobs 1975), Japan (Nakamura 1972), and northern China (Vaurie 1965). To the east and northeast, Black Terns wander to Bermuda (AOU 1957),

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Taxonomic note: This species also frequently appears in the literature as *Chlidonias nigra*. This account stresses information available for *Chlidonias niger suranamensis*, the race occurring in North America. Much additional work on the Old World race, *C. n. niger*, has been summarized recently by Haverschmidt (1978).

Madeira, the Faroes, and Iceland (Vaurie 1965).

DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

North Carolina Black Terns are uncommon spring and common fall migrants in North Carolina reaching peak abundance from mid-July through late September. Fall migrants have been recorded along the coast as early as 20 June (Teulings 1971d) and as late as 24 October (Pearson et al. 1919); spring migrants have been recorded from 24 April (Teulings 1976c) through 17 May (Teulings 1970a). This species occasionally occurs in North Carolina in winter (Wray and Davis 1959), but is largely absent from November through March.

Although Black Terns are most common along the coast and on nearby inland waters, they are also seen over interior marshes and lakes (Pearson et al. 1942). The number migrating through the state in recent years has declined sharply, and Black Terns are now rare inland in fall (LeGrand 1979a).

South Carolina These terns are common in South Carolina both as spring and fall migrants. They occur primarily along the coast but are also seen inland. The periods of migration overlap, so much so that this tern is considered a common summer resident even though it does not breed in the state (Sprunt and Chamberlain 1949, Burton 1970). Black Terns have been recorded from early May (Sprunt and Chamberlain 1949) to early November (Burton 1970), but numbers peak from mid-August to late September.

Georgia Black Terns are spring and fall migrants and nonbreeding summer birds in Georgia. They are more abundant in fall than in spring, and are seen more along the coast than in the interior (Burleigh 1958, Denton et al. 1977). Black Terns have been reported from 27 June to 20 October during fall migration along the coast and from 30 March to 11 April during spring migration (Burleigh 1958).

Florida Black Terns are abundant throughout Florida, except in the extreme southeast. As elsewhere in the southeastern United States, they are spring and fall migrants that also are present in summer but do not breed. Peak numbers are seen in fall when flocks may number in the thousands (Sprunt 1954; Kale 1979 ms a, 1979 ms b). Spring migrants are present along the Atlantic coast from April through June, and fall migrants are seen from July through November (Kale 1979 ms a).

Alabama The Black Tern is a common spring and an abundant fall migrant along the Alabama coast. They may summer in considerable numbers but are rare in winter. Migration occurs along the coast with large flocks sometimes present in late summer and fall. Black Terns have been recorded along the coast from 16 April (Imhof 1977) to 22 October, with exceptional occurrences on 31 December (Imhof 1976b) and 3 January (Hamilton 1976).

Mississippi Burleigh (1944) considered Black Terns as scarce transients along the Mississippi coast in spring, but fairly common in fall migration.

Recent sightings on offshore islands (Table 79) suggest that the species may be more common than Burleigh suggested.

Louisiana Primarily a spring and fall migrant in Louisiana, the Black Tern is a common nonbreeding bird of the coastal marshes; individuals occasionally spend the winter. Spring migration occurs from late April through the third week of June; fall migration from early July to October (Lowery 1974).

Texas The Black Tern is common to abundant in much of Texas (except the dry western regions) in spring and fall migration. Spring migration takes place from late April to mid-June, and fall migration occurs from late July to mid-October. A few birds may be found in the winter (Oberholser 1974). Judging from recent estimates of migrant numbers (Table 79), this species is a more common migrant in Texas than in any other southeastern state. Numbers peak in mid-May and from late August through September.

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

Breeding Black Terns breed abundantly in marshlands of south-central Canada, the north-central United States and central Eurasia. Most North American Black Terns pass through the southeastern United States, where they are common to abundant migrants. Neither continental nor world population estimates are available. Although breeding populations are apparently stable or declining slightly in most portions of North America, the species is apparently in trouble in the Northern Great Plains and in Saskatchewan (Tate and Tate 1982). Tate and Tate noted that the Breeding Bird Survey "shows a continuing decline in all areas east of the Rockies." Numbers of Black Terns observed on breeding bird surveys in Wisconsin (Robbins 1977) declined from 101 birds in 1968 to 29 in 1975. Populations in two western Wisconsin counties declined from 42 pairs in 1975 to 18 in 1977 (Faanes 1979), but a more recent study of that state's population (Tilghman 1980) questioned whether any real decline is occurring. About 1,050 Black Terns nested in 21 colonies near Lake Michigan in 1976 (Scharf 1979). Scharf, however, remarked that populations, while stable, could be expected to decline as a result of the destruction of nesting habitat. Erskine (1978 in Faanes 1979) reported declines in the central regions of the Canadian Prairie Provinces but noted stable populations in the southern portions. Some Old World populations also may be declining as Haverschmidt (1978) has noted that breeding habitat is rapidly disappearing in most of western Europe.

Winter and Migration A few birds winter in the southern United States, but most of the North American population moves farther south. Major wintering grounds are in South America, from Panama south to Peru on the Pacific coast and along northern South America to Surinam on the Atlantic coast (AOU 1957, Blake 1977). Through 1972, only 3,463 Black Terns were banded in North America and only 8 were recovered (Haverschmidt 1978). By 1981, the number recovered totaled only 11 birds (Clapp et al. 1982a). Consequently, specific data on migration of these terns is scanty. One nestling banded in Wisconsin

Table 79. Peak concentrations of migrant Black Terns in the coastal southeastern United States (a).

Date seen		Number seen	Locality	Source
			NORTH CAROLINA	
1975	17 Aug.	1,000+	Bird Shoal near Morehead City	Teulings 1976a
1974	23 Sep.	1,350	from Ocracoke-Cedar Island Ferry	Teulings 1975a
			SOUTH CAROLINA	
1973	23 Sep.	1,000	Folly Beach	Teulings 1974a
			GEORGIA	
1955	15 Aug.	500	St. Mary's	Chamberlain 1956a
1953	26 Aug.	200	Holden's Beach	Chamberlain 1954a
1953	27 Aug.	500	St. Mary's	Chamberlain 1954a
			FLORIDA - ATLANTIC COAST	
1971	1 Sep.	1,000's	Amelia Island	Robertson 1972
1965	10 Sep.	1,500	Guano Lake	Stevenson 1966a
1955	20 Sep.	100	Lake Okeechobee (inland)	Stevenson 1956a
			FLORIDA - KEYS	
1973	27 July	450	Key Haven	Ogden 1973
1955	29 Aug.	1,000	Key West	Stevenson 1956a
			FLORIDA - GULF COAST	
1957	21 Apr.	2,000	Pensacola	Newman 1957b
1967	10 June	100	St. Petersburg	Stevenson 1967c
1956	27 June	275	Marco Island	Stevenson 1956d
1956	28 June	3,500	Pensacola	Newman 1956b
1953	27 July	300	Mullet Key	Stevenson 1953b
1963	5 Aug.	2,500	near Tampa	Stevenson 1963c
1961	2nd week Aug.	3,000	off Pensacola	James and James 1961
1976	19 Aug.	1,000+	roosting, St. Marks Light	Edscorn 1977
1963	20 Aug.	1,000	St. George Island	Stevenson 1963c
1976	25 Sep.	1,000+	25 mi off Clearwater	Buhrman and Hopkins 1978
1958	2 Oct.	1,000's	outer beach, Pensacola	Newman 1959

Table 79. Continued.

Date seen		Number seen	Locality	Source
			ALABAMA	
1956	15-17 June	1,000+	Dauphin and Petit Bois Islands	Newman 1956b
1963	15 July	10,000+	Fort Morgan	Imhof 1976b
1960	6 Aug.	9,000	Fort Morgan	Imhof 1976b
1958	31 Aug.	10-15,000	along Alabama and Mississippi coast	Newman 1959
			MISSISSIPPI	
1977	21 May	800	West Ship Island	Weber and Jackson 1977
1977	14 June	200	East Ship Island	Weber and Jackson 1977
1978	28 June-2 July	150	East Ship Island	Jackson and Cooley 1978a
1977	4 July	200	East Ship Island	Weber and Jackson 1977
1976	31 July	400	Horn Island	Jackson and Weber 1976
1977	8 Aug	400	Horn Island	Weber and Jackson 1978
1977	12 Aug	200	East Ship Island	Weber and Jackson 1978
			LOUISIANA	
1969	25 May	500	Grand Isle	Imhof 1969
1969	22 July	300	20-25 mi off South Pass	Stewart 1969
1969	23 July	200	40-45 mi off South Pass	Stewart 1969
			TEXAS	
1974	mid-May	9,000	Anahuac NWR	Webster 1974c
1957	17 May	5,000	Galveston	Webster 1957b
1962	20 May	10,000	Galveston	Webster 1962b
1961	13 July	10,000+	between Rockport and Corpus Christi	Webster 1962a
1974	21 Aug.	10,000	Bolivar Peninsula and E Galveston Beach	Webster 1975a
1960	27 Aug.	75,000	San Luis Pass, W end of Galveston Island	Webster 1961a
1976	4 Sep.	1,000	4-10 mi off Port Aransas	Webster 1977a
1966	7 Sep.	1,100	Neuces area	Webster 1967a
1955	11 Sep.	1,000's	Galveston to High Island	Webster 1956a
1957	15 Sep.	1,000's	Corpus Christi area	Webster 1958b
1961	16-17 Sep.	1,000's	Brownsville area	Webster 1962a
1959	19 Sep.	3,000	S of San Luis Pass	Webster 1960a

Table 79. Concluded.

Date seen		Number seen	Locality	Source
1974	20 Sep.	15,000+	N. Padre Island beaches	Webster 1975a
1968	6 Oct.	8-10,000	North Padre Island	Webster 1969a
1966	23 Oct.	1,100	Neuces area	Webster 1967a

(a) Within states, records are arranged chronologically by season

was recaptured in mid-January in northern Ecuador; another bird was recovered in Florida in early September only 10 days after it had been banded in Quebec (Haverschmidt 1978); an adult banded in Minnesota during the breeding season was recaptured in El Salvador in late November (Clapp et al. 1982a). Other data indicate that migration takes place along the Atlantic coast and through the interior of the United States, as well as along both coasts of Mexico and Central America (AOU 1957).

Old World Black Terns winter primarily along the coasts of west Africa. Much more information on their wintering range and migration is provided by Haverschmidt (1978).

HABITAT

Nesting Black Terns usually nest in small colonies (1) but may also nest solitarily in shallow marshes or in open areas of deeper marshes (McNicholl 1971). A variety of aquatic habitats are used, including natural ponds, lakes, fish and stock ponds, shallow river impoundments, river oxbows, and ditches (Dement'ev and Gladkov 1951, Borodulina 1960, R. Stewart 1975). Birds also nest along the edges of streams and in flooded meadows (Tilghman 1980), and in swampy grasslands (Voous 1960).

Black Terns usually nest in areas of emergent vegetation. In Michigan, they prefer to nest near open water where the vegetation is low and thin (Cuthbert 1954). Similar habitat was used by Black Terns in Poland (Bochenski 1966). Nests are usually placed on floating vegetation or debris such as boards and logs or on muskrat (*Ondatra zibethicus*) houses or feeding platforms. From 11%

(1) McNicholl (1971) reported that most colonies contain from 2 to 20 nests to as many as 51 nests, basing his statement mainly on the North American literature. Old World colonies usually hold from a few to several dozen pairs (Dement'ev and Gladkov 1951, Baggerman et al. 1956, Voous 1960, Bochenski 1966). Larger colonies that may hold as many as 100 pairs (Dement'ev and Gladkov 1951a) are more common in the Old World, but are usually made up of a number of small, discrete subcolonies (Bochenski 1966).

(in Iowa; Bergman et al. 1970) to 98% (in Wisconsin; Faanes 1979) of the nests were found on floating materials and from 0% (in Ontario; Dunn 1979) to 36% (in Iowa; Bergman et al. 1970) of the nests were on structures used by muskrats in five North American studies (Cuthbert 1954, Bergman et al. 1970, Gould 1974 in Dunn 1979, Dunn 1979, Faanes 1979). Rootstalks of cattails (Typha spp.) were an important nest site in Iowa (Bergman et al. 1970) and made up 53% of the nest sites (n = 197) studied there. Forty-two of 52 nests in Wisconsin were on floating mats of vegetation; cattail, river bulrush (Scirpus fluviatilis), and round-stem bulrush (Scirpus acutus) supplied 32.7%, 30.8%, and 23.0%, respectively, of the sites used (Faanes 1979). Another six nests were placed on submerged aquatic vegetation and only one was found on a muskrat house. All were found in the deep marsh areas of the seven ponds studied.

Most floating nests at Long Point, Ontario, were in water 1-1.2 m (3-4 ft) deep and were found within stands of living cattail 0.5-12 m (1.6-39.4 ft) (mean 4 m [13.1 ft]) away from open water (Dunn 1979). Black Terns in this area preferred to nest where cattails emerged at least 1 m (3 ft) above the water and were moderately dense. Forty-one nests in North Dakota were in water averaging 17 in (43 cm) in depth (range = 4-34 in [10-86 cm]) (R. E. Stewart 1975), while 51 nests found in Minnesota were in water 6-31 in (15-79 cm, n = 51) deep (Eddy 1961).

Abandoned nests of other birds are sometimes used as nest sites; one-fifth of the Black Tern nests were found on such sites at one locality in California (Gould 1974 in Dunn 1979). Species of birds supplying nest sites for Black Terns include grebes (Podiceps sp.), Forster's Terns (Gould 1974 in Dunn 1979), and both American and Old World Coots (Fulica americana, F. atra) (Bent 1921, Provost 1947, Bochenski 1966).

Feeding Food for young birds was gathered mostly within a few hundred feet of the nest in Michigan (Cuthbert 1954) and within 75 ft (23 m) in Minnesota (Eddy 1961). Food was obtained from sloughs and over ploughed land or grain fields during one study in Saskatchewan (Pittman 1927). Migrating Black Terns feed over open water or fields near water (Sheppard 1952), but have been observed feeding well inland over semi-arid desert in Libya (Bundy 1971).

Nonbreeding and Offshore Black Terns frequent both fresh- and saltwater during their migration through the southeastern United States. Inland they are found along marshes, rivers, or lakes, and frequently over nearby cultivated fields (Oberholser 1974). In Florida they are most common along the coast, where they may roost in large flocks on the beaches (Howell 1932). Recent aerial surveys (Fritz et al. 1982 ms) of seabirds in the coastal waters of the southeastern United States revealed that the average distance that Black Terns were seen off Brownsville, Texas, and Merritt Island, Florida, was less than 30 km (19 mi) from shore; those seen off Naples, Florida, and Marsh Island, Louisiana, were seen farther offshore.

Black Terns migrating inland in Italy feed over lakes and sometimes occur in flocks containing up to 100 birds (Waller 1955). Wetmore (1965) found wintering Black Terns in flocks of 30 to more than 200 birds in the Gulf of Panama, commonly in the open sea. Those seen during spring migration off Italy fly by ones or twos or in flocks of 10-20 birds about 300 ft (91 m) offshore and about 5-20 ft (1.5-6.1 m) above the sea (Waller 1955). Migrants in the south Caribbean Sea are seen well offshore, as well as in the main harbor of Curacao (van Halewijn 1973).

During the breeding season, one or several birds may roost on mudflats and elevated parts of the habitat near water (e.g., poles, branches of dead bushes, clumps of reeds). Such roosts may include sleeping, preening, and courting birds, and are always found outside and sometimes as much as a mile (1.6 km) from the breeding colonies (Baggerman et al. 1956).

FOOD AND FEEDING BEHAVIOR

Black Terns, both adults and young, subsist almost entirely on insects and small fish, usually mostly on insects. Insects are commonly taken by hawking or are seized in flight from the surface of the water, from emergent plants (Cuthbert 1954, Angles 1957), or from the ground (Wotten 1950, Silcocks 1958, Haverschmidt 1969). Insects may also be seized by birds standing on perches (Cuthbert 1954). Fish are taken from the surface of the water. Diving birds usually immerse only their bill or the front of their head (Baggerman et al. 1956), and these birds only rarely splash into the water or submerge (Boyd 1950, Douglas 1950, Shepperd 1951, Bower 1970). Black Terns scavenge discarded fish (DuBois 1931) and forage behind fishing vessels (Haverschmidt 1978).

Most Black Terns forage in groups of 2-20 birds and only rarely hunt alone (Baggerman et al. 1956). They forage from heights of 10-15 ft (3-5 m) above the water (Douglas 1950, Bower 1970). They also follow ploughs (Goethe 1970), flying at heights of 2-3 ft (0.6-0.9 m) (Brewer 1969) and swooping to seize invertebrates.

Borodulina (1965) estimated that 30 g (1.1 oz) of food was the average daily intake by an adult Black Tern. During courtship feeding, Black Terns eat relatively large items. More than half the food eaten by courted females in the Netherlands consists of large dragonflies and fish about 1-2 in (2.5-5 cm) long (Baggerman et al. 1956). In the Volga Delta captive adults and 20-day-old young consumed an average of about 35 g (1.2 oz) and 25 g (0.9 oz) of food respectively (Markuze 1965).

Rates at which young are fed vary considerably from area to area but apparently increase up to about a week or so and decrease thereafter. Five-, 15- and 19-day-old young in Ontario were fed 5.4, 3.6, and 1.4 times per hour, respectively (Dunn 1979), but Dunn noted that she had too few observations to support any general conclusions. Newly hatched young in Michigan were fed 1.2 times per hour, 2- to 5-day-old young were fed about 7.2 times per hour, and 8-day-old young were fed 16.8 times per hour (Cuthbert 1954). Haverschmidt (1978) reported that week-old young at one nest at one small colony in the Netherlands were fed 61 times in a half hour. Young birds about 3 days to a week old were fed from 33 to 41 times per hour.

Fledged juveniles are also fed by the parents but much less often than unfledged young. Fledged juveniles were fed 3.4 and 5.0 items per hour during two sets of observations in Michigan (Cuthbert 1954). At least 12.9% of these feedings consisted of small fish, which made up a higher proportion of the diet than is usually reported for younger birds.

Some of the literature on the diet of the Black Tern in North America is summarized by area below. Food habits in the Old World are similar (Tima 1961, Borodulina 1965, Haverschmidt 1978) with amphibians (frogs) occasionally forming an important part of the diet (Borodulina 1965). Haverschmidt (1978) provided a thorough summary of food and feeding behavior of this species in the Old World.

North America McAtee and Beal (1912) reported the contents of 147 stomachs of Black Terns collected by the Biological Survey, but did not state when or where their specimens were obtained. Most of the food was insects; dragonflies (Odonata), mayflies (Ephemeroptera), and grasshoppers (Orthoptera) made up slightly over 50% of the bulk of the diet. Small fish (cyprinids and *Fundulus*) made up nearly a fifth of the food, and the remainder consisted of a wide variety of insects.

Ontario In a study at Long Point, Dunn (1979) identified a few of the items fed young; of 56 food items seen, 13% were minnows and 6% were dragonflies.

Great Lakes region, western Lake Erie The stomachs of 12 Black Terns collected 9 July-27 August on Starve Island and the Bass Islands contained mainly small fish (ca. 70%) and insects (Ligas 1952). Emerald shiners (*Notropis atherinoides*) made up the bulk of the diet both in bulk and in number of items found. A few white bass (*Morone chrysops*) were also taken. Insects eaten included mayflies, damselflies (Odonata) bot flies (Diptera), small beetles (Coleoptera), grasshoppers (Orthoptera), and ants (Hymenoptera).

Great Lakes region, Lake Michigan Manuel (1931a in Ligas 1952) examined 106 stomachs from birds collected at Saginaw Bay and showed that these Black Terns had fed mostly on a variety of insects. About 7% of the food items found were fish. Young Black Terns at the Indian River Marsh, Michigan, had a similar diet (Cuthbert 1954). Of 602 feedings witnessed, only 4.9% were of small fish; all the rest of the feedings appeared to be of insects. Damselflies, dragonflies, and mayflies were the most frequently identified food items.

Minnesota Eddy (1961) reported that most of the food consisted of damselflies, dragonflies, mayflies, and caddisflies (Trichoptera), as well as a few minnows.

Nebraska Six Black Terns collected in May, July, and September had eaten locusts and other insects, as well as crayfish, snails, a frog, and a lizard (Aughey 1878).

IMPORTANT BIOLOGICAL PARAMETERS

Egg Laying Most egg laying in North American colonies occurs from late May through early July (Bent 1921, Cuthbert 1954, Bergman et al. 1970, R. Stewart 1975). Laying may begin as early as mid-May at some localities (Bent 1921). Eggs may be present into late July and occasionally into August.

Mean Clutch Size Black Terns lay 1-4 eggs, but clutches of 2 or 3 are most frequent (Baggerman et al. 1956, Table 80). There seems to be little geographical variation in clutch size (Table 80).

Incubation Period Incubation lasts about three weeks. The incubation period for 6 eggs marked at a marsh in New York averaged 21 days, 2 hours (Goodman in Cuthbert 1954). Bergman et al. (1970) reported a mean incubation period of 21.4 days for 28 clutches in Iowa, and Dunn (1979) implied that eggs in Ontario took 20-22 days to hatch. Haverschmidt (1978) recorded incubation periods for two clutches in the Netherlands as 20-22 days and 21 days and Baggerman et al. (1956) indicated an incubation span of 20-23 days for the same area. Haverschmidt (1978) indicated that erroneous incubation periods for this species have been given frequently in the literature and noted several examples, some as recent as the early 1970's, that list too short a period.

Hatching Success Eggs hatched in 15 of 47 (32%) nests at Long Point, Ontario, in 1975 and 1976 (Dunn 1979). Spillner (1975) reported that 77 of 89 (86.5%) eggs hatched young.

Age at Fledging Few precise data on the age at fledging are available. Some young swim away from the nest before developing the capacity for flight, which makes age at fledging difficult to determine. Dunn (1979) thought that fledging took about 19 days. Baggerman et al. (1956) stated that young can fly three weeks after hatching. Cuthbert (1954) believed fledging occurs at about 25 days and noted one marked young flying a mile from its nest site at the age of 30 days. Eddy (1961) noted two young that could fly at an age of 21-22 days.

Fledging Success We found no information that listed the percentage of young that fledged from a known total of eggs laid. One study in Iowa (Bergman et al. 1970) reported that 29% of 192 nests held at least one young that apparently survived.

Mortality of Eggs and Young Most mortality of eggs and young is the result of inclement weather. A hailstorm destroyed all nests at one colony in Kansas (Parmalee 1961) and Bergman et al. (1970) found that most mortality in Iowa was associated with heavy rains and flooding. Baggerman et al. (1956) noted that one egg of a clutch often disappears during incubation and that most chick mortality in the Netherlands is apparently due to predators such as rats and Carrion Crows (*Corvus corone*).

Renesting Bergman et al. (1970) believed that nests started late in the season represent renesting attempts by birds whose first nests were destroyed by storms. Cuthbert (1954) described birds that built auxillary nests to hold

Table 80. Mean clutch sizes reported for the Black Tern (a).

Mean clutch size	Number of clutches	Locality and year of observation (b)	Source
2.3	--	Wisconsin, 1979	Tilghman 1980
2.90	--	Wisconsin	Bailey 1977 in Tilghman 1980
2.25	20	Michigan, 1950 (3-50%)	Cuthbert 1954
2.7	54	North Dakota	R. E. Stewart 1975
2.6	151	Iowa, 1966-1968 (3-63%)	Bergman et al. 1970
3.0	11	Kansas, 1961 (3-100%)	Parmalee 1961
2.78	60	USSR, Novosibirsk region, ca. 1947 (3-69%)	Borodulina 1960
2.18	74	USSR, Volga delta, 1950-1952 (2-43%)	Borodulina 1960
2.64	330	USSR, Estonia, Matsulu Bay, 1957-62 (3-71%)	Onno 1968

(a) Some of these figures are derived from counts of contents of nests during short-term visits. They may not adequately represent clutch size for the population because some nests may have been completed after the visit and others may have been lost previously. In some instances we calculated mean clutch size from data presented in the sources listed.

(b) When possible, we listed in parentheses the most frequently observed clutch size and the percentage of nests that contained this number.

young birds only a few days old that prematurely swam away from the original nest.

Age at First Breeding We found no quantitative data on the age at which Black Terns first breed.

Maximum Natural Longevity A Black Tern banded in Minnesota was recovered in El Salvador at a minimum age of 8 years and 5 months (Clapp et al. 1982a). One banded in Hungary reached an estimated minimum age of 18 years, 2 months, and another banded in Italy lived for at least 10 years, 5 months (Rydzewski 1978).

Weight Adult males and females both weigh from about 50 to 60 g (1.8-2.1 oz) (Table 81).

SUSCEPTIBILITY TO OIL POLLUTION

Black Terns spend much of the year in inland marshes. When at sea, on migration or in winter, they feed by plucking small fish and insects from the surface of the water, and seldom plunge into the water as some other terns do. Consequently, this species is relatively insusceptible to oiling.

Table 81. Weights (in grams) of Black Terns (a).

Mean weight	Range	Number of weights	Sample and season	Area	Source
63.4	---	27	adults	Ontario?	Dunn 1979
66.0	59-73	2	adults, Jan.	Transvaal	Schmidt et al. 1973
54.8	50.6-59	2	ad. males, summer	Georgia or South Carolina	Norris and Johnston 1958
54.7	54-55	3	males	Florida	Hartman 1955
54.0	---	1	male, Aug.	Guatemala	LSU
51	---	1	male, Apr.	SW Africa	Jensen and Berry 1972
64.5	53-76	76	males	southern USSR	Borodulina 1960
86.0	---	1	female, May	Louisiana	LSU
59.6	53.3-63.3	3	females, Aug.	Mexico	LSU
56.3	52-59	3	females, Apr.	SW Africa	Jensen and Berry 1972
63.3	49.2-76	41	females	southern USSR	Borodulina 1960
7.3	---	3	newly hatched young	Ontario	Dunn 1979
---	7.1-9.5	-	newly hatched young	Europe	Heinroth and Heinroth 1928 in Haverschmidt 1978
11.0	9.4-12.5	20	fresh eggs	Ontario	Dunn 1979
11.3	9-8-12.8	-	fresh eggs	Germany ?	Niethammer 1942 in Haverschmidt 1978
11.0	10.4-11.4	10	fresh eggs	Belgium	Verheyen 1967 in Haverschmidt 1978

(a) Range figures for eggs from Ontario are mean $\pm$ 2 S.D.

A poorly censused species in most of its range, the Black Tern is common to abundant in many areas but declining in parts of North America and the Old World. A large proportion of the North American Black Tern population passes through the waters of the southeastern United States during migration, although numbers and habitat use in this area have not been very thoroughly examined. The extensive loss of southern marshlands used by feeding migrants could pose some threat to the species.

BIBLIOGRAPHY

1982

Davis, A. H. 1982. Terns showing mixed characteristics of Black and White-winged Black Terns. Brit. Birds 75: 579-580.

Schouten, C. 1982. Voorkomen en doortrek van de Zwarte Stern Chlidonias niger in het IJsselmeergebied. [Occurrence and passage of the Black Tern Chlidonias niger in the IJsselmeer area.] Limosa 55: 56-58. [In Dutch with English summary.]

1981

Brichetti, P. and C. Martignoni. 1981. Accertata nidifcazione de Mignattino (Chlidonias nigra) sul Lago Inferiore di Mantova (Lombardia) ed attuale distribuzione in Italia. Riv. Ital. Ornitol. 51: 113-120.

Lundberg, B. 1981. Aktion Svarttarna - praktiskt fagelskydd'. [Action Black Tern - practical bird protection.] Sver. Nat. 72: 286-288. [In Swedish with English summary.]

Tanger, D. 1981. Verslag van een Zwarte Stern-telling in het IJsselmeergebied op 16 augustus 1980. Watervogels 6: 73-76.

1980

Mulder, T. and D. Tanger. 1980. Zomerkoncentraties van de Zwarte Stern in het IJsselmeergebied. Watervogels 5: 122-126.

Pearson, D. J. and A. D. Lewis. 1980. Occurrence of a Black Tern Chlidonias niger at Dandora, Kenya. Scopus 4: 94-95.

Phillips, J. 1980. American Avocets and Black Terns visit southern West Virginia. Redstart 47: 152.

Steinhaus, G. H. 1980. Black Tern with bright red legs. Dutch Birding 2: 59.

Tilghman, N. G. 1980. The Black Tern survey, 1979. Passenger Pigeon 42: 1-8.

van IJzendoorn, E. J. 1980. Broedgeval van Zwarte Chlidonias niger x Witvleugelstern C. leucopterus. [Breeding record of Black Chlidonias niger x White-winged Black Tern C. leucopterus.] Dutch Birding 2: 17-18.

Vinicombe, K. 1980. Tern showing mixed characteristics of Black Tern and White-winged Black Tern. Brit. Birds 73: 223-225.

1979

Alexandersson, H. 1979. En hybridisering mellan Vitvangad Tarna Chlidonias leucopterus och Svarttarna Chlidonias niger pa Oland 1978. [Interbreeding between White-winged Black Tern Chlidonias leucopterus and Black Tern Chlidonias niger on Oland 1978.] Calidris 8: 151-155.

Conteras, J. R. 1979. [New data about the presence of the Black Tern Chlidonias niger surinamensis (Gmelin) in the Argentine Republic (Aves: Laridae).] Hist. Nat. 1: 1-3. [In Spanish with English summary.]

Dunn, E. H. 1979. Nesting biology and development of young in Ontario Black Terns. Can. Field-Nat. 93: 276-281.

Faanes, C. F. 1979. Status of the Black Tern in western Wisconsin. Passenger Pigeon 41: 124-128.

1978

Haverschmidt, F. 1978. Die Trauerseeschwalbe Chlidonias niger. [The Black Tern Chlidonias niger.] Die Neue Brehm-Bucheri. A. Ziemsen Verlag, Wittenberg Lutherstadt. 74 pp. [In German.]

Maxson, G.-A. D. 1978. Marsh Hawk predation on Black Tern and Pectoral Sandpiper. Prairie Nat. 10: 25-26.

Spaans, A. L. 1978. Status of terns along the Surinam coast. Bird-Banding 49: 66-76.

Tilghman, N. 1978. Plea for help. Black Terns--what's up? Passenger Pigeon 40: 523.

1977

Anon. 1977. [The construction of floating nests for Black Terns.] Vogeljaar 25: 68. [In Dutch.]

Bailey, P. F. 1977. The breeding biology of the Black Tern (Chlidonias niger surinamensis Gmelin). M.S. thesis, Univ. Wisconsin/Oshkosh, WI. 67 pp.

Haverschmidt, F. 1977. Bruthilfe fur die Trauerseeschwalbe (Chlidonias niger). Vogelwelt 98: 27-29.

Iversen, M. 1977. [Black Tern breeding in the salt marsh.] Feltornithologen 19: 45. [In Danish.]

Paine, A. R. J. 1977. Black Tern movement of Sept. 15, 1974. Lond. Bird Rep. 42: 82-91.

Ptaszyk, J. 1977. Zimowe obserwacje brodzca krwawodziobego (Tringa totanus) i rybitwy czarnej (Chlidonias niger). [Winter observation of Redshank (Tringa totanus) and Black Tern (Chlidonias niger).] Notatki Ornitol. 18: 128-129. [In Polish with English summary.]

Robbins, S. 1977. The breeding bird survey in Wisconsin 1966-1975. Passenger Pigeon 39: 225-247.

Seitz, J. 1977. Brut- und Gastvorkommen von Seeschwalben (Sternidae) im Bremer Gebiet. Vogelkd. Ber. Nieders. 9: 74-81.

1976

Alexandersson, H. 1976a. Svarttarnan Chlidonias niger i Skane 1976 samt nagot om dess tidigare forekomst i landskapet. [The Black Tern Chlidonias niger in Skane, 1976.] Anser 15: 255-264. [In Swedish with English summary.]

_____. 1976b. Svarttarnan Chlidonias niger pa Oland. Calidris 5: 31-46. [In Swedish with English summary.]

Doane, L. A. 1976. Behavior of Black Terns on their nesting grounds. Inl. Bird Banding News 48: 49-53.

Isenmann, P. 1976. Observations sur la Guifette noire Chlidonias niger en Camargue. [Observations on the migration of the Black Tern (Chlidonias niger) in the Camargue.] Alauda 44: 319-327. [In French with English and German summaries.]

1975

Dascotte, R. 1975. Observation le 22 Juin 1975 a Baudour d'une guifette noire (Chlidonias niger) en plumage equivoque. Aves 12: 36-37.

Harris, M. P. 1975. Additions to the Galapagos avifauna. Condor 77: 355.

Haverschmidt, F. 1975. Angriffsverhalten der Trauerseeschwalbe Chlidonias niger. [Attack behavior of the Black Tern, Chlidonias niger.] Ornithol. Beob. 72: 280. [In German.]

Jacobs, S. 1975. The Black Tern near Perth. West. Austr. Nat. 13: 61-62.

Spillner, W. 1975. Zur Fortpflanzungsbiologie der Trauerseeschwalbe (Chlidonias niger). Beitr. Vogelkd. 21: 172-215. [In German.]

Van Zurk, H. 1975. La guifette noire (*Chlidonias niger*). Riviera Sci. 11: 78-80.

1974

Gould, G. I., Jr. 1974. Breeding success of piscivorous birds at Eagle Lake, California. M.S. thesis, Humboldt State Univ./Arcata, CA.

Haverschmidt, F. 1974. Hulp voor de Zwarte Stern. Vogeljaar 22: 797-799.

Miller, B. and C. Lalas. 1974. A Black Tern photographed in inland N.S.W. Austr. Birds 9: 14.

Sinclair, J. C. and N. F. Robson. 1974. Black Tern. Ostrich 45: 136.

Tree, A. J. 1974. Black Tern *Chlidonias niger*. Ostrich 45: 136.

1973

Berndt, R. K. 1973. Zugbeobachtungen der Trauerseeschwalbe, *Chlidonias niger*. Corax 4: 151-152.

Schmitt, M. B., P. le S. Milstein, H. C. Hunter and C. J. Hopecroft. 1973. Black Terns in the Transvaal. Bokmakierie 25: 91-92.

van Halewijn, R. 1973. Black Tern *Chlidonias niger* in the south Caribbean Sea. Ardea 61: 189-191.

White, R. V. 1973. Exceptional evening roosting movements of Black Terns. Brit. Birds 66: 537-538.

Whitt, A. L., Jr. 1973. Black Tern at Buckhorn Lake. Kentucky Warbler 49: 45.

1972

Doane, L. A. 1972. Behavior of Black Terns on their nesting grounds. Inl. Bird Banding News 44: 136-144.

Jensen, R. A. C. and H. H. Berry. 1972. The Black Tern *Chlidonias nigra* (L.) in South West Africa. Madoqua (Ser. I) 5: 53-56.

Nakamura, K. 1972. [A Black Tern *Sterna nigra* L., observed in Sagami Bay; new to Japan.] Bull. Kanagawa Prefect. Mus. 1: 19-24. [In Japanese with English summary.]

Richter, B. 1972. Die Trauerseeschwalbe (*Chlidonias niger*). Hamburg. Avifauna Beitr. 10: 39-48.

Robson, N. 1972. Black Tern *Chlidonias nigra* at Pietermaritzburg? Natal Bird Club News Sheet 210: 3-4.

Tree, A. J. 1972. The Black Tern Chlidonias nigra at Walvis Bay. Ostrich 43: 180.

1971

Bundy, G. 1971. Black Terns feeding over dry land. Brit. Birds 64: 32.

Grant, P. J., R. E. Scott and D. I. M. Wallace. 1971. Further notes on the 'portlandica' plumage phase of terns. Brit. Birds 64: 19-22.

Narosky, S. 1971. Dos hallazogos interesantes para la avifauna Argentina (Puffinus diomedea y Chlidonias niger). Hornero 11: 129-130. [In Spanish.]

Scott, R. E. 1971. Black Terns feeding over dry land. Brit. Birds 64: 279.

Vernon, J. D. R. 1971. Black Terns feeding over dry land. Brit. Birds 64: 32-33.

1970

Bergman, R. D., P. Swain and M. W. Weller. 1970. A comparative study of nesting Forster's and Black Terns. Wilson Bull. 82: 435-444.

Bower, B. P. 1970. Behaviour of migrant Black Terns. Scott. Birds 6: 44.

Campbell, R. W. 1970. Occurrence and nesting of Black Terns in southwestern British Columbia. Condor 72: 500.

Drenckhahn, D., H. J. Lepithin and V. Looft. 1970. Beitrag zum Brutvorkommen der Trauerseeschwalbe Chlidonias niger in Schleswig-Holstein von 1966 bis 1970. Corax 3: 71-81.

Goethe, F. 1970. Black Terns feeding after ploughs. Brit. Birds 63: 34.

Pascovschi, S. 1970. [About nests.] Vinat. Pesc. Sportiv. 1970: 23-24. [In Roumanian.]

Spillner, W. 1970. Lebensbilder aus einer mecklengurgischen Brutkolonie der Trauerseeschwalbe. Falke 17: 186-193. [In German.]

1969

Brewer, A. D. 1969. Black Terns feeding after ploughs. Brit. Birds 62: 282.

Cottier, E. J. and D. Lea. 1969. Black-tailed Godwits, Ruffs and Black Terns breeding on the Ouse Washes. Brit. Birds 62: 259-270.

Haverschmidt, F. 1969. Black Terns taking flies disturbed from dung. Brit. Birds 62: 156.

Olrog, C. C. 1969. Chlidonias niger y Sterna albifrons, dos laridos nuevos para la Argentina (Aves, Charadriiformes, Laridae). [Chlidonias niger and Sterna albifrons, two new larids for Argentina.] Neotropica 15: 7-8. [In Spanish with English summary.]

Rogers, A. E. F. 1969b. Black Tern near Newcastle, N.S.W. Emu 69: 238-239.

van Orden, C. 1969. Die Zwarte Stern als broedvogel in Noordholland benoorden het Noordzeeland. [The Black Tern, a breeding bird in north Holland on the north side of the North Sea canal.] Levende Nat. 71: 111-115. [In Dutch.]

Wilson, H. C. 1969. Black Terns nest in Door County. Passenger Pigeon 31: 173.

1968

Dowsett, R. J. 1968. Black Tern Chlidonias nigra at Lake Chad, and its distribution in Africa. Bull. Nigerian Ornithol. Soc. 5: 95.

Halle, L.-J. 1968. En mai, parmi les guifettes sur le Leman. Nos Oiseaux 29: 209-214. [In French.]

Koskilahti, H. and H. Jaakola. 1968. Mustatiira (Chlidonias niger) pesivana Puurijarvella. Ornis Fenn. 45: 69. [In Finnish.]

Numme, G. 1968. Svartterne ved Sandefjord. Sterna 8: 199, 202. [In Norwegian with English summary.]

Pilaski, J. 1968. Uber das Abfallfressen der Seeschwalben (Sterna, Chlidonias). Vogelwelt 89: 14-20. [In German with English summary.]

1967

Dennis, R. H. 1967. A Black Tern at Fair Isle. A new bird for the island. Bull. Fair Isle Bird Obs. 5: 229-230.

Festetics, A. 1967. Die Trauerseeschwalbe (Chlidonias niger), Brutvogel im Waldviertel. Egretta 10: 32. [In German.]

Halle, L.-J. 1967. The marsh terns. Atl. Nat. 22: 205-208.

Ludwig, B. 1967. Die Trauerseeschwalbe. Falke 14: 90-92. [In German.]

Nadler, T. 1967. Beobachtungen Trauer-, Weissflugel-und Weissbartseeschwalben. Falke 14: 292-294. [In German.]

Pilaski, J. 1967. Zum Vorkommen der Trauerseeschwalbe (Chlidonias nigra) in Sudwestafrikà. J. Ornithol. 108: 84-85. [In German.]

Richardson, F. 1967. Black Tern nest and egg moving experiments. Murrelet 48: 52-56.

1966

Bochenski, Z. 1966. Nesting of Common and Black Terns. Acta Zool. Cracov. 11: 423-449. [In English with Polish and Russian summaries.]

1965

Bezzel, E. and J. Reichholf. 1965. Vom Zug der Binnenseeschwalben (*Chlidonias*) und der Raubseeschwalbe (*Hydroprogne caspia*) in Sud-bayern. Vogelwarte 23: 121-128.

Borodulina, T. L. 1965. [Role of gulls and terns in fish economy in Azov, Black and Caspian Sea basins.] Pp. 37-64 *in* [Fish-eating birds and their significance in fish economy.] [1976 translation for the U.S. Fish Wildl. Serv. and Natl. Sci. Found. by Franklin Book Programs Inc., Cairo.]

Markuze, V. K. 1965. [Effect of fish-eating birds on the spawning-rearing farms of the delta of Volga.] Pp. 90-115 *in* [Fish-eating birds and their significance in fish economy.] [1976 translation for the U.S. Fish Wildl. Serv. and Natl. Sci. Found. by Franklin Book Programs Inc., Cairo.]

Meyer, H. 1965. Beobachtungen an Trauer--(*Chlidonias niger*) und Weissflugelseeschwalben (*Chlidonias leucopterus*). Beitr. Vogelkd. 10: 451-454. [In German.]

1964

Stromberg, G. 1964. Svarttarnans (*Chlidonias nigra*) strack i Ostersjoomradet 1960. [Passage of the Black Tern (*Chlidonias nigra*) in the Baltic Sea region in 1960.] Var Fagelvarld 23: 256-265. [In Swedish with English summary.]

1963

Henss, M. 1963. Massenamsammlung von Trauerseeschwalben (*Chlidonias n. niger* L.) an der Unterweser. Beitr. Naturkd. Nieders. 16: 28-29.

1962

O'Rourke, F. J. 1962. Black Tern, *Chlidonias niger*, in Co. Wicklow. Irish Nat. J. 14: 64.

Tordoff, H. B. 1962. Age and plumage of the Black Tern. Bull. Kansas Ornithol. Soc. 13: 7-8.

Wittenberg, J. 1962. Brutversuch der Trauerseeschwalbe bei Leiferde (Kr. Gifhorn). Beitr. Naturkd. Nieders. 15: 73.

1961

Eddy, J. 1961. Nesting habits of the Black Tern. Flicker 33: 3-4, 14-15.

Hauri, R. 1961. Dur Durchzug der Trauerseeschwalbe, Chlidonias niger, in der Schweiz im Herbst 1960. Ornithol. Beob. 58: 139-140.

Johnston, R. F. and E. E. Klaas. 1961. Probable breeding of the Black Tern in Kansas. Bull. Kansas Ornithol. Soc. 12: 23.

Parmalee, D. F. 1961. A nesting colony of Black Terns in Kansas. Bull. Kansas Ornithol. Soc. 12: 25-27.

Tima, C. B. 1961. [The composition of the food of gulls in Latvia.] Pp. 123-128 in Z. V. Spurin (ed.). [Birds of the Baltic Region: ecology and migrations.] [1968 translation from Russian for the U.S. Dep. Int. and Natl. Sci. Found. by the Israel Progr. Sci. Transl., Jerusalem.]

Timmerman, A. 1961. Hulp aan de Zwarte Stern (Chlidonias niger). Levende Nat. 64: 234-237.

1960

Goodwin, R. E. 1960. A study of the ethology of the Black Tern, Chlidonias niger surinamensis (Gmelin). Ph. D. thesis, Cornell Univ./Ithaca, N.Y. 202 pp.

Mearns, O. J. 1960. Black Terns in Dublin Bay. Irish Nat. J. 13: 186-187.

Williamson, K. 1960. Juvenile and winter plumages of the marsh terns. Brit. Birds 53: 243-252.

1959

Bell, H. L. 1959. An Australian sight record of the Black Tern. Emu 59: 62-63.

Bennett, C. G. and B. King. 1959. Communal bathing by Black Terns in deep water. Brit. Birds 52: 313-314.

Goodwin, R. E. 1959. Records of flight preening and related aerial activities in birds, particularly the Black Tern. Auk 76: 521-523.

1958

Brinkmann, M. 1958. Das Vorkommen der Trauerseeschwalbe, Chlidonias nigra, im Emsland. Beitr. Naturkd. Nieders. 11: 46-48.

Harrison, J. G. 1958. Late Black Tern in Angus. Scott. Birds 1: 16.

Izzard, J. 1958. Black Tern in South Uist. Scott. Birds 1: 16.

Jamieson, G. T. 1958. Black Tern in South Perth. Scott. Birds 1: 16.

Karpovich, V. N., T. N. Solv'ieva-Volynskaya and I. N. Shekt. 1958. [On the ecology of the Black Tern and White-winged Black Tern at flood-land of the Oka River.] Tr. Okskogo Zapov. 2: 78-101. [In Russian.]

Lugovoi, A. E. 1958. [Biocenotic connections of Black Terns in the Volga delta.] Uch. Zap. Yakutsk. Univ. 5: 107-117. [In Russian.]

Pickering, M. W. 1958. Exceptional passage of Black Terns through Somerset in September 1957. Brit. Birds 51: 242-243.

Silcocks, T. 1958. Black Terns feeding on mud-worms. Brit. Birds 51: 121.

1957

Angles, R. 1957. A feeding method of Black Terns. Brit. Birds 50: 538.

Ruttledge, R. F. 1957. Black Terns in Co. Mayo. Irish Nat. J. 12: 172-173.

1956

Baggerman, B., G. P. Baerends, H. S. Heikens and J. H. Mook. 1956. Observations on the behaviour of the Black Tern, *Chlidonias n. niger* (L.), in the breeding area. Ardea 44: 1-71.

Eddy, G. 1956. American Black Tern (*Chlidonias niger surinamensis* (Gmelin)) on Puget Sound. Murrelet 37: 37.

Wilkie, J. 1956. Fish eating a Black Tern. Flicker 28: 160.

1955

Alperin, I. M. 1955. Feeding habits of Black Terns. Linn. Newsl. 9(6-7): 2-3.

Beerman, B. 1955. Svarttarnorna (*Chlidonias niger*) i Hammarsjon 1954. [Black Terns (*Chlidonias niger*) in Lake Hammarsjon in 1954.] Var Fagelvarld 14: 178, 187. [In Swedish with English summary.]

Butterfield, A. and K. Williamson. 1955. The passage of Black Terns through Britain in autumn 1954. Brit. Birds 48: 300-307.

Chadwick, P. J. and B. King. 1955. Large autumn gathering of Black Terns inland in Somerset. Brit. Birds 48: 178.

Dickens, R. F. 1955. The passage of Black Terns through Britain in spring 1954. Brit. Birds 48: 148-169.

Smogorzhevskii, L. O. 1955. Znachenye chernoi krachky rybnon u gospodarstvi Ukrainy. [The role of the Black Tern in the fishing economy of the Ukraine.] Tezy Dopovidey XII Naukovoi Konferentsii, Kyivs'kyi Universitet. [In Ukrainian.]

Waller, R. H. 1955. Reverse migration of Black Terns off Italy. Ibis 97: 145.

1954

Cuthbert, N. L. 1954. A nesting study of the Black Tern in Michigan. Auk 71: 36-63.

Hoffmann, E. 1954. Black Terns at Big Muskegs. Passenger Pigeon 16: 3-8.

1952

Sheppard, R. W. 1952. The Black Tern as an insect-eater. Can. Field-Nat. 66: 129.

1951

Goodbody, I. M. 1951. Inland passage of Black Terns in the spring of 1950. Brit. Birds 44: 170-173.

Petersen, E. 1951. Sortternens (Chlidonias niger niger (L.)) udbredelse i Danmark. [Distribution of the Black Tern (Chlidonias niger niger (L.)) in Denmark.] Dan. Ornithol. Foren. Tidsskr. 45: 18-28. [In Danish with English summary.]

Shepperd, J. 1951. Black Tern plunging into water. Brit. Birds 44: 71.

1950

Alexander, H. G. 1950. Possible occurrence of the Black Tern, Chlidonias niger (L.) near Delhi. J. Bombay Nat. Hist. Soc. 49: 120.

[Boyd], A. W. 1950. Notes on behaviour of Black Terns. Brit. Birds 43: 258.

de Morsier, J. 1950. La Guifette noire (Chlidonias n. niger) L'Echasse blanche (Himantopus h. himantopus) en Dombes. Oiseau Rev. Fr. Ornithol. 20: 157-160.

Douglas, C. E. 1950. Notes on behaviour of Black Terns. Brit. Birds 43: 258.

Hinde, R. A. and J. D. Wood. 1950. Inland passage of Black Terns in the spring of 1949. Brit. Birds 43: 177-179.

Kumerloeve, H. 1950. Bei den Trauerseeschwalben des Dummer. Kosmos 46: 251-254.

Wotton, M. J. 1950. Notes on behaviour of Black Terns. Brit. Birds 43: 258-259.

1949

Anon. 1949. Passage of Black Terns in 1949. Brit. Birds 42: 256.

Baxter, A. P., R. L. Baxter and P. E. Parry. 1949. Black Tern in Iceland. Ibis 91: 689.

Hinde, R. A. 1949. Exceptional inland passage of Black Terns in 1948. Brit. Birds 42: 113-117.

Ruttledge, R. F. 1949. Black Terns on Lough Ree. Brit. Birds 42: 27.

1948

Gillham, E. H. and R. C. Homes. 1948. Black Terns in north Kent. Brit. Birds 41: 248-249.

Salter, R. L. 1948. Unusual flight behavior of Black Terns. Murrelet 29: 49.

1947

Anon. 1947. Exceptional passage of Black Terns in 1946. Brit. Birds 40: 24-26, 93, 378.

Berthet, G. 1947. La Guifette noire _Chlidonias niger_ en Dombes. Alauda 15: 259.

de Morsier, J. 1947. A propos de la nidification en Dombes de la Guifette noire _Chlidonias niger_ (L.). Nos Oiseaux 19: 141-145. [In French.]

Geroudet, P. 1947. Black Terns in May, 1946, on the Lake of Geneva. Brit. Birds 40: 316-317.

Gross, A. O. 1947. Black Terns nesting at Massalonskee Marsh, Belgrade, Maine. Bull. Maine Audubon Soc. 3: 24-25.

Provost, M. W. 1947. Nesting of birds in the marshes of northwest Iowa. Am. Midl. Nat. 38: 485-503.

Ruttledge, R. F. 1947a. Black Terns in Co. Mayo. Brit. Birds 40: 93.

_____. 1947b. Black Terns in Co. Westmeath. Brit. Birds 40: 377.

_____. 1947c. Black Terns on Lough Carra, Co. Mayo. Irish Nat. J. 9: 21.

Thom, A. S. 1947. Exceptional passage of Black Terns in 1946. Brit. Birds 40: 24-25.

1946

Cooke, R. 1946. Black Terns breeding in Sussex. Brit. Birds 39: 71-72.

1945

Haverschmidt, F. 1945. De broedduur van de Zwarte Stern, Chlidonias niger (L.). Ardea 33: 237-240. [In Dutch with English summary.]

Staton, J. 1945. Black Tern victimizing Coot. Brit. Birds 38: 156.

Waterston, G. 1945. Black Tern in Aberdeenshire. Brit. Birds 38: 299.

Westerkov, K. 1945. Ynglende moseterner (Chlidonias niger niger (L.)) i Engelsholm So. Dan. Ornithol. Foren. Tidsskr. 39: 270.

1944

Groebbels, F. 1944. Ein Beitrag zur Brutbiologie und Brutokologie der Trauerseeschwalbe. Beitr. Fortpfl. Vogel 20: 117-123.

1942

Slipp, J. W. 1942. The Black Tern in Western Washington. Condor 44: 125-126.

1941

Einarson, A. S. 1941. The effect on a Black Tern of a change in its habitat. Murrelet 22: 19.

Nielsen, S. W. 1941. Nogle bemaerkninger om Sortternen's (Chlidonias niger) ynglen i Gundsomogle So. Dan. Ornithol. Foren. Tidsskr. 35: 225-226.

1940

Ruiter, H. 1940. Groote sterfte onder jonge zwarte sterns, Chlidonias n. niger, door slechte weersomstandigheden. Limosa 13: 150-151.

Sedgwick, J. H. 1940. An unusual concentration of Black Terns. Nat. Notes 7: 172-173.

1939

Sibson, R. B. 1939. The Black Tern in the Lower Thames. Brit. Birds 32: 304-305.

Trautman, M. B. 1939. Twilight flight of the Black Tern. Wilson Bull. 51: 44-45.

Zimmerman, F. R. and G. M. Meade. 1939. Perching habit of the Black Tern. Auk 56: 186-187.

1938

Sprunt, A., Jr. 1938. Unusual perching habit of the Black Tern. Auk 55: 529.

Stephenson, O. K., Jr. 1938. Black Terns sitting on telegraph wires. Proc. Linn. Soc. N.Y. 49: 66.

Thomas, J. F. 1938. Black Tern in Carmathenshire. Brit. Birds 31: 273.

1937

Denmead, T. 1937. Black Tern in Maryland. Auk 54: 206.

1936

Hoffman, P. W. 1936. Weekly visits with the Black Tern in Wisconsin. Bird-Banding 7: 85-86.

1933

Haverschmidt, F. 1933. Gegevens over de Verspreiding en de Getalsterkte van de Broed-kolonies van den Zwarten Stern (Chlidonias n. niger (L.)) in Nederland. Ardea 22: 92-105. [In Dutch.]

Kuhk, R. 1933. Die Trauer-Seeschwalbe, Chlidonias n. nigra (L.), in Mecklenburg 1931/32. Arch. Ver. Fr. Naturg. Mecklenburg. 7: 81-87.

van Rossem, A. J. 1933. Terns as destroyers of birds' eggs. Condor 35: 49-51.

1931

DuBois, A. D. 1931. Black Terns feeding young in Minneapolis. Oologist 48: 72-73.

Zimmerman, R. 1931. Die Trauerseeschwalbe, Chlidonias nigra nigra (L.) in der Oberlausitzer Niederung. Sitzungsber. Abh. Naturw. Ges. Isis Dresden 1930: 29-45. [In German.]

1930

Bisseling, G. A. L. 1930. Some nests and eggs of the Black Tern, Chelidonias [sic] niger niger (L.). Oologists' Rec. 10: 57-60.

Kuhk, R. 1930. Nachtrag zur Uebersicht die Kolonien der Trauer-Seeschwalbe Chlidonias n. nigra (L.) im Mecklenburg. Arch. Ver. Fr. Naturg. Mecklenburg. 5: 51-54.

Tischer, H. 1930. Faunistisches und Brutbiologisches uber Chlidonias nigra nigra (L.). Mitt. Ornithol. Verein. Magdeburg 3: 42-57; 4: 10-14. [In German.]

1929

Kuhk, R. 1929. Die Brutkolonien der Trauer-Seeschwalbe, Chlidonias nigra nigra (L.), im Mecklenburg. Arch. Ver. Fr. Naturg. Mecklenburg. 4: 103-120.

1927

Hoffman, P. W. 1927. Home life of the Black Tern in Wisconsin. Wilson Bull. 39: 78-80.

Pittman, H. H. 1927. The Black Terns of Saskatchewan. Condor 29: 140-143.

1926

Hoffmann, P. W. 1926. Nesting of the Black Tern in Wisconsin. Auk 43: 86-87.

1925

Rosen, V. and C. Ogburn, Jr. 1925. Black Tern at Brooklyn, N.Y., in spring. Auk 42: 441.

1924

Griscom, L. 1924. Black Tern near New York City in spring. Auk 41: 337.

Guerin, C. 1924. Transport des petits par la Guifette Epouvantoil (Hydrochelidon nigra). [Transport of young by the Black Tern (Hydrochelidon nigra).] Rev. Fr. Ornithol. 16: 464-465. [In French.]

1923

Couch, L. K. 1923. Notes on American Black Tern. Murrelet 4: 13.

May, F. H. 1923. Piping Plover and Black Tern nesting at North Pond, Lake Ontario. Auk 40: 690-691.

van Rossem, A. J. 1923. A study of some plumages of the Black Tern. Condor 25: 208-213.

1922

Griscom, L. and J. M. Johnson. 1922. Black Tern on Long Island in spring. Auk 39: 101.

1921

Taning, A. V. 1921. Sortternen (Hydrochelidon nigra L.) i Danmark. Dan. Ornithol. Foren. Tidsskr. 15: 49-66.

1920

Turner, E. L. 1920. The Black Tern. Brit. Birds 14: 122-126.

1914

Pearson, C. E. 1914. [On the eggs of Hydrochelidon nigra.] Bull. Br. Ornithol. Club. 35: 37.

1911

Rockwell, R. B. 1911. Notes on the nesting of the Forster's and Black Terns in Colorado. Condor 13: 57-63.

1908

Coward, T. C. 1908. Black Tern in Cheshire. Brit. Birds 2: 33-34.

Donaldson, R. P. 1908. Black Tern on the Tweed. Ann. Scott. Nat. Hist. Soc. 1908: 185.

Evans, W. 1908. Black Tern in Tweed and Forth. Ann. Scott. Nat. Hist. Soc. 1908: 254.

Miller, R. F. 1908. The Black Tern at Camden, N.J. and Philadelphia, Pa. Auk 25: 215-216.

1907

Miller, R. F. 1907. The Black Tern at Philadelphia, Pa. Auk 24: 211.

1904

Bowman, C. W. 1904. Nesting of the Black Tern. Oologist 21: 74-75.

Thompson-Seton, E. and M. Chapman. 1904. The Black Tern at home. Bird-Lore 6: 1-5.

1903

Oldham, C. 1903. Black Tern (Hydrochelidon nigra) in Cheshire. Zoologist 1903: 393.

Ralphe, P. G. 1903. Black Tern (Hydrochelidon nigra) in the Isle of Man. Zoologist 1903: 460-461.

Wood, W. C. 1903. Notes on the Black Tern. Bull. Mich. Ornithol. Club 4: 28.

1878

Collins, W. H. 1878. Notes on the nesting of the Black Tern, at St. Clair Flats, Mich., June 7, 1878. Oologist [Utica, N.Y.] 4: 26.

1877

Roberts, T. S. 1877. Notes on the breeding of the Black Tern (Hydrochelidon lariformis) in Minnesota. Bull. Nuttall Ornithol. Club 2: 34-36.

Adult Brown Noddy. Photograph by Roger B. Clapp.

BROWN NODDY

(Anous stolidus)

[DA: Noddi, EN: Noddy, FR: Noddi niais, GE: Noddiseeschwalbe, IC: Brunperna, IT: Sterna stolida, JA: Kuro ajisashi, SP: Charran bobo, Charran pardello, SW: Dumsnuttarna, US: Common Noddy, Noddy Tern.]

GENERAL DISTRIBUTION

North America The only breeding ground of Brown Noddies in the continental United States is at Bush Key in the Dry Tortugas. Brown Noddies breed at many sites in the Caribbean, including the Bahamas and the Greater and Lesser Antilles (Watson 1966). They also breed in the southern Gulf of Mexico on Isla Perez, Alacran Reef off Yucatan (Paynter 1955), and may breed elsewhere in that area. Brown Noddies also nest on islets off Belize and Honduras (Blake 1977), on the Atlantic side of Central America and on islands off western Mexico, on Cocos Island off Costa Rica (Blake 1977), and possibly on the Los Frailes off Panama (Wetmore 1965) on the Pacific side of North America.

World Distribution In South America, Brown Noddies breed on islets off the north coast of Venezuela (Las Aves to Margarita), off Trinidad and Tobago (Blake 1977), and on Rocas, Fernando Noronha, Trindade and Martin Vas off Brazil (Watson 1966). In the central and western Atlantic they nest on St. Paul's Rocks, and on islands in the Gulf of Guinea (Annobon, off Sao Tome, probably off Principe, Ascension and St. Helena Islands, in the Tristan da Cunha group, and on Gough Island) (White 1965, Watson 1966).

To the east of Africa Brown Noddies breed on islets in the Red Sea to the Gulf of Aden and off Kenya (White 1965). In the Indian Ocean, they breed at many localities, including islands in the Chagos Archipelago (Bourne 1971b, Hutson 1975), the Iles Glorieuses (Benson et al. 1975), Cargados Carajos (Pocklington et al. 1972), the Seychelles and Laccadives (AOU 1957), and Farquhar and Cosmoledo Atolls (Bayne et al. 1970, Stoddart and Poore 1970b).

Further east, Brown Noddies are resident offshore of Malaya and southeast Thailand (King and Dickinson 1975). They occur to northern Australia where they nest south to the Abrolhous Islands on the west coast and in the east to the Cairns region of Queensland and Cato Island in the Coral Sea. Brown Noddies are widely distributed in the eastern Pacific Ocean, breeding from Easter Island in the southeast to Hawaii in the northeast, thence west to Marcus and the Bonin and Volcano Islands. From there they breed south to Palau, New Caledonia, and the Austral Islands (King 1967).

DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

North Carolina Brown Noddies rarely occur in North Carolina waters, but there are at least 11 records from the state. Most of the records are associated with Hurricane David, which occurred in September 1979 and also led to the discovery of large numbers of several species of "accidentals" (Fussell and Allen-Grimes 1980)

1949	29 Aug.	1	seen at Fort Caswell, Brunswick County	Appleberry 1951
1974	16 June	1	seen at Cape Lookout	Teulings 1974d
1977	9 June	2	seen foraging along tideline, 8 mi NE Oregon Inlet	Lee and Booth 1979
1977	3 Sep.	1	seen off Hatteras	Lee and Booth 1979
1979	28 Aug.	1	seen offshore in Gulf Stream, 143 mi from off Cape Fear to off Cape Lookout	Fussell and Allen-Grimes 1980
1979	5 Sep.	2	photogr. at Sunset Beach	Fussell and Allen Grimes 1980
1979	5 Sep.	2	seen at Long Beach	Fussell and Allen-Grimes 1980
1979	5 Sep.	3	seen (1 coll.) at Wrightsville Beach	Fussell and Allen-Grimes 1980
1979	5-6 Sep.	10+	seen (3 coll.) at east Bogue Banks	Fussell and Allen-Grimes 1980
1979	8 Sep.	1	found dying (coll.) at Cape Lookout	Fussell and Allen-Grimes 1980
1979	9 Sep.	3	seen off Core Banks	Fussell and Allen-Grimes 1980

South Carolina We know of only eight records of the Brown Noddy in South Carolina. As in North Carolina, most of the records are of birds driven inshore by storms.

1926	29 June	1	coll. near Myrtle Beach, Horry Co.	Wayne and Sherman 1927
1926	19 Sep.	several	dead and a few live birds found at Bull's Island, Charleston County	Sprunt and Chamberlain 1949

1928	18 Sep.	1	found exhausted at Porcher's Bluff, Christ Church Parish	Sprunt and Chamberlain 1949
1929	16 Jun.	3	seen on driftwood, near Charleston Harbor	Sprunt 1935
1939	14 Aug.	1	found exhausted (coll.) at the Isle of Palms	Sprunt and Chamberlain 1949
1948	9 Aug.	3	seen near Pawley's Island	Sciple 1951
1949	28 Aug.	1	seen at Charleston	Denton and Chamberlain 1950a
1950	8 Sep.	1	found exhausted (coll.) at the Isle of Palms	Burton 1970

Georgia Brown Noddies are vagrants in Georgia with only two records for the state. One was reported seen 28 August 1949 at a small lake near Milledgeville, Baldwin County (Denton and Chamberlain 1950a) and another was found mummified 1 October 1950 at Tybee Island (Burleigh 1958).

Florida - Atlantic Coast Brown Noddies are rare along the Atlantic coast and are seen mostly after hurricanes (Kale 1978 ms a). The largest numbers seen in recent years were 50 off Cape Canaveral, 9 October 1974 (Edscorn 1975), and 84 at South Hutchinson Island, 4 September 1979 (Atherton and Atherton 1980). Most recent records at Atlantic coastal localities have occurred in September and October.

Florida - Keys Although vagrant or accidental in most of the southeastern United States, the Brown Noddy breeds at Bush Key in the Dry Tortugas. Robertson (1978c) indicated that recent breeding populations consisted of about 3,000 adults. The maximum estimate of 10,000 on Map 23 probably represents the maximum number known to be present when the estimate was made rather than the actual number of active nests. Peak populations at the Tortugas occurred in 1918 and 1919. What may be overly enthusiatic estimates for these years placed the population at 15,000 and 35,000 birds, respectively (Robertson 1964). Populations declined to about 250-300 adults in the late 1940's, and then gradually increased to a breeding population of about 4,300 birds in 1962 (Robertson 1964). The reason why the populations have varied is not known, but Robertson (1978c) believed that some of the fluctuations can be explained by rat predation and destruction of nesting habitat by hurricanes.

Brown Noddies usually lay eggs at Bush Key over at least a 10-week period from April through early July (Robertson 1964). They are present there until early October (Robertson 1964).

Florida - Gulf Coast Most Brown Noddies along the Florida Gulf coast are seen near the Tortugas between late February and September. Those reported farther north have usually been seen following tropical storms (Sprunt 1954, Kale 1979 ms b).

Alabama The Brown Noddy is accidental in Alabama. We know of only three records for the state, all associated with hurricanes. The first noddy was found dying on Dauphin Island after Hurricane Carmen on 8 September 1974 (Purrington 1975, Imhof 1976b) and the second was seen in July 1979 as a result of Hurricane Bob (Duncan and Havard 1980). The third noddy was seen 13 September 1979 at Mobile during Hurricane Frederic (Duncan and Havard 1980, Purrington 1980).

Mississippi We know of only three records of the Brown Noddy from Mississippi. The first was collected at Gulfport, Harrison County, 20 September 1957 (Gandy and Turcotte 1970) and another was found dead there 30 September 1961 (James 1962). The third record consisted of a dried carcass that was collected at Horn Island 5 July 1979 (Jackson and Cooley 1980).

Louisiana Brown Noddies are accidental in Louisiana and have been recorded only twice from the state. One was collected 30 August 1940 (1) following a tropical storm (Lowery 1974) and the carcass of another was found 16 September 1961 at Johnson's Bayou, 2 mi west of Holly Beach after Hurricane Carla (Imhof 1962a, Lowery 1974).

Texas Brown Noddies are only rarely found in Texas. We know of seven reports of its occurrence along or off the coast.

1890	27-29 Nov.	several	remains found at St. Joseph Island, Aransas County	Oberholser 1974
1960	19-22 June	2	seen at Port Aransas rock jetty, Neuces County	Webster 1960c, Oberholser 1974
1961	9 Sep.	1	seen S of Galveston	Webster 1962a
1961	10 Sep.	1	seen at La Porte, Harris County	Webster 1962a, Oberholser 1974
1964	26, 28 June	1	seen at Port Aransas, Neuces County	Oberholser 1974
1975	22 June	1	photogr. (2) at Padre Island Natl. Seashore, 2 mi S Yarborough Pass	Webster 1975d

(1) Duncan and Havard (1980) listed what is apparently the same record as occurring in 1942; the 1942 listing is apparently a typographical error (Duncan, pers. comm.).

(2) This bird, found resting on an oil drum, was identified as a Black Noddy on the basis on its size (Webster 1975d), but it's identity is still regarded by some as uncertain (e.g., Duncan and Havard 1980, who listed it among their records for Brown Noddies in the northern Gulf).

1979	Aug.	1	found dead and oiled after IXTOC I spill	Duncan and Havard 1980

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

Breeding Brown Noddies, like Sooty Terns, are birds of warm waters that are found worldwide in pantropical seas. Although seldom found in colonies as large as Sooty Terns, they occupy more diverse nesting areas and are found in many more colonies. The world population is unknown but must number at least in the low millions. Some of the larger populations recorded include 50,000, 30,000, and 20,000 birds, at Nihoa, Necker, and Laysan Islands, respectively, in the Northwestern Hawaiian Islands (Harrison and Hida 1979), 30,000 breeding birds at Manana Island, Oahu, Hawaiian Islands (Brown 1976c), and 50,000 at Pelsart Island in the Abrolhos Group, western Australia (Serventy et al. 1971).

Winter and Migration Some Brown Noddy populations leave their breeding areas when the reproductive cycle is completed, but at other breeding colonies some proportion of the population is present throughout the year. Many Brown Noddies evidently spend nonbreeding periods at sea in the vicinity of the nesting areas.

Birds banded at the Dry Tortugas have been recovered, for the most part, in the Gulf of Mexico and the western Caribbean, with a few recovered along the southern Atlantic coast of the U.S. The most distant recoveries have been from the southeastern Caribbean (W. Robertson, in litt.).

HABITAT

Nesting Brown Noddies are extremely variable in their choice of nest sites, perhaps more so than any other tern. Those in the central Pacific may nest on bare ground, under bushes, or in pukas in volcanic rock. The single egg may be laid on very little supporting nest material on the ground or on rock walls, or it may be laid in bulky nests in grass (*Digitaria*), bushes (*Scaevola*), or in shrubs and trees (*Cocos*, *Pandanus*, *Tournefortia*). On rare occasions a Brown Noddy may appropriate the nest site of the closely related Black Noddy (*Anous minutus*) (Clapp, pers. observ.).

In the Atlantic, nest sites include bare ground (French Cap, U.S. Virgin Islands), cliffs (Carval Rocks, U.S. Virgin Islands) (W. Robertson, in litt.), the tops of tall *Cocos* (Belizean cays [Russell 1964]), and low to moderately tall trees or bushes (Dry Tortugas [W. Robertson, in litt.]).

In some areas Brown Noddies readily nest on structures and artifacts abandoned by man. Stager (1964) reported that Brown Noddies nesting at Clipperton Island in the eastern Pacific readily placed their nests on "every available piece of rusting military equipment, such as landing craft, amphibious tractors, fork lifts, and quonset huts."

Although most of the Brown Noddies breeding at Bush Key in the Dry Tortugas build their nests in the outer edges of a large bay cedar (Suriana maritima) thicket in the center of the island, a wide variety of other sites are used (Robertson 1964). Of 270 sites recorded outside of the main nesting area in 1962 and 1963, most (53.3%) were found in dead bushes (mostly Suriana), sea rocket (Cakile lanceolata - 15.6%), bay cedar (12.2%), on bare ground (7.4%), in spurge (Euphorbia buxifolia- 4.4%), or in prickly pear cactus (Opuntia sp. - 4.4%). Elevated nests at Bush Key have been found from a few inches to 25 ft (7.6 m) above ground (Robertson 1978c), but most are found at heights of 3-10 ft (0.9-3.0 m) (Robertson 1964).

Feeding Several authors (e.g., Ridley and Percy 1958, Robertson 1978c, Kale 1979 ms b) indicated that Brown Noddies typically feed close to the breeding colonies. Watson (in Murphy 1936), who studied this species at the Dry Tortugas, found that most birds ventured no more than 24 km (15 mi) from the nesting area. Beck (in Murphy 1936), however, saw them feeding regularly as much as 50 km (30 mi) from their breeding areas. Ashmole and Ashmole (1968) believed that Noddy Terns at Christmas Island normally feed no more than 50 mi (80.5 km) from the nesting area. Although Brown Noddies may forage over lagoons and along reefs, they typically feed farther out to sea than the closely related Black Noddy (Anous minutus). Harrison and Stoneburner's (1979) radiotelemetric study of breeding Brown Noddies at Manana Island, Oahu, showed that these birds consistently depart and return to the colony from a southerly direction; this suggests that specific feeding grounds are being used.

Nonbreeding and Offshore Although Brown Noddies are widely distributed in pelagic waters, they tend to remain near oceanic islands even when not breeding. After extensive observations were made at sea near the main Hawaiian Islands from March 1964 through June 1965, King (1970) reported that only 1.7% of the 3,937 Brown Noddies were found more than 50 mi (80 km) from land. None was seen farther than 300 mi (480 km) from land.

Serventy et al. (1971) noted the occurrence of flocks of about 50 birds at sea hundreds of miles from any nesting area. Their report, coupled with observations of Brown Noddies far out at sea in the central Pacific, band recoveries of central Pacific noddies thousands of miles from their natal islands, and the absence of these birds from some nesting areas during nonbreeding periods (Murphy 1936, Serventy and Whittell 1976) all suggest that some populations migrate or disperse extensively.

FOOD AND FEEDING BEHAVIOR

Watson (1966) noted that foraging Brown Noddies usually remained 5-10 ft (1.5-3.0 m) above the surface while fishing. They often associate in feeding flocks with Sooty Terns but fly lower than the latter species. Unlike Sooty Terns, Brown Noddies frequently dive and splash into the water when seizing prey, and readily feed while swimming on the surface. They seize food at or near the surface, and also dabble beneath the surface (Gould in Ashmole and Ashmole 1967). Brown Noddies also hover over the water seizing prey at or just above the surface. Their webbed feet may be used to keep their body off the surface while fishing (Ashmole and Ashmole 1967).

Most noddies go out to sea to feed early in the morning but some remain at the roosting site for several hours after daybreak before departing (Serventy et al. 1971). Although most feeding occurs during the day, Watson (1966) suggested that this species may also feed at night. Ashmole and Ashmole (1967), on the other hand, believed that "...*A. stolidus* is primarily--if not exclusively a diurnal feeder." A radiotelemetric study (Harrison and Stoneburner 1979) of Brown Noddies nesting at Manana Island, Oahu, showed two peaks of departure from the colony, one at 0400-0600, the other at 1200-1600 hours. Return to the colony occurred from 1600 to midnight.

Little is known of the diet of Brown Noddies in the waters of the southeastern United States. Robertson (1978c), presumably referring to the noddies in the Dry Tortugas, remarked that they feed on a wide diversity of fish and squid, most of them less than 3 in long.

Two reports from Hawaii also indicate a diet consisting of a variety of fish and squid. Brown (1975b) obtained regurgitations from adults and chicks at Manana Island, Oahu, and found that the food was made up of 62% fish and 38% squid (by weight). Mean length of fish (6.9 $\pm$ 2.6 cm) and squid (5.9 $\pm$ 1.8 cm) was virtually the same as for the Sooty Terns that nested on the same island. The same four families (Exocoetidae, Holocentridae, Carangidae, Mullidae) that provided most of the fish eaten by the latter species constituted 98.5% of the identifiable fish diet of the Noddy. Most important were the carangids, which formed 64% of the diet. These noddies also ate fish from the families Gonostomatidae, Gempylidae, Nomeidae, and Tetraodontidae. Identified squid, with the exception of one onychoteuthid, were all of the family Ommastrephidae.

The fish important in the diet in the Northwestern Hawaiian Islands were from the same families providing most of the food at Oahu (Harrison and Hida 1980). Ranked in order, the five most important families were Mullidae, Synodontidae, Carangidae, Holocentridae, and Gempylidae. Flying fish (Exocoetidae), important in the diet at Oahu, ranked only seventh in importance in the Northwestern Hawaiian Islands.

Dorward and Ashmole (1963) reported the contents of 13 samples regurgitated by noddies at Ascension Island in the Atlantic. Most of the food was various species of fish: *Ophioblennius webbii*, *Holocentrus ascensionis*, *Selar crumenophthalmus*, *Oxyporamphus micropterus*, *Hemiramphus brasiliensis*, and *Benthodesmus simonyi*. The only other food found in the sample was a squid, thought to be *Hyaloteuthis pelagicus*, and a living nematode.

Ashmole (1968) and Ashmole and Ashmole (1967, 1968) reported on the food and feeding ecology of Brown Noddies at Christmas Island in the Pacific Ocean. Most of their sample consisted of regurgitations obtained from adults as they returned to roost at the island. Seventy-one percent of the food items were fish, and the rest squid, but the two foods were of equal importance by volume. Flying fish were the most important food and were found in 40% of the samples.

Fish of the families Scombridae, Gempylidae, Engraulidae, and Holocentridae ranked in order as next in importance. All identified squid were of the family Ommastrephidae and the genus Symplectoteuthis. Most of the fish (94%) were between 2 and 12 cm (0.8-4.7 in) in length, with fish 4-6 cm (1.6-2.4 in) most favored; 22 of 50 fish were in this size range. All but one of the squid had mantle lengths between 2 and 8 cm (0.8-3.1 in).

SUSCEPTIBILITY TO OIL POLLUTION

We know of few reports of oiled Brown Noddies, but one of the few records for Texas was an oiled bird. W. Robertson (in litt.) states that oiled noddies are seen only occasionally at the Dry Tortugas, but he thinks that this may have been because oil is difficult to detect against the birds' dark plumage. He thinks that the Tortugas noddies' habit of feeding within the lagoon away from the shipping lanes helps keep the population free from oiling.

Because Brown Noddies feed in flocks and frequently sit on the water, they are more susceptible to oiling than many other gulls and terns. Brown Noddies are uncommon in much of the southeast so the total population of the species is unlikely to be affected badly by oil spills and ancillary development onshore. Because the entire breeding population (ca. 4,000) in the continental United States is found in the Dry Tortugas, oil pollution in this area may greatly influence the survival of this population.

BIBLIOGRAPHY

1982

Pettit, T. N. and G. C. Whittow. 1982. Embryonic respiration and growth in two species of noddies. (Abstract only.) Pac. Seabird Group Bull. 9: 68-69.

1980

Ash, J. S. 1980. Common and Lesser Noddy *Anous stolidus* and *A. tenuirostris* in Somalia. Scopus 4: 6-9.

Jackson, J. A. and C. D. Cooley. 1980. A Noddy Tern from Horn Island, Mississippi. Mississippi Kite 10: 4-5.

1979

Harrison, C. S. and D. Stoneburner. 1979. Radiotelemetry of the Brown Noddy (*Anous stolidus*) of Manana Island (Oahu), Hawaii. (Abstract only.) Pac. Seabird Group Bull. 6: 45.

1978

Ash, J. 1978. Noddy Tern on Long Island. Kingbird 28: 31-32.

Condamin, M. 1978. Nidifications d'oiseaux de mer en Guyane. Oiseau Rev. Fr. Ornithol. 48: 115-121. [In French with English summary.]

Ricklefs, R. E. and S. C. White-Schuler. 1978. Growth rate of the Brown Noddy on the Dry Tortugas. Bird-Banding 49: 301-312.

Robertson, W. B., Jr. 1978c. Species of special concern. Noddy Tern. Pp. 95-96 in H. W. Kale, II (ed.). Rare and endangered biota of Florida. Vol. 2. Birds. Univ. Presses of Florida, Gainesville, Fl. xix and 121 pp.

Spaans, A. L. 1978. Status of terns along the Surninam coast. Bird-Banding 49: 66-76.

1977

Britton, P. L. 1977c. First African records of two Malagasy islands. Bull. Br. Ornithol. Club 97: 54-56.

Brown, W. Y. 1977. Temporal patterns in laying, hatching and incubation of Sooty Terns and Brown Noddies. Condor 79: 133-136.

1976

Brown, W. Y. 1976b. Egg specific gravity and incubation in the Sooty Tern and Brown Noddy. Auk 93: 371-374.

_____. 1976c. The breeding of Sooty Terns and Brown Noddies on Manana Island, Hawaii. Condor 78: 61-66.

_____. 1976d. Prolonged parental care in the Sooty Tern and Brown Noddy. Condor 78: 128-129.

_____. 1976e. Growth and fledging age of the Brown Noddy in Hawaii. Condor 78: 263-264.

_____. 1976f. Brown Noddy incubation shifts. Auk 93: 626.

White, S. C., W. B. Robertson, Jr. and R. E. Ricklefs. 1976. The effect of Hurricane Agnes on growth and survival of tern chicks in Florida. Bird-Banding 47: 54-71.

1975

Brown, W. Y. 1975a. Artifactual clutch size in Sooty Terns and Brown Noddies. Wilson Bull. 87: 115-116.

Brown, W. Y. 1975b. Parental feeding of young Sooty Terns (Sterna fuscata (L.)) and Brown Noddies (Anous stolidus (L.)) in Hawaii. J. Anim. Ecol. 44: 732-742.

Brown, W. Y. and W. B. Robertson, Jr. 1975. Longevity of the Brown Noddy. Bird-Banding 46: 250-251.

Schreiber, R. W. 1975. Abnormal Anous stolidus from Christmas Island, Pacific Ocean. Auk 92: 369-370.

1974

Brown, W. Y. 1974. Rabbit destruction of tern eggs. Auk 91: 840-841.

Kumerloeve, H. 1974. Intesiver Nahrungsparasitmismus der Noddiseeschwalbe (Anous stolidus) beim Braunpelikan (Pelecanus occidentalis). [Intensive feeding parasitism of the Brown Pelican (Pelecanus occidentalis) by the Brown Noddy (Anous stolidus).] Ornithol. Mitt. 26: 186. [In German.]

1973

Brown, W. Y. 1973. The breeding biology of Sooty Terns and Brown Noddies on Manana or Rabbit Island, Oahu, Hawaii. Ph.D. thesis, Univ. Hawaii/Honolulu, HI.

Howe, D. and W. Dodd. 1973. Common Noddy in Northern Territory. Emu 73: 140.

McKean, J. L. and D. Gray. 1973. Unusual seabird records from the Northern Territory. Emu 73: 184.

1972

Woodward, P. W. 1972. The natural history of Kure Atoll, Northwestern Hawaiian Islands. Atoll Res. Bull. 164. xii and 318 pp.

1970

Potthoff, T. and W. J. Richards. 1970. Juvenile bluefin tuna, Thannus thannus (Linnaeus), and other scombrids taken by terns in the Dry Tortugas, Florida. Bull. Mar. Sci. 20: 389-413.

Simmons, K. E. L. 1970. Aerial drinking and bathing by some tropical seabirds. Brit. Birds 63: 212.

1969

Clancey, P. A. 1969. The Noddy in Natal. Ostrich 40: 63.

1968

Ashmole, M. J. and N. P. Ashmole. 1968. The use of food samples from sea birds in the study of seasonal variation in the surface fauna of tropical oceanic areas. Pac. Sci. 22: 1-10.

Ashmole, N. P. 1968. Body size, prey size, and ecological segregation in five sympatric tropical terns (Aves: Laridae). Syst. Zool. 17: 292-304.

1966

Voous, K. H. 1966. The terns of the Dry Tortugas. Auk 83: 145-146.

1965

Haverschmidt, F. 1965a. Brown Noddy (*Anous stolidus*) near the coast of Surinam. Ardea 53: 236.

Mason, C. R. and W. B. Robertson, Jr. 1965. Noddy Tern in Massachusetts. Auk 82: 109.

1964

Mason, C. R. 1964b. Noddy Tern records of interest. Fla. Nat. 37: 90-91.

Robertson, W. B., Jr. 1964. The terns of the Dry Tortugas. Bull. Fla. State Mus. 8: 1-94.

Russell, S. M. 1964. A distributional study of the birds of British Honduras. AOU Ornithol. Monogr. 1. 195 pp.

1963

Dorward, D. F. and N. P. Ashmole. 1963. Notes on the biology of the Brown Noddy (*Anous stolidus*) on Ascension. Ibis 103b: 447-457.

1962

Wright, T. and L. S. Kornicker. 1962. Island transport of marine shells by birds on Perez Island Alacran Reef, Campeche Bank, Mexico. J. Geol. 70: 616-618.

1961

Clawson, S. G. 1961. Noddy found at Gulfport. Miss. Ornithol. Soc. Newsl. 6(5): 9

1958

Ridley, M. W. and R. Percy. 1958. The exploitation of sea birds in Seychelles. Colon. Res. Stud. 25: 1-78.

1954

Hindwood, K. A. 1954. The Noddy near Sydney. Emu 54: 145-146.

1953

Moore, J. C. and W. E. Dilley. 1953. Tern counts at Dry Tortugas 1950, 1951, and 1952. Fla. Nat. 26: 75-81.

1952

Hagen, Y. 1952. Anous stolidus stolidus (Linne). Pp. 152-160 in Norwegian Sci. Exped. to Tristan de Cunha 1937-1938. Results No. 20. 248 pp.

Hindwood, K. A. 1952. The Noddy (Anous stolidus) along coastal New South Wales. Emu 52: 155-158.

1951

Appleberry, E. L. 1951. Noddy Tern seen in Brunswick County, N.C. Chat 15: 33.

Gibson-Hill, C. A. 1951. Notes on the nesting habits of seven representative tropical sea birds. J. Bombay Nat. Hist. Soc. 48: 214-235.

Sciple, G. W. 1951. Noddy Terns observed at Pawley's Island, S.C. Chat 15: 33.

1950

Tomkins, I. R. 1950. Unusual bird records after the Labor Day storm. Oriole 15: 39-40.

Vinton, C. R. 1950. Longevity of the Noddy Tern. Fla. Nat. 23: 129.

1949

Sprunt, A., Jr. 1949a. Tern colonies of the Dry Tortugas Fort Jefferson National Monument--1948. Fla. Nat. 22: 9-16.

1948

Sprunt, A., Jr. 1948a. The tern colonies of the Dry Tortugas Keys. Auk 65: 1-19.

_____. 1948b. Population survey, tern colonies of the Dry Tortugas, Fort Jefferson National Monument, 1947 (concluded). Fla. Nat. 21: 25-31.

1946

Sprunt, A., Jr. 1946a. Survey of the tern colonies of the Dry Tortugas season of 1945. Fla. Nat. 19: 26-32.

_____. 1946b. Population survey of the tern colonies of the Dry Tortugas Fort Jefferson National Monument 1946. Fla. Nat. 20: 1-8.

1944

White, W. F. 1944. Noddy Tern observed at Cocoa Beach. Fla. Nat. 17: 38.

1943

Atwood, E. L. 1943. Recent interesting Louisiana records. Auk 60: 454-455.

Vinten, C. R. 1943. The Noddy and Sooty Tern colonies of the Dry Tortugas Fort Jefferson National Monument: a summary of the records. Fla. Nat. 16: 53-61.

1941

Dickinson, J. C., Jr. 1941. Noddy and Sooty Terns nesting on bare ground. Auk 58: 259.

Munro, G. C. 1941. Birds of Hawaii and adventures in bird study. The Noddy in Hawaii. Elepaio 1: 1-4.

1939

Hoogerwerf, A. 1939. Enkele bijzonderheden van de op het Vulkaan-eiland Goenoen Api (Banda Zee, N.O.I.) levende Oceaanvogels. Limosa 12: 141-165. [In Dutch.]

1938

Beard, D. B. 1938. The 1938 count of Noddy and Sooty Terns at the Dry Tortugas. Fla. Nat. 12: 7-10.

1935

Sprunt, A., Jr. 1935. The Noddy at Charleston, South Carolina. Auk 52: 309.

1927

Longstreet, R. J. 1927. Noddy Tern (_Anous stolidus_) at Daytona Beach, Florida. Auk 44: 92-93.

Wayne, A. T. and F. Sherman. 1927. Two birds new to the fauna of South Carolina. Auk 44: 94.

1915

Lashley, K. S. 1915. Notes on the nesting activities of the Noddy and Sooty Terns. Publ. Carnegie Inst. 7: 61-83.

Watson, J. B. and K. S. Lashley. 1915. On homing instinct of Sooty and Noddy Terns. Carnegie Inst. Bull 7: 9-104.

1910

Watson, J. B. 1910. Further data on the homing sense of Noddy and Sooty Terns. Science (N.Y.) 32: 470-473.

1908

Watson, J. B. 1908. The behavior of Noddy and Sooty Terns. Publ. Carnegie Inst. 2: 189-255.

1907

Watson, J. B. 1907. Report of John B. Watson on the condition of the Noddy and Sooty Tern colony on Bird Key, Tortugas, Florida. Bird-Lore 9: 307-316.

Large juvenile Brown Noddy. Photograph by Roger B. Clapp.

BLACK SKIMMER

(*Rynchops niger*)

[SP: Rayador]

GENERAL DISTRIBUTION

North America Black Skimmers breed locally along the U.S. east coast from Massachusetts to east-central Florida, along the Gulf of Mexico from central-western Florida to Yucatan (AOU 1957), on the Salton Sea in southern California (McCaskie et al. 1974, Grant and Hogg 1976), and along the west coast of Mexico from Sonora to Nayarit (AOU 1957). They winter from southern North Carolina south to Florida, along the shores of the Gulf of Mexico, and in western Mexico south on both coasts to Middle America (AOU 1957, Blake 1977). Some also winter casually from the Caribbean to the Lesser Antilles (Bond 1971).

Skimmers occasionally wander inland. In the United States, there are records from Massachusetts, New York (AOU 1957), North Carolina (Lynch 1972), Georgia, Tennessee (AOU 1957), Michigan (Mott 1982), Kansas (Cannon and Hall 1977), Oklahoma (Newell 1968, Ray 1971), and Texas (AOU 1957). They also wander north to Canada where they have been reported from Nova Scotia, New Brunswick (Godfrey 1966), Newfoundland (Godfrey 1966, Tuck 1968), Quebec (AOU 1957), and Ontario (Bain 1978, Mott 1982).

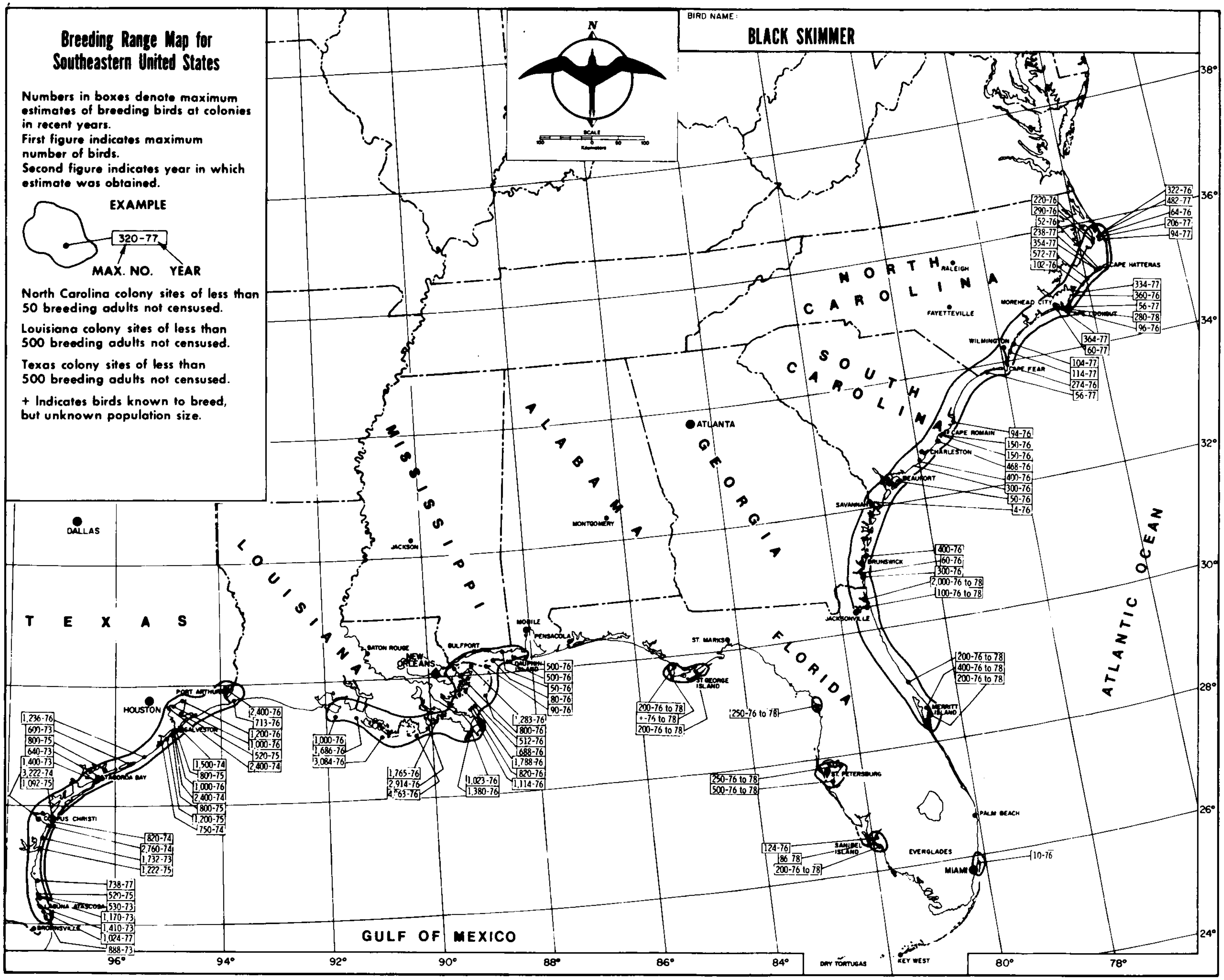
World Distribution Black Skimmers also breed locally south on the Pacific coast of the Americas to the Gulf of Guayaquil, Ecuador, on the Atlantic coast south to Argentina, and along large rivers to northern Argentina (Blake 1977). They have also strayed to Bermuda (AOU 1957) and Venezuela (Blake 1977).

DISTRIBUTION AND ABUNDANCE IN THE COASTAL SOUTHEASTERN UNITED STATES

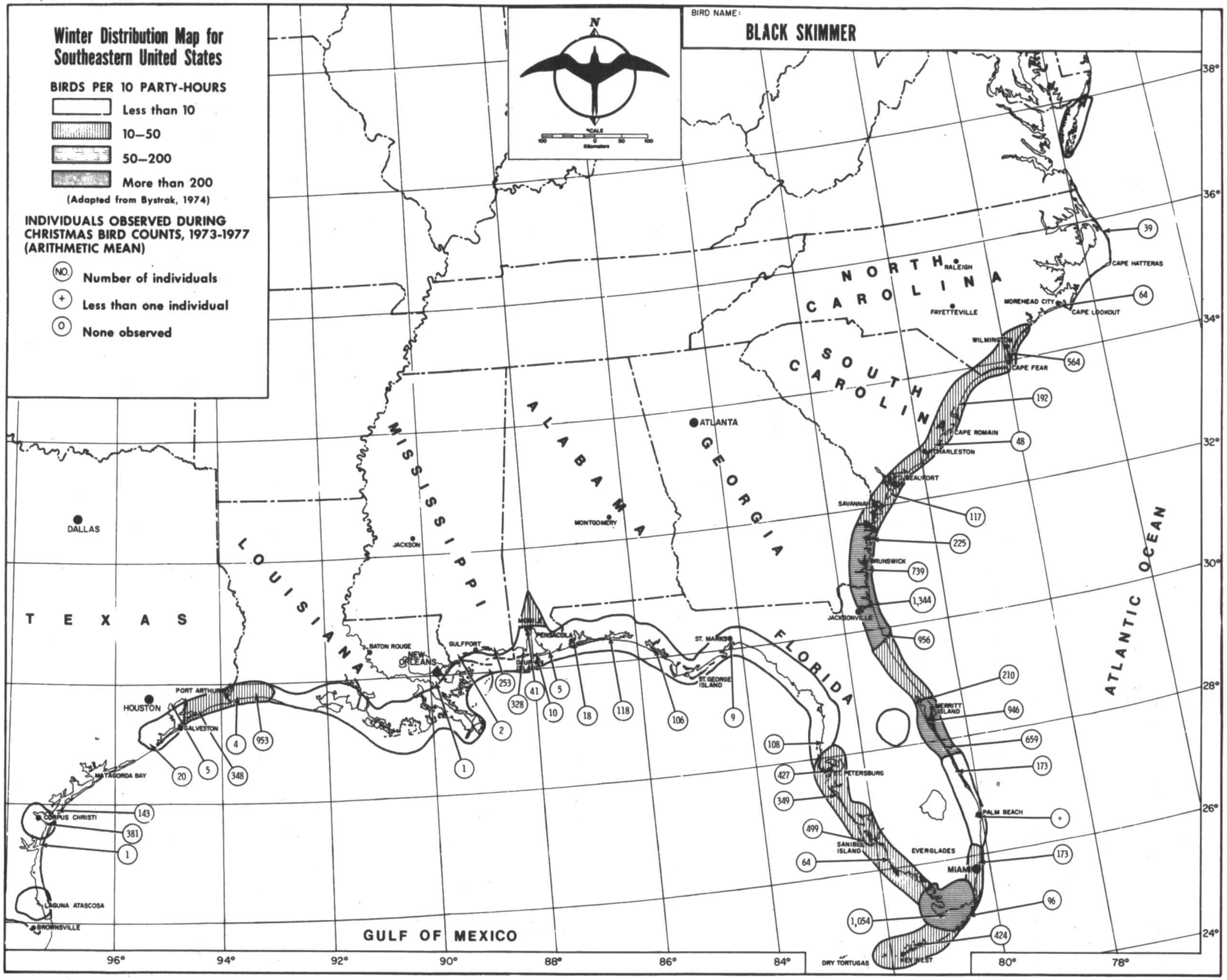
North Carolina Black Skimmers breed in moderate numbers in North Carolina, with breeding populations of 1,880, 1,525 and 1,925 pairs in 1973 (Soots and Parnell 1975a), 1976 and 1977 (Parnell and Soots 1979 ms, Portnoy et al. 1981, Table 82), respectively. Colonies are evenly distributed along the coast (Map 24).

Colony size in North Carolina in 1976 ranged from 1-196 pairs, the latter colony on the Ocracoke Flats, Hyde County. The mean size of 35 colonies was 44

Taxonomic note: The Black Skimmers breeding in North America belong to the nominate race *Rynchops n. niger*, for which much of the literature uses the specific name *nigra*. The breeding skimmers of South America belong to three other races: *intermedia* of the Pacific coast, *cinerascens* of northern and eastern South America south to the Amazon, and *intercedens* of eastern and southern South America (Peters 1934).


Breeding Range Map for Southeastern United States
Numbers in boxes denote maximum estimates of breeding birds at colonies in recent years.
First figure indicates maximum number of birds.
Second figure indicates year in which estimate was obtained.
EXAMPLE
320-77
MAX. NO.
YEAR
North Carolina colony sites of less than 50 breeding adults not censused.
Louisiana colony sites of less than 500 breeding adults not censused.
Texas colony sites of less than 500 breeding adults not censused.
+ Indicates birds known to breed, but unknown population size.
BIRD NAME:
BLACK SKIMMER
N
SCALE
TEXAS
LOUISIANA
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
SOUTH CAROLINA
NORTH CAROLINA
ATLANTIC OCEAN
GULF OF MEXICO
DALLAS
HOUSTON
PORT ARTHUR
GALVESTON
CORPUS CHRISTI
BROWNSVILLE
JACKSON
BATON ROUGE
NEW ORLEANS
GULFPORT
MOBILE
PENSACOLA
DAUPHIN ISLAND
MONTGOMERY
ATLANTA
ST. MARKS
ST. GEORGE ISLAND
ST. PETERSBURG
SANIBEL ISLAND
EVERGLADES
MIAMI
PALM BEACH
MERRITT ISLAND
JACKSONVILLE
BRUNSWICK
SAVANNAH
BEAUFORT
CHARLESTON
CAPE ROMAIN
CAPE FEAR
WILMINGTON
MOREHEAD CITY
FAYETTEVILLE
RALEIGH
CAPE HATTERAS
DRY TORTUGAS
KEY WEST
1,236-76
690-73
800-75
640-73
1,400-73
3,222-74
1,092-75
2,400-76
713-76
1,200-76
1,000-76
520-75
2,400-74
1,500-74
800-75
1,000-76
2,400-74
800-75
1,200-75
750-74
820-74
2,760-74
1,732-73
1,222-75
738-77
520-75
530-73
1,170-73
1,410-73
1,024-77
888-73
1,000-76
1,686-76
3,084-76
1,765-76
2,914-76
1,023-76
1,380-76
500-76
500-76
50-76
80-76
90-76
1,283-76
800-76
512-76
688-76
1,788-76
820-76
1,114-76
200-76 to 78
+-76 to 78
200-76 to 78
250-76 to 78
250-76 to 78
500-76 to 78
124-76
86 78
200-76 to 78
10-76
200-76 to 78
400-76 to 78
200-76 to 78
400-76
60-76
300-76
2,000-76 to 78
100-76 to 78
94-76
150-76
150-76
468-76
400-76
300-76
50-76
4-76
104-77
114-77
274-76
56-77
364-77
60-77
334-77
360-76
56-77
280-78
96-76
220-76
290-76
52-76
238-77
354-77
572-77
102-76
322-76
482-77
64-76
206-77
94-77
38°
36°
34°
32°
30°
28°
26°
24°
96°
94°
92°
90°
88°
86°
84°
80°
78°

Map 24


Winter Distribution Map for Southeastern United States
BIRDS PER 10 PARTY-HOURS
Less than 10
10–50
50–200
More than 200
(Adapted from Bystrak, 1974)
INDIVIDUALS OBSERVED DURING CHRISTMAS BIRD COUNTS, 1973-1977 (ARITHMETIC MEAN)
NO.
Number of individuals
+
Less than one individual
O
None observed
N
BIRD NAME:
BLACK SKIMMER
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI
LOUISIANA
TEXAS
FLORIDA
ATLANTIC OCEAN
GULF OF MEXICO
RALEIGH
FAYETTEVILLE
CAPE HATTERAS
MOREHEAD CITY
CAPE LOOKOUT
WILMINGTON
CAPE FEAR
CAPE ROMAIN
CHARLESTON
BEAUFORT
SAVANNAH
BRUNSWICK
JACKSONVILLE
ATLANTA
MONTGOMERY
JACKSON
DALLAS
HOUSTON
PORT ARTHUR
GALVESTON
MATAGORDA BAY
CORPUS CHRISTI
LAGUNA ATASCOSA
BROWNSVILLE
BATON ROUGE
NEW ORLEANS
GULFPORT
MOBILE
PENSACOLA
ST. MARKS
ST. GEORGE ISLAND
ST. PETERSBURG
SANIBEL ISLAND
EVERGLADES
MIAMI
PALM BEACH
MERRITT ISLAND
KEY WEST
DRY TORTUGAS
39
64
564
192
48
117
225
739
1,344
956
210
946
659
173
+
173
96
424
1,054
64
499
349
427
108
9
106
118
18
5
10
41
328
253
2
1
953
4
348
5
20
143
381
1
38°
36°
34°
32°
30°
28°
26°
24°
96°
94°
92°
90°
88°
86°
84°
80°
78°

Map 25

pairs, but 77% of the colonies contained 60 pairs or less (Portnoy et al. 1981). The following year the smallest colonies were two with three pairs at Tump Island, Carteret County and Bird Island, Dare County. The largest was again on the Ocracoke Flats and contained 286 pairs. The mean size of 26 colonies in 1977 was 74 pairs, but 65% of them contained 60 pairs or less (Parnell and Soots 1979 ms).

In North Carolina and in other areas Black Skimmers have a protracted breeding season with unpredictable peaks. Laying may begin in late May, but, because of renesting, incubation has been recorded in some colonies to as late as late July. Unfledged young may be present well into September (Parnell and Soots 1979 ms).

Black Skimmers winter commonly in the southeastern portion of the state (Parnell and Soots 1979 ms, Map 25) but are relatively uncommon in the northeastern portion. Even in the southeastern part of the state populations are small from about late December to early April because a majority of the breeding population winters in states to the south.

South Carolina Black Skimmers are common throughout the year along the South Carolina coast, but they are less abundant in winter (Sprunt and Chamberlain 1949). They probably once bred on every major sea island in the state, but now breed solely at a few estuarine islands, usually in association with Gull-billed Terns. Black Skimmers are seldom found nesting on spoil islands in South Carolina, although they do so in other areas of the southeast (Blus and Stafford 1980).

The largest breeding population recorded from 1971 to 1975 was 1,580 birds in 1975 (Blus and Stafford 1980). The following year 1,436 skimmers were found breeding in seven colonies (Portnoy et al. 1981). The largest colonies reported were ones containing 245 pairs at Raccoon Key, Cape Romain NWR, in 1973; 262 pairs at Bird Bank, Bulls Bay, and 238 pairs at Bird Key, south of Charleston, in 1975 (Blus and Stafford 1980); and one colony with 234 pairs at Bird Island (= Bird Bank) in 1976 (Portnoy et al. 1981). Locations of these and other colonies are shown on Map 24.

Probably because less breeding habitat is available in South Carolina, colonies there tend to be larger than in North Carolina. Twenty-seven colonies censused in 1971-1975 averaged 106.7 nests (Blus and Stafford 1980), and seven colonies censused in 1976 averaged 102.3 nests (Portnoy et al. 1981). Most (62%) of these 34 colonies contained 60 pairs or more.

As in North Carolina, the breeding season is extended and erratic. Most laying occurs from late June through early July. The earliest and latest dates at which eggs were found in 1971-1975 were 22 May and 5 September; hatching young were found from 5 June to 5 September. The earliest that young fledged was 3 July and some fledged as late as September (Blus and Stafford 1980).

Georgia Black Skimmers breed commonly along the Georgia coast. Few are present in winter (Denton et al. 1977), but large concentrations are occasionally seen (Table 83). Adequate information on the total breeding population is lacking. In 1976, about 760 birds bred at three localities (Portnoy et al. 1981).

Florida - Atlantic Coast Skimmers nest commonly along the coast in colonies containing from a dozen to several hundred pairs. They apparently occur inland fairly frequently (Sprunt 1954), although they do not do so regularly elsewhere in the southeast. Not less than 2,900 birds bred along the northeastern coast in 1976-1978 (Map 24), but the total number nesting along the Atlantic coast is not adequately known (1). Howell (1932) believed that the local populations are year-round residents. Some postbreeding dispersal occurs, but its frequency and extent are unknown. Large numbers are present during winter, when migrants add to the local populations.

The Black Skimmer is considered one of "special concern" in Florida (Barbour 1978) because much of its nesting habitat in the state has already been developed and because the few remaining sites are vulnerable to disturbance. In their study of colonial bird use of dredge-spoil islands, Schreiber and Schreiber (1978) remarked that skimmers nested least successfully of all species studied. They attributed this lack of success primarily to human disturbance.

Florida - Gulf Coast Black Skimmers are common on the Gulf coast of Florida (Kale 1979 ms b), but the populations nesting there are less well known than are those on the Atlantic coast. At least 1,600 birds bred there in 1976-78 (Map 24). The skimmers in this area nest from May through August or early September (Kale 1979 ms b).

Alabama Along the Alabama Gulf coast, Black Skimmers are locally common, sometimes abundant, residents (Imhof 1976b). Recent breeding has been reported only from the west end of Dauphin Island, where an estimated 500 birds nested in 1976 (Portnoy 1977, 1978; Map 24). Breeding has been recorded from mid-May to October, with unfledged young present even in late September. Because early nests are often lost to summer storms, the largest numbers of breeding birds (mostly renesters) are said to be present in August (Imhof 1976b).

Mississippi Black Skimmers occur throughout the year on the Mississippi coast and reach peak abundance in winter. Burleigh (1944) thought that as many as 10,000 skimmers winter along the coast. Limited data indicate that the breeding population is small. Portnoy (1977) estimated a breeding population of 720 in four colonies in 1976, one on Cat Island, another on Horn Island, one on a spoil island in Horn Island Pass, and one between the mouths of the Pascagoula River. The largest of these colonies was on the spoil island where

(1) A 1976 survey of Atlantic coastal colonies (Portnoy et al. 1981) listed for Florida only 2 birds breeding at Micco and included about 1,900 nesting at the Bird Islands, Nassau Sound, under their listing for Georgia. This report fails to give an adequate estimate for Florida Black Skimmer populations because the area covered primarily for nesting colonial charadriiforms was Florida Bay and the Keys.

Portnoy (1977) reported 500 breeding birds. The following year, this site had more than 400 breeding birds, but in 1979 only about 200 nested there (Jackson et al. 1980). Jackson et al. (1980) indicated that eggs may be present from late May through late August and that young may be present from mid-June through late August.

Louisiana Black Skimmers are abundant permanent residents along the coasts of Louisiana. As elsewhere in the southeast, Black Skimmers nesting here have an extended nesting season with eggs recorded from at least 26 May through 27 July (Oberholser 1938). Skimmers are widely distributed along the coast, with large colonies found in many different areas (Map 24), particularly in the Chandeleurs (Lowery 1974). Data provided by Portnoy (1977) indicate that approximately 28,760 breeding birds were present in Louisiana in 1976. Most of the birds nested on barrier beaches or spoil islands, but a sizeable proportion (ca. 15%) nested on small shell berms within salt marsh (Portnoy 1977). One colony on such a site contained nearly 1,300 breeding birds and was larger than all but one colony known from the Atlantic coast. The largest colony in Louisiana, with about 4,850 breeding birds on East Timbalier Island (Portnoy 1978, Map 24), is the largest known colony in the eastern United States.

Little is known of winter populations, but Oberholser (1938) considered skimmers less abundant along the coast in winter than in summer. Burleigh (1944) suggested that "this species appears to desert the Louisiana coast to a large extent when winter approaches, and to move eastward to the shallow waters of the Mississippi Sound". This movement occurs in early December. Dispersal of skimmers in Gulf waters has not been studied adequately and there is virtually no information based on marked birds.

Texas Skimmers are locally common to uncommon residents along the Texas coast (Oberholser 1974) where they breed most abundantly on shell beaches near the waterline (Blacklock et al. 1978). Blacklock (1978 ms) considered them uncommon in winter, when they occur locally in small flocks. Breeding occurs from mid-March to early September (Oberholser 1974), with peak numbers present from April through November.

The largest colonies in recent years were found in 1974. Two colonies in Neuces County contained 3,222 and 2,760 breeding birds, and two others (one at Atkinson Island, Chambers County, the other at Tika Island, Galveston County) both contained about 2,400 breeding birds (Blacklock et al. 1978). Between them, these four colonies contained nearly half the total found nesting in Texas that year. The largest colonies in 1975-1976 were considerably smaller. One at the Snake Islands, Galveston County, held 1,200 breeding birds in 1975, and one at Cedar Lakes, Brazoria County, held 1,236 breeding birds in 1976.

The mean number of breeding birds in the state, based on waterbird surveys from 1973 through 1978 (Blacklock et al. 1978, Blacklock et al. 1978 ms) was about 9,200 birds. The discrepancy between this figure and those implied by Map 24, which delineates maximum populations recorded in recent years, is that the Black Skimmer breeding population on the Texas coast has declined rapidly.

SYNOPSIS OF PRESENT DISTRIBUTION AND ABUNDANCE

Breeding Black Skimmers breed only in the New World and are almost entirely restricted to coastal areas in the northern part of their range. In South America many breed along river systems. They occur in the east from Massachusetts south along the coasts of the Atlantic to Argentina, and in the west from southern California to Ecuador.

Data on the size of breeding populations in the southeastern United States are from a few incomplete surveys. This should be kept in mind when examining the estimates of the number of breeding birds in the southeast (Table 82).

We have few data on the size of skimmer breeding populations in the western part of the range and none for regions south of the U.S. border. About 80 bred in California ca. 1980 (Sowls et al. 1980). For the northeastern U.S., Erwin (1979a) recently reported a breeding population of about 8,500 birds from Maine to Virginia. This gives a total breeding population for the eastern United States of approximately 67,900 birds, about 70% of which are found in Louisiana and Texas.

Winter Black Skimmers from eastern populations winter from North Carolina south to Florida, along the coast of the Gulf of Mexico (Map 25), and to a more limited extent in the Caribbean. Map 25 and Table 83 indicate some areas in which concentrations have been found.

Table 82. Recent estimates of Black Skimmer populations nesting in the southeastern United States.

State	Number found breeding in 1976 (a)	Percent of southeastern breeding population	Maximum number found breeding in recent years and year
North Carolina	3,050	5.1	3,850 (1977)
South Carolina	1,440	2.4	1,580 (1975)
Georgia	760	1.3	760 (1976)
Florida-Atlantic Coast	ca. 2,900	4.9	2,900 (1976-78)
Florida-Keys	none		none
Florida-Gulf Coast	ca. 1,600	2.7	1,600 (1976-78)
Alabama	500	0.8	500 (1976)
Mississippi	720	1.2	720 (1976)
Lousisiana	28,760	48.5	28,760 (1976)
Texas	19,620	33.1	23,080 (1974)
	59,350		

(a) Figures rounded to the nearest 10. Figures for Florida are incomplete and probably do not reflect the true number breeding in 1976.

Table 83. Peak concentrations of migrant and wintering Black Skimmers in the coastal southeastern United States.

Date seen		Number seen	Locality	Source
			NORTH CAROLINA	
1965	1 Oct.	3,000+	Oregon Inlet	Parnell 1966a
1971	3 Oct.	4,000	sandflats, Oregon Inlet	Teulings 1972e
1935	7 Oct.	10,000	near Beaufort	Pearson et al. 1942
1974	13 Oct.	3,000	one flock, Bird Shoal	Teulings 1975a
1955	16 Oct.	2,000	Shark Shoals, Beaufort	Chamberlain 1956a
1965	27 Oct.	ca. 1,550	Oregon Inlet	Parnell 1966a
1964	31 Oct.	1,200	Oregon Inlet	Parnell 1965a
1964	7 Nov.	ca. 10,000	between Beaufort and Ft. Macon	Parnell 1965a
1970	16 Nov.	600	mudflats, Oregon Inlet	Teulings 1971a
1973	26 Nov.	ca. 2,000	Bird Shoal near Morehead City	Teulings 1974d
1971	27 Nov.	2,000	Bird Shoal	Teulings 1972e
1970	28 Nov.	1,500	Cedar Island	Teulings 1971a
1975	13 Dec.	ca. 600	Morehead City	Teulings 1976d
			SOUTH CAROLINA	
1961	7 Oct.	500+	Murrell's Inlet	Chamberlain 1962a
			GEORGIA	
1961	30 Nov.	400-500	Savannah area	Chamberlain 1962a
1932	21 Jan.	1,000	Blackbeard Island	Burleigh 1958
1902	10 Mar.	ca. 2,500	Cumberland Island	Burleigh 1958
1958	27 Mar.	ca. 500	Blackbeard Island	Chamberlain 1958a
			FLORIDA	
1923	25 Dec.	ca. 2,000	Daytona Beach	Longstreet and Longstreet 1924
1956	30 Dec.	2,300	near Jacksonville	Stevenson 1957b
1917	Jan.	3-4,000	Talbot Island	Howell 1932
1917	Feb.	1,000	Anastasia Island	Howell 1932
1956	31 Mar.	ca. 1,000	Baytown	Webster 1956b
			ALABAMA	
1956	25 Aug.	1,020	Dauphin Id. and vicinity	Imhof 1976b
1969	20 Dec.	425	Mobile CBC	Imhof 1976b

Table 83. Concluded.

Date seen		Number seen	Locality	Source
1968	22 Dec.	250	Dauphin Island CBC	Imhof 1976b
1957	19 Jan.	250	Mississippi Sound	Imhof 1976b
			MISSISSIPPI	
1960	22 Sep.	500	Gulfport	Gandy and Turcotte 1970
1960	26 Oct.	200	Ship Island	Gandy and Turcotte 1970
1974	5 Nov.	1,000+	flats, Gulfport Harbor	Purrington 1975
1977	3 Dec.	1,200	Gulfport Harbor	Hamilton 1978
1941	22 Dec.	ca. 5,000	Mississippi coast	Burleigh 1944
1962	3 Feb.	300, 200	Gulfport; Pascagoula	Gandy and Turcotte 1970
1976	18 Mar.	200	Gulfport	Jackson 1976a
			LOUISIANA	
1937	6 Apr.	ca. 1,000	Grand Isle	Oberholser 1938
			TEXAS	
1954	27 Nov.	400	Rockport	Watson 1955
1952-53	winter	300	intra-coastal canal near Harlingen	Goldman and Watson 1953b
1956	31 Mar.	ca. 1,000	Baytown	Webster 1956b

Migration Although birds from the northeastern United States and northern North Carolina clearly migrate south, mostly to Florida, the degree to which other populations migrate or disperse is poorly known because little work has been done with marked birds. Gillespie (1931) reported five recoveries of young banded in New Jersey, four of them taken when the birds were probably wintering. One recovery was from North Carolina, two were from South Carolina, and two were from Florida. Kale (1967) reported nine recoveries of young banded at Little Egg Island, Georgia. The majority of these, all recovered during the nonbreeding season, were from southern Georgia and the northern two-thirds of the Florida Atlantic coast. One, however, was from the southern Florida Atlantic coast, and another was from the mid-Gulf coast. Although hardly conclusive, these two reports suggest that each wintering population may be composed of young and/or breeding birds largely from different areas.

HABITAT

Nesting In North America Black Skimmers nest almost exclusively in coastal areas, but they also have nested inland along the shores of the man-made Salton Sea (Grant and Hogg 1976). In South America, most breed on sandbars along rivers (Gochfeld 1978a). In the southeastern United States, they nest primarily on barrier beaches and spoil islands usually near shallow estuaries.

In North Carolina a majority of the skimmers breed on dredge-spoil islands. In 1973 and 1977, 90% and 64% of the breeding population was found in man-made or modified sites (Soots and Parnell 1975a, Parnell and Soots 1979 ms). In such areas skimmers nest on open sandy or sparsely vegetated sites and prefer the upper beach or slopes and domes (Parnell and Soots 1979 ms). The colonies are often at elevations not far above the high tide line and may be subject to considerable damage from storm tides.

In Florida Black Skimmers nest on sandy, sparsely vegetated, natural and dredge-spoil islands, as well as on construction fill and berms along highways (Schreiber and Schreiber 1978). They nest rarely on gravel rooftops (Fisk 1978a). Extensive dune areas near inlets seem to be preferred nesting habitat (Kale 1979 ms a).

Nesting habitats chosen along the less developed northern Gulf coast may indicate better the natural habitat preferences of Black Skimmers. Portnoy (1978) found that 64% of the skimmers nesting in 1976 along the coasts of Louisiana, Mississippi, and Alabama were on barrier beaches, 17% were on spoil islands, and 19% were on shell berms in salt marshes.

Although skimmers prefer to nest on sand or gravel, Gochfeld (1978a) presented evidence that they tolerate a wide range of habitats. He found them nesting on Long Island in "relatively dense" vegetation compared to the more typically sparsely vegetated areas. An exception to a sandy or gravelly substrate was found in one colony in southwestern Louisiana, where nest sites were depressions in hard clay on the tops of thinly vegetated levees (J. L. Chamberlain 1959).

Black Skimmers also nest on wrack (dead *Spartina* and eelgrass [*Zostera marina*]) in salt marshes. Such sites have been found in New Jersey (Frohling 1965, Burger in Gochfeld 1978a), Maryland (Therres et al. 1978), Virginia (M. Byrd in Gochfeld 1978a) and Long Island, New York (Gochfeld 1978a), and are apparently not uncommon in New Jersey and Virginia (Gochfeld 1978a, Buckley and Buckley 1980a). From 1976 through 1980 all but one of 19 nesting sites in Barnegat Bay, New Jersey, were on wrack in *Spartina* salt marsh (Burger 1982a). Nests on the Salton Sea in California were in an analogous habitat and consisted of deep depressions in a line of dead twigs and vegetation left on a mudbar by high water (McCaskie et al. 1974).

In some areas, colony size is strongly dependent on habitat. Erwin et al. 1981) reported that Black Skimmers nesting on the Delmarva Peninsula had much larger colonies when they nested on barrier beaches (a mean of 197 adults per colony in both 1976 and 1977) than when they nested on marsh islands (means of 24 and 19 in 1976 and 1977, respectively). They reported similar differences in 1978 and 1979 for colonies found on dredge spoil and marsh in New Jersey. Colonies on dredge spoil averaged 317 and 483 adults in 1978 and 1979, respectively, while those on marshes averaged 87 and 112 adults.

As a result of man's incursions into coastal habitats, a number of waterbird species have begun nesting on roofs in urban areas. Roofs are used by Black Skimmers, although rarely. Four nesting attempts were made on the roofs of warehouses and stores in 1975 and 1976 in Miami, Fort Lauderdale, and Fort Pierce on the east coast of Florida, but apparently only one succeeded in fledging young (Green and Kale 1976, Fisk 1978a). Another artificial site recorded for the skimmer was a tarpaulin on a ship's forecastle (Preston 1962).

Skimmers nest either in pure or mixed-species colonies. The degree to which they associate with other species in some areas suggests that their nesting associates are almost a necessary element of nesting habitat. Gochfeld (1978a) noted that skimmers were associated with Common Terns in all but one of 61 nestings on Long Island. He also found a strong positive correlation ($r = 0.91$) between the number of nesting skimmers and the number of nesting terns and concluded that "...within a given range of plausible habitats the presence of the terns is of overriding importance" [in choice of colony sites]. A similar association with Common Terns was noted for New York, New Jersey, and Virginia by Erwin (1977b, 1979b), and for North Carolina by Soots and Parnell (1975a). The reason for this association is not known, but the Common Tern's vigorous territorial defense may afford nesting skimmers increased protection against human intruders (Gochfeld 1978a) and predators.

Where Common Terns are rare or absent, other species may replace them as nesting associates. In South Carolina skimmers usually nest with Gull-billed Terns (Blus and Stafford 1980). Along the northern Gulf of Mexico their nesting associates may be Forster's Terns (J. Chamberlain 1959), Least Terns (Imhof 1976b), or Gull-billed Terns (Portnoy 1977).

Among marine birds, skimmers are one of the species that most readily change colony sites from year to year. From 1976 to 1980 Burger (1982a) studied the effect of reproductive success on site fidelity at 19 colonies in Barnegat Bay, New Jersey. She defined successful colonies as ones that produced at least 0.4 young per nest and found that successful colonies were invariably reoccupied the following year while unsuccessful colonies usually were abandoned. A significantly higher proportion of the abandoned, unsuccessful sites were lost to predators rather than to flood tides. Other authors have also noted the frequency with which skimmers abandon nesting areas. Only two of five discrete subcolony sites were occupied in successive years at Fisherman's Island, Virginia (Erwin 1977b), and six subcolonies occupied different areas than were used the year before at one colony on Long Island (Gochfeld 1978a). Black Skimmer colonies on marsh islands on the Delmarva Peninsula were the most likely to be abandoned (i.e. had the highest turnover rate [0.49]) of all colonies of any of five species of larids studied there and in New Jersey. Only Forster's and Common Tern colonies on marsh islands on the Delmarva Peninsula had nearly equivalent turnover rates (0.47 and 0.44, respectively) (Erwin et al. 1981).

Feeding Skimmers perform much of their "skimming" along shallow mudflats, tidal streams, and along the edges of marshes (Erwin 1977b). Tomkins (1951) reported that these birds often skim in water an inch or less in depth. Erwin (1977a) found that Black Skimmers in coastal Virginia fed almost almost exclusively (88%) in marsh channels and tidepools, and only occasionally along tidal creeks (7%), beaches and inlets (4%), or in the open bay (1%). Skimmers wintering near Cedar Key, Florida, fed both inshore and far from the mainland (Black and Harris 1981), the distance from the mainland varying in part with the type of foraging behavior used (see below). Skimmers that were "flurry feeding" fed within 250 m (820 ft) of loafing sites, all of which were over 3,500 m (2.2 mi) from the mainland. Skimmers that were "tidal feeding" fed 1-4,000 m (3 ft-2.5 mi) from the mainland and were much less frequently observed near loafing sites (Black and Harris 1981).

Nonbreeding and Offshore Wintering skimmers utilize much the same habitat as they do during the breeding season. They are largely restricted to sheltered waters such as bays, lagoons, estuaries, and inlets, and remain close to the beach along ocean shores. If large numbers winter in the Caribbean, they may be more seagoing than is presently suspected.

FOOD AND FEEDING BEHAVIOR

Black Skimmers obtain almost all of their food by skimming along the surface of the water with their lower mandible immersed. Upon contact with a food item, and sometimes wrack or shell (Erwin 1977b), the maxilla snaps down to seize the prey. Skimming is usually performed into the wind (Tomkins 1951, Erwin 1977b), and repetitive skimming across a particular tidal pool is common (Erwin 1977b). Two other reported techniques--plunging the bill into the water to seize fish (Stone 1921), and standing in shallow water seizing fish with a downward motion of the mandible (Arthur 1921)--may not be feeding behavior but instead misinterpretations of other activities (R.L. Zusi, pers. comm.).

Crepuscular or nocturnal feeding is very common, and some authors (Bent 1921, Howell 1932, Oberholser 1974) have suggested that most food is procured at night. Tomkins (1933) remarked that skimming is more common at dusk. Nocturnal skimming over inland bodies of freshwater has occasionally been seen in Florida (Nicholson 1948b). The water level, more than time of day, may determine peaks of feeding activity (Tomkins 1951; Erwin 1977a, 1977b). In some habitats, very pronounced peaks of feeding activity occur at low tide, and sometimes at high tide, with little feeding in intervening periods. Erwin (pers. comm.) stated that such peaks are obvious in skimmers wintering along the coast of Guyana.

Black Skimmers wintering at Cedar Key in northern Florida display two types of foraging (Black and Harris 1981). In both types of foraging skimmers usually foraged alone or with another bird. In one type, termed "tidal feeding" by Black and Harris, about four-fifths of the foraging birds began feeding during low tide but fed mostly during flow tide. These birds were seldom associated with other feeding birds and usually fed in a single area for less than 20 minutes. Feeding activity for "tidal feeding" skimmers peaked two hours after low tide. In the other type of foraging, "flurry feeding", small groups fed near one another and fed for longer periods (20-50 minutes) in one small area. During "flurry feeding" the total number of birds feeding near one another was usually about 10-12 birds. Most "flurry feeding" occurred during mid-tide within two hours of sunset. Skimmers in Virginia usually foraged alone, but pairs of foraging birds were also commonly seen (Erwin 1977b).

Foraging success is highly variable. Adults in Virginia captured prey once for every five minutes of foraging (Erwin 1977b). At Laguna Atascosa, Texas, Davis (1951) found that the maximum rate at which skimmers caught fish was one every 6.2 minutes. Zusi (1959), who also observed skimmers at Laguna Atascosa, reported that fish were caught as frequently as once every three seconds and as infrequently as once every four minutes.

Little information is available on foraging range. Tomkins (1951) indicated that birds from a Georgia colony foraged up to about three-and-one-fourth miles (ca. 5.2 km) away. Birds in Virginia also tend to feed close to their nesting areas (Erwin 1977a).

Black Skimmers usually feed almost entirely on small fish, but in some areas shrimp may also be significant in the diet. Specific food items vary widely, presumably in relation to availability. Information on foods eaten is summarized by area below:

Virginia Young fed almost exclusively on fish, over 90% of which were silversides (*Menidia* spp.) and killifish (*Fundulus* spp.). Other fish taken, in decreasing order of frequency, were bay anchovy (*Anchoa mitchilli*), mullet (*Mugil* spp.), spot (*Leiostomus xanthurus*), and bluefish (*Pomatomus saltatrix*) (Erwin 1977b). The fish were small compared to the size of the bird. Forty-one fresh fish weighed an average of 4.3 g (0.15 oz) (Erwin 1977a).

South Carolina/Georgia Border Young were fed shrimp (*Penaeus*), small mullet, and menhaden (*Brevoortia*) (Tomkins 1933).

Florida - Atlantic Coast Leavitt (1957) collected ten birds at Merritt Island during early February 1954 to determine food habits. Six stomachs contained fish and shrimp (*Palaemonetes* sp.), and the rest contained only fish. The fish could be identified only to genus and included several *Lutjanus* and *Fundulus* and a single needlefish (*Tylosurus*). Whole fish ranged in size from 2.1 to 5.5 cm (0.8-2.2 in).

Loftin (1982) reported the composition of 67 items regurgitated by Black Skimmer chicks at Bird Island, Nassau Sound. Most (73.1%) were striped mullet (*Mugil cephalus*). Other species eaten were 9 mummichogs (*Fundulus heteroclitus*), 5 Atlantic menhaden (*Brevoortia tyrannus*), 2 flounders (*Paralichthys* sp.), 1 ladyfish (Elops saurus), and 1 sharksucker (Echeneis naucrates). Twelve mullet averaged 8.9 cm (3.5 in) and weighed 8.4 g (0.30 oz), and 7 mummichogs averaged 7.7 cm (3.0 in) and weighed 7.3 g (0.26 oz)

Alabama Six of 10 Black Skimmer stomachs collected in Alabama were empty; the rest contained small fish (Howell 1928).

Louisiana Arthur (1921) stated that skimmers in Louisiana fed exclusively on a wide variety of small fish and reported that the five species taken most frequently were Cynoscion nothus, silversides (Atherina sp.), mullet, Spanish mackerel (Scomberomorus maculatus), and bluefish. The largest item fed to young was 7.3 cm (2.9 in) long.

California Discarded sailfin mollies (Poecilia latipinna) were found in some nest scrapes on the Salton Sea (Grant and Hogg 1976), suggesting that others may have been fed to young.

IMPORTANT BIOLOGICAL PARAMETERS

Egg Laying The nesting season may be erratic and prolonged, often subject to conditions that result in one or more renesting attempts. Nesting usually begins in late May and may continue until August or September (Gochfeld 1974a, Grant and Hogg 1976, Erwin 1977b, Portnoy 1977).

Mean Clutch Size Black Skimmers lay clutches of two to five eggs, but how clutch size varies with season, age of bird, initial or subsequent laying attempt, or geography is unknown. Four-egg clutches are most common in New York and Virginia; clutches in Virginia average 3.55 eggs (Erwin 1977b). Mean clutch size at 57 successful nests (i.e., nests that hatched at least one egg) at Cape Island Point, South Carolina, was 3.8 eggs (Blus and Stafford 1980). Six colonies in Texas at which 10 or more nests were monitored had mean clutch sizes of 2.29 to 3.16 eggs (Chaney et al. 1978). Thirteen nests at the Salton Sea, California, contained an average of 2.92 eggs (Grant and Hogg 1976). The "clutch size" reported in California is apparently based on a count of eggs seen in scrapes during a single visit; thus, this "clutch size" may not be accurate.

Incubation Period Hagar (1946) reported an incubation period of 22-23 days based on one nest observed at Plymouth Beach, Massachusetts. Erwin (1977b) reported that the mean incubation period at 110 nests in Virginia was 22.9 days.

Hatching Success In Virginia, Erwin (1977b) found that 78.6% of the eggs laid hatched, an average of 2.78 eggs per nest. Blus and Stafford (1980) reported that at least one egg hatched at 61% of 106 nests marked at Cape Island Point in 1971. At least 35% of 348 eggs in this colony hatched, but the fate of some eggs was unknown. Chaney et al. (1978) found that hatching success at three colonies in Texas ranged from 50.4% to 60.9% of the eggs laid, or 1.28 to 1.59 eggs per nest. These studies reported only successful colonies and do not include those obliterated by tides or storms. The success of a given pair of birds relative to the reproductive effort expended would have to consider abortive early nestings as well as final successful attempts. Consequently, available information on nesting success of Black Skimmers is a poor predictor of what proportion of eggs laid will either hatch or result in fledged young.

Age at Fledging Tomkins (1933) indicated that skimmers begin to fly at about 5 weeks of age, but Erwin (pers. comm.) believes the usual age at fledging is closer to 30 days.

Fledging Success Erwin's (1977b) studies in Virginia in 1973 and 1974 provided similar data on success in both years. The number of young fledged per pair was 0.40 and 0.37, or 0.12 and 0.11 young fledged per hatched egg. At the Cape Island colony in South Carolina an average of 1.2 young left per nest, and 1.8 left per nest of those nests that hatched eggs (Blus and Stafford 1980).

Mortality of Eggs and Young A common, perhaps major, cause of nesting failure in Black Skimmers is adverse weather. Sudden summer rain squalls were the primary source of nest destruction in colonies along the South Carolina/ Georgia border (Tomkins 1933). Inundation of nests, particularly by high tides driven by offshore winds, also frequently causes losses of both eggs or young. These conditions completely eliminated all but the oldest young at a colony at Cardwell Island, Virginia in 1933 (Pettingill 1937). A similar situation resulted in a total nesting failure at a colony on Little St. Simons Island, Georgia in 1972 (Fountain 1975). Flooding and high tides, as well as predation, were the most important causes of nest failure at colonies in South Carolina in the early and mid-1970's (Blus and Stafford 1980) and in colonies at Barnegat Bay, New Jersey, 1976-1980 (Burger 1982a).

The principal avian predators on eggs of the Black Skimmer are gulls. At Barnegat Bay, New Jersey, Herring Gulls are the most severe predators (Burger 1980a, 1982a), but in South Carolina Laughing Gulls are the worst predators (Blus and Stafford 1980). The extent of Laughing Gull predation on colonies in South Carolina, ranging from nil to extreme, is severely exacerbated by human disturbance. Human disturbance may result in extensive mortality of young birds. Adults readily leave their young when confronted by humans and young die quickly when exposed to the heat of the sun (Blus and Stafford 1980).

Mammalian predation is less commonly a source of mortality because many colonies are located on islands lacking such predators. Where mammalian predators do occur, they may inflict severe damage. Raccoons (Procyon lotor) destroyed all eggs within four days in two successive years at a colony on Little St. Simons Island, Georgia (Fountain 1975). Rats (Rattus sp.) destroyed all the eggs at one colony at Bird Bank, South Carolina in 1971 (Blus and Stafford 1980), and a mink (Mustela vison) destroyed one colony in New Jersey (Burger 1982a).

Eggs are occasionally harvested for human consumption. Preston (1962) reported the taking of eggs on the upper Amazon. Eggs were formerly used for food in the southeast; this has been documented in South Carolina (Wayne 1910, Sprunt and Chamberlain 1949).

Renesting Black Skimmers readily renest after breeding failures (Parnell and Soots 1979 ms), and in some areas usually do so (Gochfeld 1978a). Some birds may relay repeatedly. Gochfeld (1976) reported that one marked female on Long Island laid three unsuccessful clutches and initiated a fourth attempt.

Age at First Breeding Unknown.

Maximum Natural Longevity Clapp et al. (1982a) report a banded bird that reached an age of 20 years.

Weight Few data are available on the weights of Black Skimmers (Table 84).

Table 84. Weights (in grams) of Black Skimmers.

Mean weight	Range (a)	Number of birds	Sample and season	Area	Source
343.5	266-421	13	adult males	"several localities"	Erwin 1977b
351	308-374	6	adult males	Texas	Zusi 1962, pers. comm.
255.4	219-292	8	adult females	"several localities"	Erwin 1977b
254	232-295	6	adult females	Texas	Zusi 1962, pers. comm.
373	---	1	adult male in summer	Georgia or South Carolina	Norris and Johnston 1958
295.2	---	5	fledging males, 1974	Virginia	Erwin 1977b
264.4	---	7	fledging females, 1974	Virginia	Erwin 1977b

(a) Figures from Erwin (1977b) are mean $\pm$ 2 standard deviations.

SUSCEPTIBILITY TO OIL POLLUTION

Comments on the extent of oil contamination in wild populations of Black Skimmers were reported by Gochfeld (1979a) who examined skimmers at colonies on western Long Island, New York from 1970 to 1978. He based his estimates of the prevalence of oiling on a comparison of the number of oiled birds seen with the estimated number of nesting adults present. During this period Gochfeld found from as few as none oiled to as many as 2.00% of the adults oiled. The skimmers were being oiled significantly more frequently than the Common Terns in the same colonies. One-sixth of the skimmers found oiled had about one-third to two-thirds of the plumage covered with oil.

We found no published reports of skimmers dying as a result of oiling in the southeastern United States, but records in the Bird Banding Laboratory indicate that two died from oiling in Florida. Nonetheless, the Black Skimmer is probably at high risk from the effects of oil development in this area. Although they breed abundantly in the southeastern U.S., some populations in that area are declining or are believed to have declined in recent years (Blacklock et al. 1978 ms, Blus and Stafford 1980), partly because of the ease with which their nesting habitat is destroyed and the rate at which it has been being developed, and partly because this species is highly susceptible to human disturbance. The direct effects of oiling on this species are probably not great, but the ancillary effects of petroleum development involving environmental modification could severely affect what are probably the largest breeding concentrations of this species in the world. Blus and Stafford (1980), believed that the welfare of the Black Skimmer "cannot be taken for granted in any area."

BIBLIOGRAPHY

1982

Baptist, T. R. 1982. First state breeding record of Black Skimmers. Conn. Warbler 2: 47-48.

Burger, J. 1982a. The role of reproductive success in colony-site selection and abandonment in Black Skimmers (Rynchops niger). Auk 99: 109-115.

_____. 1982b. Jamaica Bay Studies: I. Environmental determinants of abundance and distribution of Common Terns (Sterna hirundo) and Black Skimmers (Rynchops niger) at an east coast estuary. Colonial Waterbirds 5: 148-160.

Jackson, J. A., B. E. Rowe, M. S. Hetrick and B. J. Schardien. 1982. Site-specific nest defense behavior of Black Skimmers and Least Terns. Condor 84: 120.

Loftin, R. W. 1982. Diet of Black Skimmers and Royal Terns in northeastern Florida. Fla. Field Nat. 10: 19-20.

Mott, S. 1982. First Michigan record of a Black Skimmer. Jack-Pine Warbler 60: 29-30.

Williams, S. O., III. 1982. Black Skimmers on the Mexican Plateau. Am. Birds 36: 255-257.

1981

Black, B. B. and L. D. Harris. 1981. Winter foraging patterns of Gulf coast Black Skimmers. Colonial Waterbirds 4: 187-193.

Burger, J. 1981f. Aggressive behaviour of Black Skimmers (Rynchops niger). Behaviour 26: 207-222.

_____. 1981g. Sexual differences in parental activities of breeding Black Skimmers. Am. Nat. 117: 975-984.

Erwin, R. M., J. Galli and J. Burger. 1981. Colony site dynamics and habitat use in Atlantic coast seabirds. Auk 98: 550-561.

Gochfeld, M. 1981a. Differences in behavioral responses of young Common Terns and Black Skimmers to intrusion and handling. Colonial Waterbirds 4: 47-53.

_____. 1981b. Responses of young Black Skimmers to high-intensity distress notes. Anim. Behav. 29: 1137-1145.

Robinson, S. R. 1981. Head-scratching and yawning in Black Skimmers. J. Field Ornithol. 52: 59-60.

Zusi, R. L. and D. Bridge. 1981. On the slit pupil of the Black Skimmer (Rynchops niger). J. Field Ornithol. 52: 338-340.

1980

Blus, L. J. and C. J. Stafford. 1980. Breeding biology and relation of pollutants to Black Skimmers and Gull-billed Terns in South Carolina. U.S. Fish Wildl. Serv. Spec. Sci. Rep. Wildl. 230. 18 pp.

Buckley, P. A. and F. G. Buckley. 1980b. Population and colony-site trends of Long Island waterbirds for five years in the mid 1970s. Trans. Linn. Soc. N.Y. 9: 23-56.

Erwin, R. M. 1980b. Breeding habitat use by colonially nesting waterbirds in two mid-Atlantic U.S. regions under different regimes of human disturbance. Biol. Conserv. 18: 39-51.

1979

Clayton, D. H., C. L. Hartley and M. Gochfeld. 1979. Two optical tracking devices for nocturnal field studies of birds. Proc. 1978 Conf. Colonial Waterbird Group 2: 79-83.

Erwin, R. M. 1979b. Species interactions in a mixed colony of Common Terns (Sterna hirundo) and Black Skimmers (Rynchops niger). Anim. Behav. 27: 1054-1062.

Gochfeld, M. 1979a. Prevalence of oiled plumage of terns and skimmers on western Long Island, New York: baseline data prior to petroleum exploration. Environ. Pollut. 20: 123-130.

_____. 1979c. Breeding synchrony in Black Skimmers: colony vs. subcolonies. Proc. 1978 Conf. Colonial Waterbird Group 2: 171-177.

<u>1978</u>

Bain, M. 1978. First sighting of a Black Skimmer in Ontario. Ont. Field Biol. 32: 33.

Barbour, D. B. 1978. Species of special concern. Black Skimmer. Pp. 96-97 <u>in</u> H. W. Kale, II (ed.). Rare and endangered biota of Florida. Vol. 2. Birds. Univ. Presses of Florida, Gainesville, FL. xix and 121 pp.

Buckley, P. A., M. Gochfeld and F. G. Buckley. 1978b. Efficacy and timing of helicopter censuses of Black Skimmers and Common Terns on Long Island, N.Y.: a preliminary analysis. Proc. 1977 Conf. Colonial Waterbird Group 1: 48-61.

Duffy, D. C. 1978. Terns and skimmers in Connecticut and eastern Long Island, N.Y., 1972-76. (Abstract only.) Ibis 120: 131.

Fisk, E. J. 1978a. Roof-nesting terns, skimmers, and plovers in Florida. Fla. Field Nat. 6: 1-8.

_____. 1978c. The growing use of roofs by nesting birds. Bird-Banding 49: 134-141.

Gochfeld, M. 1978a. Colony and nest site selection by Black Skimmers. Proc. 1977 Conf. Colonial Waterbird Group 1: 78-90.

Grant, G. S. 1978. Foot-wetting and belly-soaking by incubating Gull-billed Terns and Black Skimmers. J. Bombay Nat. Hist. Soc. 75: 148-152.

Portnoy, J. W. 1978. Black Skimmer abundance on the Louisiana-Mississippi-Alabama coast. Wilson Bull. 90: 438-441.

Therres, G. D., J. S. Weske and M. A. Byrd. 1978. Breeding status of Royal Tern, Gull-billed Tern, and Black Skimmer in Maryland. Md. Birdlife 34: 75-77.

<u>1977</u>

Cannon, T. A. and C. D. Hall. 1977. Black Skimmer at Wilson Reservoir. Bull. Kansas Ornithol. Soc. 28: 27-28.

Duffy, D. 1977b. Breeding populations of terns and skimmers on Long Island Sound and eastern Long Island: 1972-1975. Proc. Linn. Soc. N.Y. 73: 1-48.

Erwin, R. M. 1977a. Foraging and breeding adaptations to different food regimes in three seabirds: the Common Tern, Sterna hirundo, Royal Tern, Sterna maxima, and Black Skimmer, Rynchops niger. Ecology 58: 389-397.

_____. 1977b. Black Skimmer breeding ecology and behavior. Auk 94: 709-717.

Groves, F. H. 1977. Chick retrieval by the Black Skimmer. Fla. Field Nat. 5: 48-49.

Withers, P. C. and P. L. Timko. 1977. The significance of ground effect to the aerodynamic cost of flight and energetics of the Black Skimmer (Rynchops nigra). J. Exp. Biol. 70: 13-26.

1976

Armistead, H. T. 1976. Black Skimmers in Dorchester County. Md. Birdlife 32: 87.

Gochfeld, M. 1976. Waterbird colonies of Long Island, New York. 3. Cedar Beach ternery. Kingbird 26: 62-80.

Grant, G. S. and N. Hogg. 1976. Behavior of late-nesting Black Skimmers at Salton Sea, California. West. Birds 7: 73-80.

Green, L. L. and H. W. Kale, II. 1976. Roof nesting by Black Skimmers. Fla. Field Nat. 4: 15-17.

Sears, H. F., L. J. Moseley and H. C. Mueller. 1976. Behavioral evidence on skimmers' evolutionary relationships. Auk 93: 170-174.

1975

Fountain, M. 1975. Nesting failure of Black Skimmers on Little St. Simons Island, Ga. Oriole 40: 11-12.

1974

DePue, J. 1974a. Nesting and reproduction of the Black Skimmer (Rynchops niger niger Linnaeus) on four spoil islands in the Laguna Madre, Texas. M.S. thesis, Texas A & I Univ. 190 pp.

_____. 1974b. Nesting and reproduction of Black Skimmers Rynchops nigra on 4 spoil islands in the Laguna Madre, Texas. Tex. J. Sci. 25: 129-130.

Gochfeld, M. 1974a. Waterbird colonies of Long Island, New York. 2. Wantagh Parkway colony. Kingbird 24: 47-50.

_____. 1974b. Prevalence of subcutaneous emphysema in young terns, skimmers, and gulls. J. Wildl. Dis. 10: 115-120.

McCaskie, G., S. Liston and W. A. Rapley. 1974. First nesting of Black Skimmer in California. Condor 76: 337-338.

1973

Downing, R. L. 1973. A preliminary nesting survey of Least Terns and Black Skimmers in the east. Am. Birds 27: 946-949.

Lincer, J. L. and D. Salkind. 1973. A preliminary note on organochlorine residues in the eggs of fish-eating birds of the west coast of Florida. Fla. Field Nat. 1: 3-6.

1972

Kinsella, J. M. 1972. Helminth parasites of the Black Skimmer, *Rynchops nigra*, from Lake Okeechobee, Florida. J. Parasitol. 58: 1014-1015.

Lynch, J. M. 1972. Inland record of a Black Skimmer at Roanoke Rapids, N.C. Chat 36: 62.

1971

McCaskie, G. and S. Suffel. 1971. Black Skimmers at the Salton Sea, California. Calif. Birds 2: 69-71.

Ray, G. E. 1971. Second Black Skimmer record for Oklahoma. Bull. Okla. Ornithol. Soc. 4: 33-34.

1970

Hays, H. and G. Donaldson. 1970. Sand-kicking camouflages young Black Skimmers. Wilson Bull. 82: 100.

Mengel, R. M. 1970. Black Skimmer in Douglas County, Kansas. Bull. Kansas Ornithol. Soc. 21: 15.

1968

Leck, C. F. 1968. An additional observation of Laughing Gulls robbing a Black Skimmer. Cassinia 50: 27.

Newell, J. G. 1968. Black Skimmer in Oklahoma. Bull. Okla. Ornithol. Soc. 1: 25.

Tuck, L. M. 1968. Laughing Gulls (*Larus atricilla*) and Black Skimmers (*Rynchops nigra*) brought to Newfoundland by hurricane. Bird-Banding 39: 200-208.

1967

Kale, H. W., II. 1967. Recoveries of Black Skimmers banded on Little Egg Island, Georgia. Oriole 32: 13-16.

1965

Frohling, R. C. 1965. American Oystercatcher and Black Skimmer nesting on salt marsh. Wilson Bull. 77: 193-194.

1963

Siler, R. H. 1963. Black Skimmer inland in North Carolina. Chat 27: 56.

Streetman, A. and R. Perryman. 1963. Break-niks (Skimmers). Texas Game Fish 21: 12-15, 30.

1962

Preston, F. W. 1962. A nesting of Amazonian terns and skimmers. Wilson Bull. 74: 286-287.

Zusi, R. L. 1962. Structural adaptations of the head and neck in the Black Skimmer, _Rynchops nigra_ Linnaeus. Publ. Nuttall Ornithol. Club 3: 1-101.

1959

Chamberlain, J. L. 1959. A nesting colony of Forster's Terns and Black Skimmers in southwestern Louisiana. Wilson Bull. 71: 283-284.

Tordoff, H. B. and W. E. Southern. 1959. Caspian Tern and Black Skimmer in Newfoundland. Wilson Bull. 71: 385-386.

Wolk, R. G. 1959b. Some reproductive behavior patterns of the Black Skimmer, _Rynchops nigra nigra_ Linneaus. Ph.D. thesis, Cornell Univ./Ithaca, NY. 78 pp.

Zusi, R. L. 1959. Fishing rates in the Black Skimmer. Condor 61: 298.

1958

Zusi, R. L. 1958. Laughing Gull takes fish from Black Skimmer. Condor 60: 67-68.

1957

Leavitt, B. B. 1957. Food of the Black Skimmer (_Rynchops nigra_). Auk 74: 394.

1952

Johnson, J. E. 1952. Black Skimmer in Washington, D.C. Atl. Nat. 8: 90.

1951

Davis, L. I. 1951. Fishing efficiency of the Black Skimmer. Condor 53: 259.

Tomkins, I. R. 1951a. Method of feeding of the Black Skimmer, Rynchops nigra. Auk 68: 236-239.

1948

Friedman, R. 1948. Black Skimmer and White Pelican in the Bahamas. Auk 65: 142.

Nicholson, D. J. 1948b. Nocturnal fresh-water wandering of the Black Skimmer. Auk 65: 299-300.

1946

Hagar, J. A. 1946. Black Skimmer breeding in Massachusetts. Auk 63: 594-595.

1944

Wetmore, A. 1944. The subspecific characters and distribution of the New World skimmers (Rynchops nigra). Caldasia 3: 111-118.

1941

Dargan, L., P. Knappen and R. C. McClanahan. 1941. A Maryland winter record for the Black Skimmer. Auk 58: 458.

Tomkins, I. R. 1941. Foot-washing by the Black Skimmer. Auk 58: 96.

1938

Kuerzi, R. G. 1938. Banded terns, Black Skimmers and gulls observed at Fort Pierce, Florida, during January, 1938. Bird-Banding 9: 198-199.

1937

Griscom, L. 1937. Black Skimmers in New England. Auk 54: 206-207.

Hickey, J. J. and L. Wilcox. 1937. On the nesting of the Black Skimmer in New York State. Proc. Linn. Soc. N.Y. 48: 98-99.

Pettingill, O. S. 1937. Behavior of Black Skimmers at Cardwell Island, Virginia. Auk 54: 237-244.

1935

Griscom, L. 1935. Notes on New World skimmers. Ibis (13th Ser.) 5: 544-546.

1934

Vogt, W. 1934. Black Skimmer (_Rynchops nigra_) breeding in New York. Auk 51: 521.

1933

Tomkins, I. R. 1933. Ways of the Black Skimmer. Wilson Bull. 45: 147-151.

1932

Potter, J. K. 1932. Fishing ability of the Black Skimmer (_Rynchops nigra nigra_). Auk 49: 477.

Tomkins, I. R. 1932a. The Black Skimmer a permanent resident in Georgia. Auk 49: 85-86.

1931

Gillespie, J. A. 1931. _Rynchops nigra_, the Black Skimmer: some returns and recoveries. Bird-Banding 2: 52-58.

Schildmacher, H. 1931. Ueber das "Wasserpfugen" der Scherenschnabel (_Rynchops_). Ornithol. Monatsber. 39: 37-41.

Sprunt, A., Jr. 1931. Abnormal sets of heron eggs in coastal South Carolina. Auk 48: 594.

1930

Greene, E. R. 1930. Unusual winter records from southern Georgia. Auk 47: 266-267.

1926

Dingle, E. von S. 1926. Winter records for the Black Skimmer (_Rynchops nigra_). Auk 43: 363.

Sprunt, A., Jr. 1926a. An unusual set of eggs of the Black Skimmer (_Rynchops nigra_). Auk 43: 532.

Urner, C. A. 1926. Black Skimmer (_Rynchops nigra_) nesting in Ocean County, New Jersey. Auk 43: 532.

1925

Fix, G. E. 1925. The Black Skimmer (Rynchops nigra) at Ipswich, Massachusetts. Auk 42: 125.

Kuerzi, J., R. Kuerzi and P. Kesski. 1925. Black Skimmer and Golden Plover in Bronx County. Auk 42: 125-126.

Norton, A. H. 1925. Notes on the Black Skimmer in Maine. Auk 42: 261-262.

Parker, A. C. 1925. Black Skimmer on Lake Ontario. Auk 42: 441.

1921

Arthur, S. C. 1921. The feeding habits of the Black Skimmer. Auk 38: 566-574.

Shufeldt, R. W. 1921. Life history of the Black Skimmer or Scissor-Bill. Nat. Study Rev., April 1921.

Stone, W. 1921. Fish-catching by the Black Skimmer. Auk 38: 595-596.

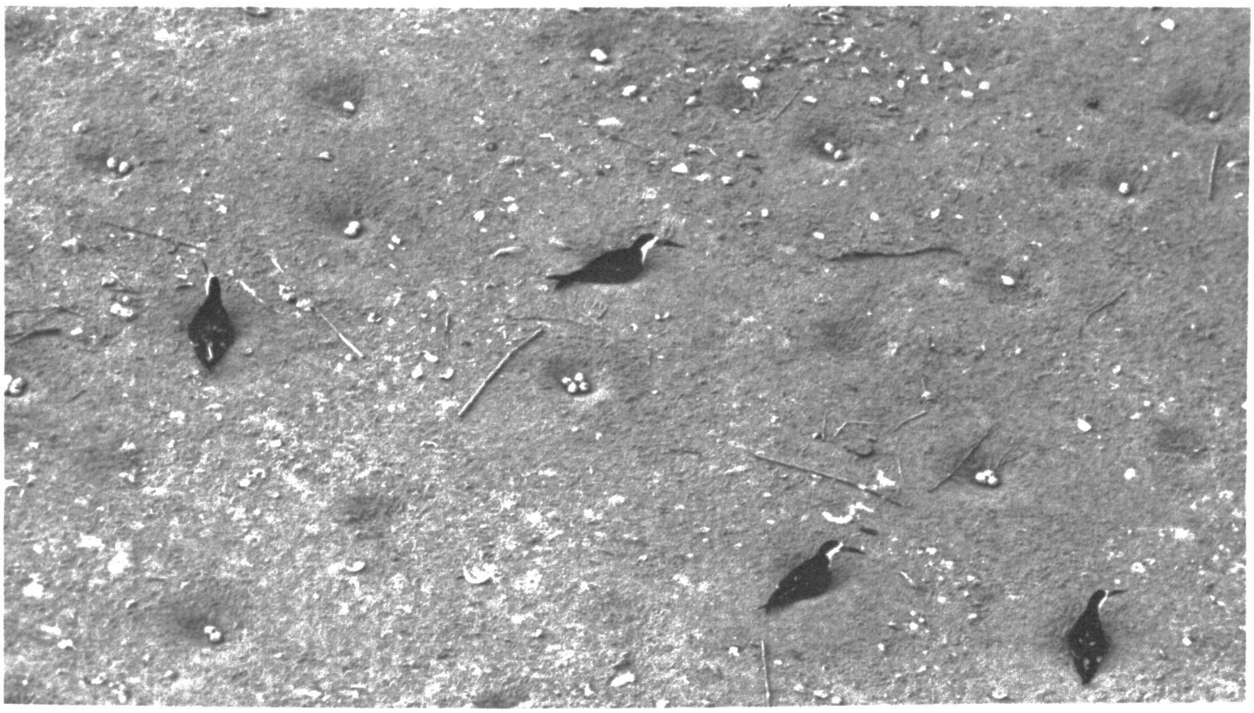
1919

Bales, B. B. 1919. Twenty-four hours in a Black Skimmer colony. Wilson Bull. 31: 83-87.

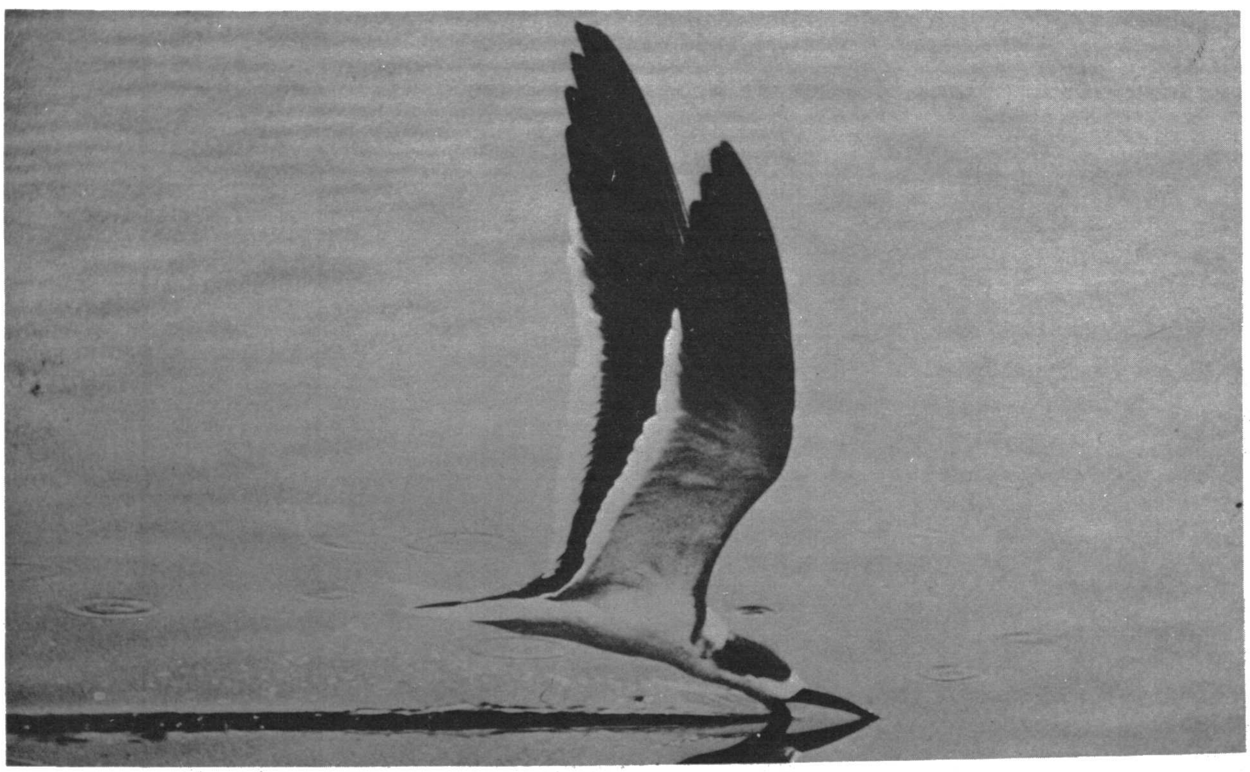
1903

Jones, L. 1903b. Black Skimmer at Woods Hole, Mass. Wilson Bull. 15: 113.

Juvenile Black Skimmer. Photograph by Roger B. Clapp.



Black Skimmer colony in Louisiana. Photograph by J. A. Spendelow.



Black Skimmer skimming. Photograph by Clayton Taylor.

LITERATURE CITED

Anon. 1978. Recovery round-up. Corella 2: 76-77.

Anon. 1981. Mystery spill kills birds. Mar. Pollut. Bull. 12: 142.

Anon. 1982a. BTO oiling news. Brit. Trust Ornithol. News 116: 2.

Anon. 1982b. Oil spillage kills seabirds. Mar. Pollut. Bull. 13: 40.

Anon. 1982c. Oil pollution by Belgium. Mar. Pollut. Bull. 13: 182.

Anon. 1982d. Marshland pollution clean-up impasse. Mar. Pollut. Bull. 13: 218.

Abe, N. and T. Mano. 1980. The first breeding record of the Bridled Tern *Sterna anaethetus* in Japan. J. Yamashina Inst. Ornithol. 12: 183-191.

Abramson, I. J. 1961. Observations of terns in the Miami area. Fla. Nat. 34: 23-24.

Addy, C. E. 1945. Great Black-backed Gull kills adult Black Duck. Auk 62: 142-143.

Ainley, D. G. 1976. Beached bird survey. Report No. 5. Point Reyes Bird Obs. Newsl. 37: 1-3.

Ainley, D. G. and G. S. Sanger. 1979. Trophic relationships in the Northeastern Pacific Ocean and Bering Sea. Pp. 95-122 *in* J. C. Bartonek and D. N. Nettleship (eds.). Conservation of marine birds of northern North America. U.S. Fish Wildl. Serv. Wildl. Res. Rep. 11. ix and 319 pp.

Ainley, D. G., C. R. Grau, T. E. Roudybush, S. H. Morrell and J. M. Utts. 1981. Petroleum ingestion reduces reproduction in Cassin's Auklets. Mar. Pollut. Bull. 12: 314-317.

Albrektsson, T. and P. Lindberg. 1967. Field-characters of the immature Laughing Gull. Brit. Birds 60: 159-160.

Alcorn, J. R. 1943. Flight-feeding of the Ring-billed Gull. Condor 45: 199-200.

Alexander, M. M. 1955. The nesting of the Common Tern at Montezuma [NY]. Bird-Banding 26: 161-162.

Amerson, A. B., Jr. and P. C. Shelton. 1976. The natural history of Johnston Atoll, Central Pacific Ocean. Atoll Res. Bull. 192. 479 pp.

Ames, J. E. 1963. Herring Gull nesting on the North Carolina coast. Chat 27: 29.

Andersen, J. 1945. Sandternens (*Gelochelidon nilotica* (Gm.)) fode. [Food of the Gull-billed Tern (*Gelochelidon nilotica* (Gm.)).] Dan. Ornithol. Foren. Tidsskr. 39: 198-205. [In Danish with English summary.]

Anderson, B. H. 1972. Some uncommon avian records for central Florida. Fla. Nat. 45: 192.

Anderson, D. A. 1978. A Franklins Gull from the Marshall Islands. Micronesica 14: 361-362.

Anderson, W. 1965. Waterfowl production in the vicinity of gull colonies. Calif. Fish Game 51: 5-15.

Andersson, A. 1970. Food habits and predation of an inland-breeding population of the Herring Gull *Larus argentatus* in southern Sweden. Ornis Scand. 1: 75-81.

Andersson, A. and K. E. Fridzen. 1970. Havstrut fangar vigg pa Stockholms strom. Var Fagelvarld 29: 267-269. [In Swedish with English summary.]

Andrle, R. F. 1976. Herring Gulls breeding on cliff at Niagara Falls, New York. Can. Field-Nat. 90: 480-481.

Angles, R. 1957. A feeding method of Black Terns. Brit. Birds 50: 538.

Ansingh, F. H. and H. J. Koelers. 1957. Common Tern (*Sterna h. hirundo*) breeding in the Netherlands Antilles. Auk 74: 266.

AOU (American Ornithologists' Union). 1957. Check-list of North American birds. Fifth ed. AOU, Baltimore, MD. 691 pp.

_____. 1982. Thirty-fourth supplement to the American Ornithologists' Union check-list of North American birds. Auk 99 supplement. 16 pp.

Appleberry, E. L. 1951. Noddy Tern seen in Brunswick County, N.C. Chat 15: 33.

Armistead, H. T. 1975. Breeding of Greater Black-backed Gull, Herring Gull, and Gadwall at Smith Island, Maryland. Md. Birdlife 31: 131-134.

Arthur, S. C. 1921. The feeding habits of the Black Skimmer. Auk 38: 566-574.

Ash, J. S. and A. A. Karani. 1981. Roseate and Sooty Terns *Sterna dougallii* and *fuscata* breeding on islets in southern Somalia. Scopus 5: 22-27.

Ashmole, M. J. and N. P. Ashmole. 1968. The use of food samples from sea birds in the study of seasonal variation in the surface fauna of tropical oceanic areas. Pac. Sci. 22: 1-10.

Ashmole, N. P. 1963a. The biology of the Wideawake or Sooty Tern _Sterna fuscata_ on Ascension Island. Ibis 103b: 297-364.

_____. 1965. Adaptive variation in the breeding regime of a tropical sea bird. Proc. Natl. Acad. Sci. U.S.A. 53: 311-318.

_____. 1968. Body size, prey size, and ecological segregation in five sympatric tropical terns (Aves: Laridae). Syst. Zool. 17: 292-304.

Ashmole, N. P. and M. J. Ashmole. 1967. Comparative feeding ecology of sea birds of a tropical oceanic island. Peabody Mus. Nat. Hist. Yale Univ. Bull. 24. v and 131 pp.

Ashmole, N. P. and H. Tovar. 1968. Prolonged parental care in Royal Terns and other birds. Auk 85: 90-100.

Atherton, L. S. and B. H. Atherton. 1980. The changing seasons; the autumn migration: Aug. 1-Nov. 30, 1979; Florida Region. Am. Birds 34: 152-155.

Atwood, J. L., P. D. Jorgensen, R. M. Jurek, and T. D. Manolis. 1977. California Least Tern census and nesting survey, 1977. Calif. Dep. Fish Game Nongame Wildl. Invest. Final Rep. Job V-2.11. 35 pp.

Aughey, S. 1878. Notes on the nature of the food of the birds of Nebraska. Appendix II. Pp. 13-62 _in_ U.S. Entomol. Comm. Annu. Rep. 1877. GPO, Washington, D.C.

Austin, O. L. [Sr.]. 1932a. The status of Cape Cod terns in 1932. Bird-Banding 3: 143-156.

_____. 1946a. The status of the Cape Cod terns in 1944: a behavior study. Bird-Banding 17: 10-27.

_____. 1953a. The migration of the Common Tern (_Sterna hirundo_) in the Western Hemisphere. Bird-Banding 24: 39-55.

Austin, O. L. and O. L. Austin, Jr. 1956. Some demographic aspects of the Cape Cod population of Common Terns (_Sterna hirundo_). Bird-Banding 27: 55-66.

Austin, O. L., Jr. 1932b. Further contributions to the knowledge of the Cape Cod Sterninae. Bird-Banding 3: 123-139.

_____. 1958. Verification of Australian Common Tern recovery. Bird-Banding 29: 41-42.

Austin, O. L., Jr. and N. Kuroda. 1953. The birds of Japan--their status and distribution. Bull. Mus. Comp. Zool. Harv. Univ. 109: 279-637.

Baerends, G. P. and R. H. Drent (eds.). 1970. The Herring Gull and its egg. Behavior Suppl. 17: ix and 312 pp.

Baggerman, B., G. P. Baerends, H. S. Heikens and J. H. Mook. 1956. Observations on the behaviour of the Black Tern, Chlidonias n. niger (L.), in the breeding area. Ardea 44: 1-71.

Bailey, H. H. 1913. The birds of Virginia. J. P. Bell. Publ. Co., Lynchburg, VA. xxiii and 362 pp.

Bailey, P. F. 1977. The breeding biology of the Black Tern (Chlidonias niger surinamensis Gmelin). M.S. thesis, Univ. Wisconsin/Oshkosh, WI. 67 pp.

Bain, M. 1978. First sighting of a Black Skimmer in Ontario. Ont. Field Biol. 32: 33.

Baird, P. A. 1976. Comparative ecology of California and Ring-billed Gulls (Larus californicus and L. delawarensis). Ph.D. thesis, Univ. Montana/ Missoula, MT. x and 183 pp.

Baird, P. A. and R. A. Moe. 1978. The breeding biology and feeding ecology of marine birds in the Sitkalidak Strait area, Kodiak Island, 1977. Pp. 313-524 in Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators, Volume 3. NOAA, Environ. Res. Lab., Boulder, CO.

Baker, M. C. 1977. Shorebird food habits in the eastern Canadian Arctic. Condor 79: 56-62.

Baldwin, W. P. 1946. Laughing Gull robs Brown Pelican. Auk 63: 96-97.

_____. 1960. Red Phalarope at Cape Romain, S. C. Chat 24: 76.

Baltz, D. M. and G. V. Morejohn. 1977. Food habits and niche overlap of seabirds wintering on Monterey Bay, California. Auk 94: 526-543.

Baltz, D. M., G. V. Morejohn and B. S. Antrim. 1979. Size selective predation and food habits of two California terns. West. Birds 10: 17-24.

Bannerman, D. A. 1962. The birds of the British Isles. Vol. XI. Oliver and Boyd, London. 368 pp.

Barbour, D. B. 1978. Species of special concern. Black Skimmer. Pp. 96-97 in H. W. Kale, II. (ed.). Rare and endangered biota of Florida. Volume 2. Birds. Univ. Presses of Florida, Gainesville, FL. xix and 121 pp.

Barbour, D. B. and R. W. Schreiber. 1978. Species of special concern. Royal Tern. Pp. 91-92 in H. W. Kale, II (ed.). Rare and endangered biota of Florida. Vol. 2. Birds. Univ. Presses of Florida, Gainesville, FL. xix and 121 pp.

Barbour, D. B., S. A. Nesbitt and D. T. Gilbert. 1976. A second recent Royal Tern nesting colony on the Gulf coast of Florida. Fla. Field Nat. 4: 9-10.

Bartlett, L. M. 1957. Ring-billed Gull steals food from Coot. Wilson Bull. 69: 182.

Bartonek, J. C. and C. J. Lensink. 1978. A review of the literature and a selected bibliography of published and unpublished information on marine birds of Alaska. Unpubl. rep. U.S. Fish Wildl. Serv. Off. Biol. Serv., Anchorage, AK. 95 pp.

Bayne, C. J., B. H. Cogan, A. W. Diamond, J. Frazier, P. Grubb, A. Hutson, M. E. D. Poore, D. R. Stoddart and J. D. Taylor. 1970. Geography and ecology of Cosmoledo Atoll. Pp. 37-56 in D. R. Stoddart (ed.). Coral islands of the Western India Ocean. Atoll Res. Bull. 136. 224 pp.

Beaman, M. A. S. 1978. The feeding and population ecology of the Great Black-backed Gull in northern Scotland. Ibis 120: 126-127.

Beardslee, C. S. 1944. Bonaparte's Gull on the Niagara River and eastern Lake Erie. Wilson Bull. 56: 9-14.

Beaudoin, J.-C. 1979. Une Mouette de Franklin (*Larus pipixcan*) a Angers, Maine-et-Loire: premiere donnee francaise. Oiseau Rev. Fr. Ornithol. 49: 45-49. [In French with English summary.]

Beckett, T. A. 1966. Deveaux Bank--1964 and 1965. Chat 30: 93-100.

Bell, H. L. 1959. An Australian sight record of the Black Tern. Emu 59: 62-63.

Bellrose, F. C. 1976. Ducks, geese and swans of North America. Stackpole Books. Harrisburg, PA. 540 pp.

Belopol'skii, L. O. 1957. Ekologiya morskikh kolonial'nykh ptits barentsova morya. [Ecology of sea colony birds in the Barents Sea.] Israel Progr. Sci. Transl., Jerusalem. 346 pp. [1961 translation from the Russian by R. Ettinger and C. Salzmann.]

Belterman, T. 1972. The Amer oil spill. Rep. 2-71 in Center for Short-lived Phenomena. 1971 Annu. Rep. Off. Environ. Sci., Smithson. Inst., Washington, DC. xii and 310 pp.

Bengtson, S.-A. 1971. Breeding success of the Arctic Tern, *Sterna paradisaea* (Pontoppidan) in the Kongsfjord area, Spitsbergen in 1967. Norw. J. Zool. 19: 77-82.

Benning, W. E. 1971. Phalaropes hawking insects over the water at Montezuma. Kingbird 21: 11.

Benson, C. W., H. H. Beamish, C. Jovanin, J. Salvan and G. E. Watson. 1975. The birds of the Iles Glorieuses. Atoll Res. Bull. 176. 34 pp.

Bent, A. C. 1921. Life histories of North American gulls and terns. U.S. Natl. Mus. Bull. 113. 345 pp.

______. 1927. Life histories of North American shore birds. U.S. Natl. Mus. Bull. 142. ix and 420 pp.

Berger, A. J. 1972. Hawaiian birdlife. Univ. Press of Hawaii, Honolulu, HI. 270 pp.

Bergersen, L. 1975. Splitterne funnet hekkende pa lista 1974. [First breeding of Sandwich Tern in Norway.] Sterna 14: 101-102. [In Norwegian with English summary.]

Bergman, G. 1953. Verhalten und Biologie der Raubseeschwalbe (Hydroprogne tschegrava). [Behavior and biology of the Caspian Tern.] Acta Zool. Fenn. 77: 1-50. [In German.]

______. 1960. Uber neue Futtergewohnheiten der Mowen an den Kusten Finnlands. Ornis Fenn 37: 11-28. [In German with Finnish summary.]

______. 1980. Single-breeding versus colonial breeding in the Caspian Tern Hydroprogne caspia, the Common Tern Sterna hirundo and the Arctic Tern Sterna paradisaea. Ornis Fenn. 57: 141-152. [In English with Finnish summary.]

Bergman, R. D., P. Swain and M. W. Weller. 1970. A comparative study of nesting Forster's and Black Terns. Wilson Bull. 82: 435-444.

Berndt, R. and U. Rahne. 1968. Erstnachweis der Ringschnabelmowe (Larus delawarensis) in Europa. J. Ornithol. 109: 438-440. [In German.]

Bevis, J. H. 1979. Roseate Tern sighted on Jekyll Island. Oriole 44: 52-53.

Bianki, V. V. 1967. [Gulls, shorebirds and alcids of Kandalalaksha Bay.] Israel Progr. Sci. Transl., Jerusalem. vi and 250 pp. [1977 translation from the Russian.]

Billet, D. F. and P. J. Grant. 1971. Franklin's Gull in Hampshire: a species new to Britain and Ireland. Brit. Birds 64: 310-313.

Birkhead, T. R. and D. N. Nettleship. 1980. Census methods for murres, Uria species: a unified approach. Can. Wildl. Serv. Occas. Pap. 43.

Birkhead, T. R., C. Lloyd and P. Corkhill. 1973. Oiled seabirds successfully cleaning their plumage. Brit. Birds 66: 535-537.

Black, B. B. and L. D. Harris. 1981. Winter foraging patterns of Gulf coast Black Skimmers. Colonial Waterbirds 4: 187-193.

Blacklock, G. W. 1978 ms. Birds of Padre and Mustang Island and adjacent waters. Annotated checklist. viii and 140 pp.

Blacklock, G. W., D. R. Blankenship, S. Kennedy, K. A. King, R. T. Paul, R. D. Slack, J. C. Smith and R. C. Telfair. 1978. Texas Colonial Waterbird Census, 1973-1976. Tex. Parks Wildl. Dep., FA Rep. Ser. 15. 107 pp.

Blacklock, G. W., R. D. Slack, D. R. Blankenship, A. H. Chaney, K. A. King, J. C. Smith and L. Mullins. 1978 ms. Texas Colonial Waterbird Census, 1977-78. 12 pp.

Blake, E. R. 1977. Manual of neotropical birds. Volume I. Univ. of Chicago Press, Chicago, IL. xix and 674 pp.

Blick, M. A. 1979. Franklin's Gull in Cleveland. Brit. Birds 72: 478-479.

BLM (Bureau of Land Management). 1978a. Draft Environmental Impact Statement. Proposed 1978 Outer Continental Shelf oil and gas lease sale. Offshore eastern Gulf of Mexico. OCS Sale # 65. Vol. I. BLM, U.S. Dep. Int., New Orleans, LA. vi and 466 pp.

______. 1978b. Final Environmental Impact Statement. Proposed 1978 Outer Continental Shelf oil and gas lease sale. Offshore eastern Gulf of Mexico. OCS Sale # 65. Vol. I. BLM, U.S. Dep. Int., New Orleans, LA. vi and 451 pp.

Blokpoel, H. 1977. Gulls and terns nesting in northern Lake Ontario and the upper St. Lawrence River. Can. Wildl. Serv. Prog. Notes 75. 12 pp.

Blokpoel, H. and P. Courtney. 1980. Site tenacity in a new Ring-billed Gull colony. J. Field Ornithol. 51: 1-5.

Blokpoel, H. and P. M. Fetterolf. 1978. Colonization by gulls and terns of the Eastern Headland, Toronto Outer Harbour. Bird-Banding 48: 59-65.

Blokpoel, H. and G. T. Haymes. 1979a. Small mammals and birds as food items of Ring-billed Gulls on the Lower Great Lakes. Wilson Bull. 91: 623-625.

Blokpoel, H., R. M. Catling and G. T. Haymes. 1978. Relationship between nest sites of Common Terns and vegetation on the Eastern Headland, Toronto Outer Harbour. Can. J. Zool. 56: 2057-2061.

Blus, L. J. and T. G. Lamont. 1979. Organochlorine residues in six species of estuarine birds, South Carolina, 1971-75. Pestic. Monit. J. 13: 56-60.

Blus, L. J. and R. M. Prouty. 1979. Organochlorine pollutants and population status of Least Terns in South Carolina. Wilson Bull. 91: 62-71.

Blus, L. J. and C. J. Stafford. 1980. Breeding biology and relation of pollutants to Black Skimmers and Gull-billed Terns in South Carolina. U.S. Fish Wildl. Serv. Spec. Sci. Rep. Wildl. 230. 18 pp.

Blus, L. J., R. M. Prouty and B. S. Neely, Jr. 1979. Relation of environmental factors to breeding status of Royal and Sandwich Terns in South Carolina, USA. Biol. Conserv. 16: 301-320.

Bochenski, Z. 1966. Nesting of Common and Black Terns. Acta Zool. Cracov. 11: 423-449.

Boecker, M. 1967. Vergleichende Untersuchungen zur Nahrungs und Nistokologie der Flussseeschwalbe (Sterna hirundo L.) und der Kustenseeschwalbe (Sterna paradisaea Pont.). Bonn. Zool. Beitr. 18: 15-126. [In German.]

Bond, J. 1950. A Florida record of Bridled Tern. Fla. Nat. 23: 68.

_____. 1956. Check-list of the birds of the West Indies. 4th ed. Philadelphia, PA. 214 pp.

_____. 1971. Birds of the West Indies. 2nd ed. Collins, London. 256 pp.

_____. 1978. Twenty-second supplement to the check-list of birds of the West Indies. Phila. Acad. Nat. Sci., Philadelphia, PA. 12 pp.

Bongiorno, S. F. 1968. Egg puncturing behavior in Laughing Gulls. Auk 85: 697-699.

_____. 1970. Nest-site selection by adult Laughing Gulls (Larus atricilla). Anim. Behav. 18: 434-444.

Bonhote, J. L. 1903. On a collection of birds from the northern islands of the Bahama group. Ibis (8th Ser.) 3: 273-315.

Borodulina, T. L. 1960. [Biology and economic importance of gulls and terns of southern U.S.S.R. water bodies.] Israel Progr. Sci. Transl., Jerusalem. [1966 translation from the Russian by R. Ettinger.] 132 pp.

_____. 1965. [Role of gulls and terns in fish economy in Azov, Black and Caspian Sea basins.] Pp. 37-64 in [Fish-eating birds and their significance in fish economy.] [1976 translation for the U.S. Fish Wildl. Serv. and Natl. Sci. Foundation by Franklin Book Programs, Inc., Cairo.]

Boswall, J. 1978. The birds of Alacran Reef, Gulf of Mexico. Bull. Br. Ornithol. Club 98: 99-109.

Boswall, J. and M. Barrett. 1978. Notes on the breeding birds of Isla Raza, Baja California. West. Birds 9: 93-108.

BOU (British Ornithologists' Union). 1971. The status of birds in Britain and Ireland. BOU and D. W. Snow (eds.). Blackwell Scientific Publ., Oxford, England. xviii and 333 pp.

Bourget, A. A. 1973. Relations of eiders and gulls nesting in mixed colonies in Penobscot Bay, Maine. Auk 90: 809-820.

Bourke, P. A., V. T. Lowe and T. G. Lowe. 1973. Notes on the Gull-billed Tern. Austr. Bird Watcher 5: 69.

Bourne, W. R. P. 1968a. Oil pollution and bird populations. Pp. 99-121 in J. D. Carthy and D. R. Arthur (eds.). The biological effects of oil pollution on littoral communities. Proc. symp. held at Pembroke, Wales, 17-19 February, 1968. Suppl. to Vol. 2 of Field Studies. Field Studies Council, London. vii and 198 pp.

_____. 1968b. Observation of an encounter between birds and floating oil. Nature 219: 632.

_____. 1971a. The threat of oil pollution to North Scottish seabird colonies. Mar. Pollut. Bull. 2: 117-120.

_____. 1971b. The birds of the Chagos Group, Indian Ocean. Atoll Res. Bull. 149: 175-207.

_____. 1976. Seabirds and pollution. Pp. 403-502 in R. Johnston (ed.). Marine Pollution. Academic Press, London, England. xiv and 729 pp.

_____. 1982. The marine pollution scene. Brit. Trust Ornithol. News 118: 4.

Bourne, W. R. P. and C. J. Bibby. 1975. Temperature and the seasonal and geographical occurrence of oiled birds on western European beaches. Mar. Pollut. Bull. 6: 77-80

Bourne, W. R. P. and T. R. E. Devlin. 1969. Birds and oil. Birds (Lond.) 2: 176-178.

Bower, B. P. 1970. Behaviour of migrant Black Terns. Scott. Birds 6: 44.

[Boyd], A. W. 1950. Notes on behaviour of Black Terns. Brit. Birds 43: 258.

Bradley, J. T. 1974. The climate of Florida. Pp. 45-70 in National Oceanic and Atmospheric Administration, U.S. Dep. Commerce. Climates of the states. Vol. I--eastern states. Water Information Center, Inc., Port Washington, NY. 486 pp.

Braun, B. M., P. A. Heinz and G. H. Heinz. 1980. Herring Gull predation on Red-breasted Merganser ducklings. Wilson Bull. 92: 403.

Braune, B. M. and D. E. Gaskin. 1982a. Feeding ecology of nonbreeding populations of larids off Deer Island, New Brunswick. Auk 99: 67-76.

Brewer, A. D. 1969. Black Terns feeding after ploughs. Brit. Birds 62: 282.

Brewster, W. 1886. The Bridled Tern (*Sterna anaethetus*) in South Carolina. Auk 3: 131.

Brichetti, P. 1979. Sulla nidificazione in Italia di Sterna s. sandvicensis Latham (Beccapesci). Riv. Ital. Ornitol. 49: 197-207. [In Italian with English summary.]

Britton, P. L. 1977a. Status and identification of East African terns. Scopus 1: 29-34.

Britton, P. L. and L. H. Brown. 1971. Breeding sea-birds at the Kiunga Islands, Kenya. Ibis 113: 364-366.

_____. 1974. The status and breeding behaviour of East African Lari. Ostrich 45: 63-82.

Brookfield, C. M. 1951. The changing seasons; the winter season: December 1, 1950-March 31, 1951; Florida Region. Audubon Field Notes 5: 200-201.

Brown, B. J. 1979. Franklin's Gull in Suffolk. Brit. Birds 72: 479-482.

Brown, H. C. and B. L. Monroe, Jr. 1974. Bird records from Honduras. Condor 76: 348-349.

Brown, R. G. B. 1967a. Seabirds off Halifax, March, 1967. Can. Field-Nat. 81: 276-278.

_____. 1968. Sea birds in Newfoundland and Greenland waters, April-May, 1966. Can. Field-Nat. 82: 88-102.

Brown, R. G. B., D. I. Gillespie, A. R. Lock, P. A. Pearce and G. H. Watson. 1973. Bird mortality from oilslicks off eastern Canada, February-April 1970. Can. Field-Nat. 87: 225-234.

Brown, W. Y. 1975a. Artifactual clutch size in Sooty Terns and Brown Noddies. Wilson Bull. 87: 115-116.

_____. 1975b. Parental feeding of young Sooty Terns (Sterna fuscata (L.)) and Brown Noddies (Anous stolidus (L.)) in Hawaii. J. Anim. Ecol. 44: 732-742.

_____. 1976a. Growth and fledging age of Sooty Tern chicks. Auk 93: 179-183.

_____. 1976b. Egg specific gravity and incubation in the Sooty Tern and Brown Noddy. Auk 93: 371-374.

_____. 1976c. The breeding of Sooty Terns and Brown Noddies on Manana Island, Hawaii. Condor 78: 61-66.

_____. 1976d. Prolonged parental care in the Sooty Tern and Brown Noddy. Condor 78: 128-129.

_____. 1977. Temporal patterns in laying, hatching and incubation of Sooty Terns and Brown Noddies. Condor 79: 133-136.

Browne, M. M. and G. S. Grant. 1970. Sooty Tern and Audubon's Shearwaters off North Carolina in September. Chat 34: 102-103.

Browne, M. M., D. L. Hughes and G. M. Williamson. 1976. A Bridled Tern from North Carolina. Chat 40: 95.

Brun, E. 1979. Present status and trends in population of seabirds in Norway. Pp. 289-301 in J. C. Bartonek and D. N. Nettleship (eds.). Conservation of marine birds of northern North America. U.S. Fish Wildl. Serv. Res. Rep. 11. ix and 319 pp.

Bruns, H. 1979. Zur nistokologischen Potenz der Kustenseeschwalbe (Sterna paradisaea) im arktischen Brutgebiet. Kustenseeschwalbe nistet im Industriegelande von Spitsbergen. Ornithol. Mitt. 31: 3-19. [In German.]

Bryant, H. 1859. [Birds observed in east Florida, south of St. Augustine.] Proc. Boston Soc. Nat. Hist. 7: 5-21.

Buckley, F. G. and P. A. Buckley. 1972a. The breeding ecology of Royal Terns Sterna (Thalasseus) maxima maxima. Ibis 114: 344-359.

_____. 1974. Comparative feeding ecology of wintering adult and juvenile Royal Terns (Aves: Laridae, Sterninae). Ecology 55: 1053-1063.

_____. 1980a. Habitat selection and marine birds. Pp. 69-112 in J. Burger, B. L. Olla and H. E. Winn (eds.). Behavior of marine animals. Vol. 4: Marine Birds. Plenum Press, NY. xvii and 515 pp.

Buckley, F. G. and C. A. McCaffrey. 1978. Use of dredged material islands by colonial seabirds and wading birds in New Jersey. U.S. Army Engineer Waterways Exp. Stn., Vicksburg, MS. Tech. Rep. D-78-1. 157 [and 48] pp.

Buckley, F. G., M. Gochfeld and P. A. Buckley. 1978a. Breeding Laughing Gulls return to Long Island. Kingbird 28: 203-207.

Buckley, P. A. 1966. Foot-paddling in four American gulls, with comments on its possible function and stimulation. Z. Tierpsychol. 23: 395-402.

Buckley, P. A. and F. G. Buckley. 1976a. Guidelines for the protection and management of colonially nesting waterbirds. Natl. Park Serv., Boston, MA. 54 pp.

_____. 1977a. Human encroachment on barrier islands of the northeastern U.S. and its impact on coastal birds. Pp. 68-76 in J. H. Noyes and E. H. Zube (eds.). A symposium on coastal recreation resources in an urbanizing environment: a monograph. Univ. Massachusetts/Amherst, MA.

_____. 1980b. Population and colony-site trends of Long Island waterbirds for five years in the mid 1970s. Trans. Linn. Soc. N.Y. 9: 23-56.

_____. 1981. The endangered status of North American Roseate Terns. Colonial Waterbirds 4: 166-173.

Buckley, P. A., F. G. Buckley and M. Gochfeld. 1975. Gull-billed Tern: New York State's newest breeding species. Kingbird 25: 178-183.

Buckley, P. A., M. Gochfeld and F. G. Buckley. 1978b. Efficacy and timing of helicopter censuses of Black Skimmers and Common Terns on Long Island, N.Y.: a preliminary analysis. Proc. 1977 Conf. Colonial Waterbird Group 1: 48-61.

Buhrman, C. B. and L. A. Hopkins. 1978. Eleven pelagic trips into the eastern Gulf of Mexico. Fla. Field Nat. 6: 30-32.

Bullock, I. D. and C. H. Gomersall. 1981. The breeding populations of terns in Orkney and Shetland in 1980. Bird Study 28: 187-200.

Bundy, G. 1971. Black Terns feeding over dry land. Brit. Birds 64: 32.

Bunker, A. 1946. Gulls taking fish from mergansers. Can. Field-Nat. 60: 115.

Burford, F. C. 1963. Franklin's Gull at Norfolk, Virginia. Raven 34: 52.

Burger, J. 1974. Breeding adaptations of Franklin's Gull (<u>Larus pipixcan</u>) to a marsh habitat. Anim. Behav. 22: 521-567.

_____. 1976. Daily and seasonal activity patterns in breeding Laughing Gulls. Auk 93: 308-323.

_____. 1977a. Nesting behavior of Herring Gulls: invasion into <u>Spartina</u> salt marsh areas of New Jersey. Condor 79: 162-169.

_____. 1977b. Role of visibility in nesting behavior of <u>Larus</u> gulls. J. Comp. Physiol. Psychol. 91: 1347-1358.

_____. 1978. Great Black-backed Gulls breeding in salt marsh in New Jersey. Wilson Bull. 90: 304-305.

_____. 1979a. Competition and predation: Herring Gulls versus Laughing Gulls. Condor 81: 269-277.

_____. 1980a. Nesting adaptation of Herring Gull (<u>Larus argentatus</u>) to salt marshes and storm tides. Biol. Behav. 5: 147-162.

_____. 1981a. Effects of human disturbance on colonial species, particularly gulls. Colonial Waterbirds 4: 28-36.

_____. 1981b. Feeding competition between Laughing Gulls and Herring Gulls at a sanitary landfill. Condor 83: 328-335.

_____. 1981c. Movements of juvenile Herring Gulls hatched at Jamaica Bay Rufuge, New York. J. Field Ornithol. 52: 285-290.

Burger, J. 1981d. Behavioural responses of Herring Gulls Larus argentatus to aircraft noise. Environ. Poll. 24: 177-184.

_____. 1982a. The role of reproductive success in colony-site selection and abandonment in Black Skimmers (Rynchops niger). Auk 99: 109-115.

Burger, J. and M. Gochfeld. 1981a. Age-related differences in piracy behaviour of four species of gulls, Larus. Behaviour 77: 242-267.

Burger, J. and F. Lesser. 1978a. Selection of colony sites and nest sites by Common Terns Sterna hirundo in Ocean Countv, New Jersey. Ibis 120: 433-449.

_____. 1978b. Determinants of colony site selection in Common Terns (Sterna hirundo). Proc. 1977 Conf. Colonial Waterbird Group 1: 118-127.

_____. 1980. Nest site selection in an expanding population of Herring Gulls. J. Field Ornithol. 51: 270-280.

Burger, J. and J. Shisler. 1978a. Nest site selection and competitive interactions of Herring and Laughing Gulls in New Jersey. Auk 95: 252-266.

_____. 1978b. The effects of ditching a salt marsh on colony and nest site selection by Herring Gulls (Larus argentatus). Am. Midl. Nat. 100: 54-63.

_____. 1979. The immediate effects of ditching a saltmarsh on nesting Herring Gulls Larus argentatus. Biol. Conserv. 15: 85-103.

_____. 1980a. Colony and nest site selection in Laughing Gulls in response to tidal flooding. Condor 82: 251-258.

_____. 1980b. The process of colony formation among Herring Gulls Larus argentatus nesting in New Jersey. Ibis 122: 15-26.

Burggraeve, G. 1977. Waarnemingen bij een vermoedelijk gemengd broedpaar Dougalls Stern, Sterna dougallii, X Visdief, Sterna hirundo, te Knokke. [Observations on a probably mixed pair Roseate Tern, Sterna dougallii, new record, X Common Tern, Sterna hirundo, at Knokke.] Gerfaut 67: 75-80. [In Dutch with French and English summaries.]

Burleigh, T. D. 1944. The bird life of the Gulf coast of Mississippi. Occas. Pap. Mus. Zool. La. State Univ. 20: 324-490.

_____. 1958. Georgia birds. Univ. Oklahoma Press, Norman, OK. xxix and 746 pp.

Burroughs, R. C. 1966. A study of the breeding biology of Least Terns on Nantucket Island. M.S. thesis, Univ. Massachusetts/Amherst, MA. v and 87 pp.

Burton, D. E. 1960. Ring-billed Gulls flycatching. Ont. Field Biol. 14: 31.

Burton, E. M. 1970. South Carolina bird life, by A. Sprunt, Jr. and E. B. Chamberlain (1949). Revised edition. Univ. South Carolina Press, Columbia, SC. xx and 659 pp.

Burton, P. J. K. and M. H. Thurston. 1959. Observations on Arctic Terns in Spitsbergen. Brit. Birds 52: 149-161.

Butler, R. G. and W. Trivelpiece. 1981. Nest spacing, reproductive success, and behavior of the Great Black-backed Gull (Larus marinus). Auk 98: 99-107.

Butler, R. G., P. Lukasiewicz, W. Trivelpiece and W. B. Kinter. 1978. Field studies of crude oil toxicity in seabirds. Bull. Mt. Desert Isl. Biol. Lab. 18: 21-23.

Bystrak, D. (ed.) 1974. Wintering areas of bird species potentially hazardous to aircraft. A special report jointly prepared by the National Audubon Society and the U.S. Fish & Wildlife Service. Natl. Audubon Soc. iii and 156 pp.

Cain, W. 1933. Nesting of the Gull-billed Tern (Gelochelidon nilotica). S. Austr. Ornithol. 12: 28-30.

Cambridge Ornithological Expedition. 1976. Report on birds observed in the British Virgin Islands. Unpubl. rep.

Campbell, R. W. 1970. Occurrence and nesting of Black Terns in southwestern British Columbia. Condor 72: 500.

Campbell, K. E., Jr. 1971. First report of Sandwich Terns in Peru. Auk 88: 676.

Campbell, L. B., K. T. Strandring and C. J. Cadbury. 1978. Firth of Forth oil pollution incident, February 1978. Mar. Pollut. Bull. 9: 335-339.

Campredon, P. 1978. Reproduction de la Sterne caugek Thalasseus sandvicensis Lath. sur le Banc d' Arguin (Gironde). Apercu de sa distribution hivernale. [Reproduction of the Sandwich Tern Thalasseus sandvicensis Lath. on the Banc d'Arguin (Gironde). Survey of their winter distribution.] Oiseau Rev. Fr. Ornithol. 48: 123-150, 263-279. [In French with English summary.]

Cannon, T. A. and C. D. Hall. 1977. Black Skimmer at Wilson Reservoir. Bull. Kansas Ornithol. Soc. 28: 27-28.

Carleton, G. 1972. Unusual larids in Volusia County [Florida]. Fla. Nat. 45: 94.

Carlsson, L. 1979. Trutar som narinsparasit pa hagar. [Gulls kleptoparasitizing heron.] Var Fagelvarld 38: 50. [In Swedish with English summary.]

Carter, H. S. 1974. The climate of Georgia. Pp. 71-89 in National Oceanic and Atmospheric Administration, U. S. Dep. Commerce. Climates of the states. Vol. I--eastern states. Water Information Center, Inc., Port Washington, NY. 486 pp.

Casement, M. 1966. Seabirds avoiding oil patches. Sea Swallow 18: 79.

Cathcart, N. 1977. Hilton Head Island, S. C. [Spring Count]. Chat 41: 88.

Cave, B. 1982. Forster's Tern: new to Britain and Ireland. Brit. Birds 75: 55-61.

Center for Short-Lived Phenomena (CSLP). 1969. Annual progress report 1968. Center for Short-Lived Phenomena, Smithson. Inst., Cambridge, MA. xi and 152 pp.

______. 1971. Anuual report 1970. Center for Short-Lived Phenomena, Smithson. Inst., Cambridge, MA. x and 296 pp.

Chabrzyk, G. and J. C. Coulson. 1976. Survival and recruitment in the Herring Gull *Larus argentatus*. J. Anim. Ecol. 45: 187-203.

Chamberlain, B. R. 1952. The changing seasons; the fall migration: August 16-November 30, 1951; Southern Atlantic Coast Region. Audubon Field Notes 6: 11-12.

______. 1953. The changing seasons; the fall migration: August 16-November 30, 1952; Southern Atlantic Coast Region. Audubon Field Notes 7: 11-12.

______. 1954. The changing seasons; the fall migration: August 16-November 30, 1953; Southern Atlantic Coast Region. Audubon Field Notes 8: 11-13.

______. 1956a. The changing seasons; the fall migration: August 16-November 30, 1955; Southern Atlantic Coast Region. Audubon Field Notes 10: 15-18.

______. 1956b. The changing seasons; the spring migration: April 1-May 31, 1956; Southern Atlantic Coast Region. Audubon Field Notes 10: 323-325.

______. 1958a. The changing seasons; the winter season: December 1, 1957-March 31, 1958; Southern Atlantic Coast Region. Audubon Field Notes 12: 269-271.

______. 1958b. The changing seasons; the spring migration: April 1-May 31, 1958; Southern Atlantic Coast Region. Audubon Field Notes 12: 341-344.

______. 1959a. The changing seasons; the fall migration: August 16-November 30, 1958; Southern Atlantic Coast Region. Audubon Field Notes 13: 19-21.

______. 1959b. The changing seasons; the spring migration: April 1-May 31, 1959; Southern Atlantic Coast Region. Audubon Field Notes 13: 360-362.

_____. 1960a. The changing seasons; the fall migration: August 16-November 30, 1959; Southern Atlantic Coast Region. Audubon Field Notes 14: 23-25.

_____. 1960b. Gull-billed Tern telefeeding. Chat 24: 98-99.

_____. 1961a. The changing seasons; the fall migration: August 16-November 30, 1960; Southern Atlantic Coast Region. Audubon Field Notes 15: 23-26.

_____. 1961b. The changing seasons; the winter season: December 1, 1960-March 31, 1961; Southern Atlantic Coast Region. Audubon Field Notes 15: 317-320.

_____. 1962a. The changing seasons; the fall migration: August 16-November 30, 1961; Southern Atlantic Coast Region. Audubon Field Notes 16: 18-21.

_____. 1962b. The changing seasons; the winter season: December 1, 1961-March 31, 1962; Southern Atlantic Coast Region. Audubon Field Notes 16: 319-321.

Chamberlain, E. B. 1933. Bridled Tern in South Carolina. Auk 50: 104-105.

_____. 1934. Northern Phalarope in South Carolina. Auk 51: 519-520.

_____. (comp.) 1968. The 68th Christmas Bird Count. Charleston, S.C. Audubon Field Notes 22: 204.

Chamberlain, E. B. and B. R. Chamberlain. 1948. The changing seasons; the winter season: December 1, 1947-March 31, 1948; Carolina Region. Audubon Field Notes 2: 136-137.

Chamberlain, E. B. and H. T. Odum. 1947. The changing seasons; the winter season: December 1, 1946-April 1, 1947; Carolina Region. Audubon Field Notes 1: 128-129.

Chamberlain, J. L. 1959. A nesting colony of Forster's Terns and Black Skimmers in southwestern Louisiana. Wilson Bull. 71: 283-284.

Chamberlin, M. L. 1975. Breeding ecology of Herring Gulls on an island in northern Lake Huron. M.S. thesis, Central Mich. Univ./ Mt. Pleasant, MI. iv and 75 pp.

Chaney, A. H., B. R. Chapman, J. P. Karges, D. A. Nelson, R. R. Schmidt and L. C. Thebeau. 1978. Use of dredged material islands by colonial seabirds and wading birds in Texas. U.S. Army Engineer Waterways Exp. Stn., Vicksburg, MS. Tech. Rep. D-78-8. 170 [and 146] pp.

Chapin, C. S. 1975. Hilton Head Island, S.C. [Spring Count]. Chat 39: 84.

Chapman, B. R. 1981. Effects of the Ixtoc I oil spill on Texas shorebird populations. Pp. 461-465 in Proc. 1981 Oil Spill Conf. Am. Petrol. Inst. Publ. No. 4334. Am. Petrol. Inst., Washington, D. C.

Chestney, R. 1970. Notes on the breeding habits of Common and Sandwich Terns on Scolt Head Island. Trans. Norfolk Norwich Nat. Soc. 21: 353-363.

Christensen, M. D. 1955. Bridled Tern, Sterna anaethetus, at Little Duck Key. Fla. Nat. 28: 60.

Christie, D. A. 1982. Common Tern feeding by wading. Brit. Birds 75: 129.

Clancy, P. A. 1970. Miscellaneous taxonomic notes on African birds. XXIX. The Royal Tern Sterna maxima Boddaert in South-Eastern Africa. Durban Mus. Novit. 8: 375-377.

Clapp, R. B. 1968. Additional new records of birds from the Phoenix and Line Islands. Ibis 110: 573-575.

_____. 1975. Arctic Terns from the Phoenix Islands and at sea in the Central Pacific. Condor 77: 100.

_____. 1980. Occurrence of Central Pacific Blue-faced Booby and Sooty Tern in southeast Asia. Tori 29: 95-96. [In English with Japanese summary.]

Clapp, R. B. and P. W. Woodward. 1968. New records of birds from the Hawaiian Leeward Islands. Proc. U.S. Natl. Mus. 124 (3640). 39 pp.

Clapp, R. B., M. K. Klimkiewicz and J. H. Kennard. 1982a. Longevity records of North American birds: Gaviidae through Alcidae. J. Field Ornithol. 53: 81-124.

Clapp, R. B., R. C. Banks, D. Morgan-Jacobs and W. A. Hoffman. 1982b. Marine birds of the Southeastern United States and Gulf of Mexico. Part I. Gaviiformes through Pelecaniformes. U.S. Fish Wildl. Serv. Off. Biol. Serv., Washington, D.C. FWS/OBS-82/01. xi and 637 pp.

Clapp, R. B., D. Morgan-Jacobs and R. C. Banks. 1982c. Marine birds of the Southeastern United States and Gulf of Mexico. Part II. Anseriformes. U.S. Fish Wildl. Serv. Off. Biol. Serv., Washington, D.C. FWS/OBS-82/20. xiii and 492 pp.

Clark, R. B. 1973. Impact of acute and chronic oil pollution on sea birds. Pp. 619-634 in Background papers for a workshop on inputs, fates, and effects of petroleum in the marine environment II. Oceanic Affairs Board, Natl. Acad. Sci., Washington, D.C. 2 vol. 824 pp.

Clark, R. B. 1982. The long-term effect of oil pollution on marine populations, communities and ecosystems: some questions. Philos. Trans. R. Soc. Lond. B. Biol. Sci. 297: 185-192.

Cleghorn, J. D. 1942. Great Black-backed Gull killing American Goldeneye. Auk 59: 584-585.

Clement, R. C. 1946. Some Louisiana observations. Auk 63: 97-99.

Cobb, S. 1957. Great Black-backed Gull (Larus marinus). Auk 74: 498.

Collinge, W. E. 1926. An investigation of the food of terns at Blakeney Point, Norfolk. Trans. Norfolk Norwich Nat. Soc. 12: 35-52.

Collins, C. T. 1970. The Black-crowned Night Heron as a predator of tern chicks. Auk 87: 584-586.

Collins, C. T. and M. LeCroy. 1972. Analysis of measurements, weights, and composition of Common and Roseate Tern eggs. Wilson Bull. 84: 187-192.

Condamin, M. 1978. Nidifications d'oiseaux de mer en Guyane. Oiseau Rev. Fr. Ornithol. 48: 115-121. [In French with English summary.]

Condon, H. T. 1975. Checklist of the birds of Australia. Part I--Non-Passerines. Royal Austr. Ornithol. Union, Melbourne. xx and 311 pp.

Connors, P. G. and S. Gelman. 1979. Red Phalarope responds to thin oil films in foraging experiments. (Abstract only.) Pac. Seabird Group Bull. 6: 43.

Conover, M. R. and D. O. Conover. 1981. A documented history of Ring-billed and California Gull colonies in the western United States. Colonial Waterbirds 4: 37-43.

Conover, M. R. and D. E. Miller. 1979. Reaction of Ring-billed Gulls to predators and disturbances at their breeding colonies. Proc. 1978 Conf. Colonial Waterbird Group 2: 41-47.

Conover, M. R, D. E. Miller and G. L. Hunt, Jr. 1979a. Female-female pairs and other unusual reproductive associations in Ring-billed and California Gulls. Auk 96: 6-9.

Conover, M. R., B. C. Thompson, R. E. Fitzner and D. E. Miller. 1979b. Increasing populations of Ring-billed and California Gulls in Washington State. West. Birds 10: 31-36.

Cooke, M. T. 1940. Winter range of the Herring Gull. Auk 57: 250-251.

Cooke, W. W. 1915. Distribution and migration of North American gulls and their allies. U.S. Dep. Agric. Bull. 292. 70 pp.

Coon, N. C., P. H. Albers and R. C. Szaro. 1979. No. 2 fuel oil decreases embryonic survival of Great Black-backed Gulls. Bull. Environ. Contam. Toxicol. 21: 152-156.

Cooper, D., H. Hays and C. Pessino. 1970. Breeding of the Common and Roseate Terns on Great Gull Island [New York]. Proc. Linn. Soc. N. Y. 71: 83-104.

Cooper, J. and A. J. Williams. 1975. Franklin's Gull in South Africa. Ostrich 46: 117.

Corkhill, P. 1973. Oiled birds successfully cleaning their plumage. Brit. Birds 66: 535-537.

Cott, H. B. 1953. The exploitation of wild birds for their eggs. Ibis 95: 643-675.

Cottam, C. 1944. Gulls as vegetarians. Condor 46: 127-128.

Courtney, P. [A.] 1979a. Seasonal variation in intra-clutch hatching intervals among Common Terns *Sterna hirundo*. Ibis 121: 207-211.

_____. 1979b. Effects of a rabbit on nesting Common Terns. Can. J. Zool. 57: 2457-2460.

Courtney, P. A. and H. Blokpoel. 1980a. Behavior of Common Terns nesting near Ring-billed Gulls. Can. Field-Nat. 94: 336-338.

_____. 1980b. Food and indicators of food availability for Common Terns on the lower Great Lakes. Can. J. Zool. 58: 1318-1323.

_____. 1980c. Canada Goose predation on eggs of Common Terns. Ont. Field Biol. 34: 40-42.

Cox, J. B. 1973. A further occurrence of the Red-necked Phalarope in South Australia. S. Austr. Ornithol. 26: 116-117.

Cramp, S., W. R. P. Bourne and D. Saunders. 1974. The seabirds of Britain and Ireland. Collins, London and Taplinger Publ. Co., NY. 287 pp.

Cramp, S., K. E. L. Simmons, J. J. Ferguson-Lees, R. Gillmor, P. A. D. Hollom, R. Hudson, E. M. Nicholson, M. A. Ogilvie, P. J. S. Olney, K. H. Voous and J. Wattel. 1977. Handbook of the birds of Europe, the Middle East and North Africa. The birds of the western Palearctic. Vol. I: Ostrich to ducks. Oxford Univ. Press, Oxford. 722 pp.

Crossin, R. S. and L. N. Huber. 1970. Sooty Tern egg predation by Ruddy Turnstones. Condor 72: 372-373.

Crowell, E. M. and S. Crowell. 1946. The displacement of terns by Herring Gulls at the Weepecket Islands. Bird-Banding 17: 1-10.

Crowell, S. 1935. A lengthened egg-laying interval in the Common Tern. Auk 52: 86.

Croxall, J. P. 1975. The effect of oil on nature conservation, especially birds. Pp. 93-101 *in* H. A. Cole (ed.). Petroleum and the continental shelf of NW Europe. Vol. 2: environmental protection. Applied Sciences Publ. Ltd., Essex, England.

Cruikshank, A. D. 1950. Ring-billed Gulls and cabbage palmettos. Auk 67: 237.

Cunningham, R. L. 1964a. The changing seasons; the fall migration: August 16-November 30, 1963; Florida Region. Audubon Field Notes 18: 24-28.

_____. 1964b. Recent records from Everglades National Park. Fla. Nat. 37: 91-92.

_____. 1965a. The changing seasons; the fall migration: August 16-November 30, 1964; Florida Region. Audubon Field Notes 19: 28-33.

_____. 1965b. The changing seasons; the spring migration: April 1-May 31, 1965; Florida Region. Audubon Field Notes 19: 462-466.

_____. 1966. Caspian Tern feeding on carrion. Wilson Bull. 78: 319.

Cuthbert, N. L. 1954. A nesting study of the Black Tern in Michigan. Auk 71: 39-63.

Daniels, G. 1973. Laughing Gulls prey on migrants. Linn. Newsl. 27:1.

Davant, P. 1967. Premiere nidification de la Sterne caugek Sterna sandvicensis Lath. sur le Banc d'Arguin (Bassin d'Arcachon). Acta Soc. Linn. Bordeaux 104: 1-11. [In French.]

Davis, H. T. 1961. Bird banding, 1961. Chat 25: 63-64.

Davis, L. I. 1951. Fishing efficiency of the Black Skimmer. Condor 53: 259.

Davis, M. E. 1968. Nesting behavior of the Least Tern (Sterna albifrons). M. A. thesis, Univ. Calif./Los Angeles, CA. 72 pp.

Davis, T. A. W. 1958. The breeding distribution of the Great Black-backed Gull in England and Wales in 1956. Bird Study 5: 191-215.

Dawson, W. R., A. F. Bennett and J. W. Hudson. 1976. Metabolism and thermoregulation in hatchling Ring-billed Gulls. Condor 78: 49-60.

DeGroot, D. S. 1931. History of a nesting colony of Caspian Terns of San Francisco Bay. Condor 33: 188-192.

Dement'ev, G. P. and N. A. Gladkov (eds.). 1951. [Birds of the Soviet Union. Vol. III.] Israel Progr. Sci. Transl., Jerusalem. [1969 translation from Russian.] xi and 755 pp.

de Naurois, R. 1959. Premieres recherches sur l'avifaune des iles du Banc d'Arguin (Mauritanie). Alauda 27: 241-308.

de Naurois, R. 1969. Notes breves sur l'avifaune de l'archipel du Cap Vert, faunistique, endemisme, ecologie. Bull. Inst. Fondam. Afr. Noire Ser. A. Sci. Nat. 31: 143-218.

Dennis, J. V. and W. Pepper. 1962. More on the travels of Herring Gulls. EBBA News 25: 139-144.

Denton, J. F. and B. R. Chamberlain. 1950a. The changing seasons; the fall migration: August 16-November 30, 1949; Southern Atlantic Coast Region. Audubon Field Notes 4: 9-11.

_____. 1950b. The changing seasons; the spring migration: April 1-May 31, 1950; Southern Atlantic Coast Region. Audubon Field Notes 4: 238-239.

Denton, J. F., E. B. Chamberlain and B. R. Chamberlain. 1951. The changing seasons; the winter season: December 1, 1950-March 31, 1951; Southern Atlantic Coast Region. Audubon Field Notes 5: 198-200.

Denton, J. F., W. W. Baker, L. B. Davenport, Jr., M. N. Hopkins, Jr. and C. S. Robbins. 1977. Annotated checklist of Georgia birds. Georgia Ornithol. Soc. Occas. Publ. 6. iii and 57 pp.

de Waard, S. 1950. Drie broedparen van de Lachstern, Gelochelidon nilotica (Gm.), op "De Beer," Rozenburg, in 1949. Ardea 37: 161-167. [In Dutch with English summary.]

Dewey, R. A. 1980. Summary of studies of Roseate Terns in the U.S. Virgin Islands, 1975-79. Unpubl. rep. Bur. Fish Wildl., Gov. of the Virgin Islands, St. Thomas, V.I.

Dewey, R. A. and D. W. Nellis. 1980. Seabird research in the U.S. Virgin Islands. Trans. N. Am. Wildl. Nat. Resourc. Conf. 45: 445-452.

DeWire, R. C. 1981. Banding gulls at Chimon Island [Connecticut]. Conn. Warbler 1: 17-18.

Dexheimer, M. and W. E. Southern. 1974. Breeding success relative to nest location and density in Ring-billed Gull colonies. Wilson Bull. 86: 288-290.

Dexter, R. W. 1978. Recoveries of Herring Gulls banded at Cape Ann, Massachusetts. N. Am. Bird Bander 3: 52-54.

Diamond, A. W. 1976. Subannual breeding and moult cycles in the Bridled Tern Sterna anaethetus in the Seychelles. Ibis 118: 414-419.

Dicks, B. 1982. Monitoring the effects of North Sea platforms. Mar. Pollut. Bull. 13: 221-227.

Dicks, B. and J. P. Hartley. 1982. The effects of repeated small oil spillages and chronic discharges. Philos. Trans. R. Soc. Lond. B. Biol. Sci. 297: 285-307.

DiCostanzo, J. 1978. Occurrences of the Common Tern in the interior of South America. Bird-Banding 49: 248-251.

_____. 1980. Population dynamics of a Common Tern colony. J. Field Ornithol. 51: 229-243.

Dingle, E. von S. 1927. Sooty Tern (Sterna fuscata) and Bridled Tern (Sterna anaetheta) on the South Carolina coast. Auk 44: 93-94.

_____. 1955. A 1950 Bridled Tern record for South Carolina. Chat 19: 87.

Dinsmore, J. J. 1972. Sooty Tern behavior. Bull. Fla. State Mus. 16: 129-179.

Dinsmore, J. J. and R. W. Schreiber. 1974. Breeding and annual cycle of Laughing Gulls in Tampa Bay, Florida. Wilson Bull. 86: 419-427.

Dodson, S. I. and D. L. Egger. 1980. Selective feeding of Red Phalaropes on zooplankton of arctic ponds. Ecology 61: 755-763.

Donahue, P. K. 1974. Gull-billed Tern in Caribbean South America. Auk 91: 845.

_____. 1977. Reddish Egret and Herring Gull in Caribbean Colombia. Am. Birds 31: 286.

Dopson, C. W., Jr. and J. I. Richardson. 1968. Late summer and fall observations from the Georgia coast. Oriole 33: 41-43.

Dorst, J. 1960. [The migrations of birds.] Houghton Moffin Co., Boston. xix and 476 pp. [1962 transl. from French by C. D. Sherman.]

Dorward, D. F. and N. P. Ashmole. 1963. Notes on the biology of the Brown Noddy (Anous stolidus) on Ascension. Ibis 103b: 447-457.

Douglas, C. E. 1950. Notes on behaviour of Black Terns. Brit. Birds 42: 258.

Downing, R. L. 1973. A preliminary nesting survey of Least Terns and Black Skimmers in the east. Am. Birds 27: 946-949.

_____. 1980. Survey of Interior Least Tern nesting populations. Am. Birds 34: 209-211.

Dragesco, J. 1961a. La Sterne Royale. Sci. Nat. 46: 1-4. [In French.]

Drent, R. H. 1970. Functional aspects of incubation in the Herring Gull. Pp. 1-132 in G. P. Baerends and R. H. Drent (eds.). The Herring Gull and its egg. Behaviour Suppl. 17. ix and 312 pp.

Drury, W. H., Jr. 1963a. Herring Gull populations and movements in southeastern New England. Mass. Audubon Soc. cyclostyled rep. to U.S. Fish Wildl. Serv. 68 pp.

_____. 1965a. Results of a study of Herring Gull populations and movements in southeastern New England. Pp. 207-219 in R. G. Bushnel and J. Giban (eds.). Colloque: le probleme des oiseaux sur les aerodomes. Inst. Natl. Rech. Agron. Paris. 326 pp.

_____. 1980. Coastal surveys--northeast and northwest. Trans. Linn. Soc. N. Y. 9: 57-75.

Drury, W. H. and J. A. Kadlec. 1974. The current status of the Herring Gull population in the northeastern United States. Bird-Banding 45: 297-306.

Drury, W. H. and I. C. T. Nisbet. 1972. The importance of movements in the biology of Herring Gulls in New England. Pp. 173-212 in Population Ecology of Migratory Birds: a symposium. U.S. Fish Wildl. Serv. Wildl. Res. Rep. 2. 278 pp.

DuBois, A. D. 1931. Black Terns feeding young in Minneapolis. Oologist 48: 72-73.

Duchein, A. 1968. Sooty Tern at Chimney Rock, N.C. Chat 32: 98-99.

Duchrow, H. 1958. Stosstauchen und Beuterauben bei Mowen. Vogelwelt 79: 183-184.

Duffy, D. 1977a. Incidence of oil contamination on breeding Common Terns. Bird-Banding 48: 370-371.

_____. 1978 ms. The feeding ecology of Common and Roseate Terns during the breeding season at Great Gull Island, New York.

DuMont, P. A. 1931. Summary of bird notes from Pinellas County, Florida. Auk 48: 246-255.

_____. 1941. Relation of Franklin's Gull to agriculture on the Great Plains. Trans. N. Am. Wildl. Conf. 5: 183-189.

DuMont, P. G. 1976. Sabine's Gull and Arctic Tern sightings near Ocean City. Md. Birdlife 32: 108.

_____. 1977. Oiled birds seen at Ocean City, Maryland. Md. Birdlife 33: 12-13.

DuMont, P. G. and P. A. DuMont. 1973a. Birds of the season. June, July and August 1972. Atl. Nat. 28: 27-28.

_____. 1973b. Birds of the season. December 1972 through February 1973. Atl. Nat. 28: 121-129.

_____. 1973c. Birds of the season. March through May 1973. Atl. Nat. 28: 169-178.

Duncan, C. D. 1978. Bridled Tern and Aububon's Shearwater in Alabama. Ala. Birdlife 26: 16-17.

Duncan, C. D. and R. W. Harvard. 1979 ms. Pelagic birds of the northern Gulf of Mexico. A preliminary survey. Museum Section, Denver Wildl. Res. Cent., U.S. Fish Wildl. Serv., Washington, D. C. 25 pp.

_____. 1980. Pelagic birds of the northern Gulf of Mexico. A preliminary survey of distribution and abundance with comments on field identification. Am. Birds 34: 122-132.

Dunn, E. H. 1979. Nesting biology and development of young in Ontario Black Terns. Can. Field-Nat. 93: 276-281.

Dunn, E. K. 1972a. Effect of age on the fishing ability of Sandwich Terns (*Sterna sandvicensis*). Ibis 114: 360-366.

_____. 1972b. Studies on terns with particular reference to feeding ecology. Ph.D. thesis, Univ. Durham/Durham, England.

_____. 1973a. Changes in fishing ability of terns associated with windspeed and sea surface conditions. Nature 244: 520-521.

_____. 1973b. Robbing behavior of Roseate Terns. Auk 90: 641-651.

Dunnet, G. M. 1956a. Common Tern, *Sterna hirundo hirundo* L., banded in Sweden and recovered in Australia. CSIRO Wildl. Res. 1: 68.

_____. 1982. Oil pollution and seabird populations. Philos. Trans. R. Soc. Lond. B. Biol. Sci. 297: 413-427.

Dunstan, F. M., R. W. Schreiber and J. J. Dinsmore. 1975. Caspian Tern nesting in Florida, 1973 and 1974. Fla. Field Nat. 3: 16-17.

Dupont, J. E. 1976. South Pacific Birds. Del. Mus. Nat. Hist. Monogr. Ser. 3. 218 pp.

Dusi, J. L. 1968. Feeding interaction between Bonaparte's Gull and Horned Grebes. Auk 85: 129.

Dwight, J., Jr. 1925. The gulls (Laridae) of the world; their plumages, moults, variations, relationships, and distribution. Bull. Am. Mus. Nat. Hist. 52: 63-401.

Dyck, J. 1969. Traekkende dvaegfalk (Falco columbarius) druknet af Mager. [Migrating Merlin (Falco columbarius) drowned by gulls.] Dan. Ornithol. Foren. Tidsskr. 63: 130-131. [In Danish with English summary.]

Easterla, D. A. and D. L. Damman. 1977. Unusual food item of Franklin's Gull. Auk 94: 163.

Eastin, W. C. and D. J. Hoffman. 1978. Biological effects of petroleum on aquatic birds. Pp. 561-582 in C. C. Bates (chairman) Proc. Conf. Assessment of Ecological Impacts of Oil Spills. Am. Inst. Biol. Sci., Arlington, VA. viii and 936 pp.

Eastin, W. C. and H. C. Murray. 1981. Effects of crude oil ingestion on avian intestinal function. Can. J. Physiol. Pharmacol. 59: 1063-1068.

Eaton, R. J. 1933. The migratory movements of certain colonies of Herring Gulls (Larus argentatus smithsonianus Coues) in eastern North America. Bird-Banding 4: 165-176.

_____. 1934a. The migratory movements of certain colonies of Herring Gulls in eastern North America. Part II. Bird-Banding 5: 1-19.

_____. 1934b. The migratory movements of certain colonies of Herring Gulls in eastern North America. Part III. Bird-Banding 5: 70-84.

Eddy, J. 1961. Nesting habits of the Black Tern. Flicker 33: 3-4, 14-15.

Edholm, M. 1978. Notskrika anfallen och dodad av Gratrutar. [Herring Gulls, Larus argentatus, attacking and killing migrating Jay, Garrulus glandarius.] Var Fagelvarld 37: 258-259. [In Swedish with English summary.]

Edscorn, J. B. 1971. Northern Phalarope (Lobipes lobatus) occurrences in central Florida. Fla. Nat. 44: 94.

_____. 1974. The changing seasons; the fall migration: August 1-November 30, 1973; Florida Region. Am. Birds 28: 40-44.

_____. 1975. The changing seasons; the fall migration: August 1-November 30, 1974; Florida Region. Am. Birds 29: 44-48.

_____. 1976. The changing seasons; the fall migration: August 1-November 30, 1975; Florida Region. Am. Birds 30: 54-58.

_____. 1977. The changing seasons; the fall migration: August 1-November 30, 1976; Florida Region. Am. Birds 31: 166-169.

Edscorn, J. B. 1978. The changing seasons; the fall migration: August 1-November 30, 1977; Florida Region. Am. Birds 32: 193-197.

_____. 1979. The changing seasons; the fall migration: August 1-November 30, 1978; Florida Region. Am. Birds 33: 169-171.

Edwards, E. P. 1972. A field guide to the birds of Mexico. E. P. Edwards, Sweet Briar, VA. vi and 300 pp.

Edwards, H. M. 1933. Bridled Tern, a new bird for Alabama. Auk 50: 105.

Elliott, C. C. H. 1971. Analyses of the ringing and recoveries of three migrant terns. Ostrich Suppl. 9: 71-82.

Ellis, L. 1969. Bridled Terns (*Sterna anaethetus*) along the East Coast. Fla. Nat. 42: 40.

Elston, S. F., C. D. Rymal and W. E. Southern. 1978. Intraspecific klepto-parasitism in breeding Ring-billed Gulls. Proc. 1977 Conf. Colonial Waterbird Group 1: 102-109.

Emlen, J. T., Jr. 1956. Juvenile mortality in a Ring-billed Gull colony. Wilson Bull. 68: 232-238.

Emlen, J. T., D. E. Miller, R. M. Evans and D. H. Thompson. 1966. Predator-induced parental neglect in a Ring-billed Gull colony. Auk 83: 677-679.

Ericksen, W. J. 1926. Gull-billed Terns breeding on the coast of Georgia. Auk 43: 533-534.

Erskine, A. J. 1978. The first ten years of the cooperative Breeding Bird survey in Canada. Can. Wildl. Serv. Rep. Ser. 42. 59 pp.

Erwin, R. M. 1971. The breeding success of two sympatric gulls, the Herring Gull and the Great Black-backed Gull. Wilson Bull. 83: 152-158.

_____. 1977a. Foraging and breeding adaptations to different food regimes in three seabirds: the Common Tern, *Sterna hirundo*, Royal Tern *Sterna maxima*, and Black Skimmer, *Rynchops niger*. Ecology 58: 389-397.

_____. 1977b. Black Skimmer breeding ecology and behavior. Auk 94: 709-717.

_____. 1978a. Population and colony site dynamics in selected Massachusetts waterbirds. Proc. 1977. Conf. Colonial Waterbird Group 1: 19-25.

_____. 1978b. Coloniality in terns: the role of social feeding. Condor 80: 211-215.

_____. 1979a. Coastal waterbird colonies: Cape Elizabeth, Maine to Virginia. U.S. Fish Wildl. Serv. Biol. Serv. Progr. FWS/OBS-79/10. 212 pp.

Erwin, R. M. 1979b. Species interactions in a mixed colony of Common Terns (Sterna hirundo) and Black Skimmers (Rynchops niger). Anim. Behav. 27: 1054-1062.

_____. 1980a. Censusing waterbird colonies: some sampling experiments. Trans. Linn. Soc. N.Y. 9: 77-85.

_____. 1981. Censusing waterbird colonies: an update on the "flight-line" count method. Colonial Waterbirds 4: 91-95.

Erwin, R. M. and C. E. Korschgen. 1979. Coastal waterbird colonies: Maine to Virginia, 1977. An atlas showing colony locations and species compositions. U.S. Fish Wildl. Serv. Biol. Serv. Progr. FWS/OBS-79/08. 647 pp.

Erwin, R. M. and J. C. Ogden. 1980. Multiple-factor influences upon feeding flight rates at wading bird colonies (Alias: are flight-line counts useful?). Proc. 1979 Conf. Colonial Waterbird Group 3: 225-234.

Erwin, R. M., J. Galli and J. Burger. 1981. Colony site dynamics and habitat use in Atlantic coast seabirds. Auk 98: 550-561.

Etchecopar, R. D. and F. Hue. 1964. Les Oiseaux du Nord de l'Afrique. Editions N. Boubee & Cie, Paris, France. 606 pp. [In French.]

_____. 1978. Les Oiseaux de Chine de Mongolie et de Coree. Non Passereaux. Editions du Pacifique, Papeete, Tahiti. 585 pp. [In French.]

Evans, R. M. and M. K. McNicholl. 1972. Variations in the reproductive activities of Arctic Terns at Churchill, Manitoba. Arctic 25: 131-141.

Everett, J. J. 1976. Mutual spinning by Red-necked Phalaropes. Brit. Birds 69: 219-220.

Eyster, M. B. 1968. Birds of the Chandeleur Islands. La. Ornithol. Soc. News 49: 5-7.

Faanes, C. F. 1979. Status of the Black Tern in western Wisconsin. Passenger Pigeon 41: 124-128.

Farley, F. L. 1931. Nesting of Bonaparte's Gull (Larus philadelphia) in central Alberta. Can. Field-Nat. 45: 138-139.

Feare, C. J. 1975. Post-fledging parental care in Crested and Sooty Terns. Condor 77: 368-370.

_____. 1976a. Desertion and abnormal development in a colony of Sooty Terns Sterna fuscata infested by virus-infected ticks. Ibis 118: 112-115.

Feare, C. J. 1976b. The breeding of the Sooty Tern *Sterna fuscata* in the Seychelles and the effects of experimental removal of its eggs. J. Zool. (Lond.) 79: 317-360.

Fetterolf, P. M. 1979a. Common Garter Snake predation on Ring-billed Gull chicks. Can. Field-Nat. 93: 317-318.

_____. 1981. Reproductive performance of minimally disturbed Ring-billed Gulls. (Abstract only.) Colonial Waterbirds 4: 68.

ffrench, R. 1973. A guide to the birds of Trinidad and Tobago. Livingston Publ. Co., Wynnegood, PA. xix and 470 pp.

Finch, D. W. 1968. The changing seasons; the nesting season: June 1-August 15, 1968; Northeastern Maritime Region. Audubon Field Notes 22: 586-590.

Fisher, D., J. Hubbard and P. DeBenedictis. 1966. First Michigan specimens of the Little Gull and Franklin's Gull. Jack-Pine Warbler 44: 50.

Fisk, E. J. 1974 ms. Atlantic coast Least Tern survey. 27 pp. [Typescript ms. in the files of the Museum Section, Denver Wildl. Res. Cent., U.S. Fish Wildl. Serv., Washington, D. C.]

_____. 1975. Least Tern: beleaguered, opportunistic and roof-nesting. Am. Birds 29: 15-16.

_____. 1978a. Roof-nesting terns, skimmers, and plovers in Florida. Fla. Field Nat. 6: 1-8.

_____. 1978b. Least Tern. Pp. 40-43 *in* H. W. Kale, II (ed.). Rare and endangered biota of Florida. Vol. 2: Birds. Univ. Presses of Florida, Gainesville, FL. xix and 121 pp.

Floyd, C. B. 1927. Notes on the development of young Common and Roseate Terns. Bull. N.E. Bird-Banding Assoc. 3: 95-101.

_____. 1930. Further banding notes from Tern Island, Massachusetts. Bird-Banding 1: 181-184.

_____. 1932a. Strange disappearance of nesting Penikese Island terns. Bird-Banding 3: 173-174.

Food and Agricultural Organization of the United Nations (FAO). 1977. IMCO/UNESCO/WMO/WHO/IAEA/UN Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP), impact of oil on the marine enviroment. Rep. Stud. GESAMP 6. 250 pp.

Forbush, E. H. 1924. Gulls and terns feeding on the Seventeen-year Cicada. Auk 41: 468-470.

Ford, J. 1961. Additional records of the Gull-billed Tern in Western Australia. West. Austr. Nat. 7: 208.

Ford, R. G., J. A. Wiens, D. Heinemann and G. L. Hunt. 1982. Modelling the sensitivity of colonially breeding marine birds to oil spills: guillemot and kittiwake populations on the Pribilof Islands, Bering Sea. J. Appl. Ecol. 19: 1-31.

Forsberg, B. 1979. Havstrut som naringsparasit pa hagar. [Great Black-backed Gull Larus marinus kleptoparasitizing heron, Ardea cinerea.] Var Fagelvarld 38: 107. [In Swedish with English summary.]

Forssgren, K. 1981. The kleptoparasitic behaviour of the Arctic Skua Stercorarius parasiticus and the Lesser Black-backed Gull Larus fuscus with the Caspian Tern Hydroprogne caspia. [Abstract only.] Mem. Soc. Fauna Flora Fenn. 57: 5.

Forsythe, D. M. 1972. Ring-billed and Herring Gull recoveries from South Carolina. Bird-Banding 43: 276-281.

_____. 1973. Gull populations at Charleston, S.C., June 1971 to June 1972. Chat 37: 57-62.

_____. 1974a. An ecological study of gull populations to reduce the bird-aircraft strike hazard at Charleston Air Force Base. Air Force Weapons Lab. Tech. Rep. 73. 142 pp.

_____. 1974b. Gulls, solid waste disposal, and the bird-aircraft strike hazard. Pp. 17-25 in S. A. Gauthreaux, Jr. (ed.). A conference on the biological aspects of the bird/aircraft collision problem. Clemson Univ., Clemson, SC., 5-7 Feb. 1974. Dep. Zool., Clemson Univ. xi and 513 pp.

Fountain, M. 1975. Nesting failure of Black Skimmers on Little St. Simons Island, Ga. Oriole 40: 11-12.

French, T. W. 1982. Piracy by a Great Black-backed Gull on a shark. Wilson Bull. 94: 96.

Fritts, T. H., L. A. Collum and R. Jennings. 1982 ms. The distribution and abundance of selected marine birds in the Gulf of Mexico and nearby Atlantic Ocean on the basis of aerial surveys. U.S. Fish Wildl. Serv. Denver Wildl. Res. Cent., Tulane Univ. Mus. Nat. Hist., Belle Chasse, LA. 45 pp.

Frohling, R. C. 1965. American Oystercatcher and Black Skimmer nesting on salt marsh. Wilson Bull. 77: 193-194.

_____. 1967. Bonaparte's Gull feeding on walnut meat. Wilson Bull. 79: 341.

Fry, C. H. 1961. Notes on the birds of Annobon and other islands in the Gulf of Guinea. Ibis 103a: 267-276.

Fry, V. 1948. Another Common Tern nest with seven eggs. Auk 65: 604-605.

Fuchs, E. 1977a. Kleptoparasitism of Sandwich Terns Sterna sandvicensis by Black-headed Gulls Larus ridibundus. Ibis 119: 183-190.

_____. 1977b. Predation and anti-predator behavior in a mixed colony of terns Sterna spp. and Black-headed Gulls Larus ridibundus with special reference to the Sandwich Tern Sterna sandvicensis. Ornis Scand. 8: 17-32.

Fussell, J. 1974. Forster's Tern nest found near Cape Lookout, N.C. Chat 38: 24.

Fussell, J. O., III, and A. Allen-Grimes. 1980. Bird sightings associated with Hurricane David. Chat 44: 89-100.

Fussell, J. O., III, T. L. Quay and R. J. Hader. 1981. Sooty Tern nest found near Cape Lookout, N.C. Am. Birds 35: 236.

Gamble, G. 1959. Great Black-backed Gull attacking migrant Blackbird. Brit. Birds 52: 164.

Gandy, D. E. and W. H. Turcotte. 1970. Catalog of Mississippi bird records. Vol. I. Miss. Game Fish Comm. xix and 105 pp.

Garmon, L. 1980. Autopsy of an oil spill. Sci. News 118: 267-270.

Gates, L. J. 1976. Northern Phalarope in Hattiesburg, Mississippi. Mississippi Kite 6: 37.

_____. 1977. (comp.). Hattiesburg, Miss. The 77th Audubon Christmas Bird Count. Am. Birds 31: 654.

Gates, L. J. and T. Fairley. 1979. Bridled Tern: first observation of a live bird in Mississippi. Mississippi Kite 9: 40-41.

Gates, L. J. and J. Runzo. 1978. A Red Phalarope in Hattiesburg, Mississippi. Mississippi Kite 8: 2.

Gauzer, M. E. 1981. [Socially conditioned mortality of nestlings in the Thalasseus sandvicensis colonies on the Krasnovodsk Bay islands. 1. General characterisitics of juvenile mortality and its possible causes.] Zool. Zh. 60: 530-539. [In Russian with English summary.]

Gerrard, J. M. and D. W. A. Whitfield. 1971. Breeding distribution of Forster's Tern in the prairie provinces. Blue Jay 29: 19-22.

Gibson, D. D. and S. O. MacDonald. 1971. The changing seasons; the nesting season: June 1-August 15, 1971; Alaska Region. Am. Birds 25: 893-895.

Gibson, R. 1966. Oil pollution and its effect on birds in southeast Kent. Seabird Bull. 2: 67-69.

Gilbertson, M. 1974a. Pollutants in breeding Herring Gulls in the lower Great Lakes. Can. Field-Nat. 88: 273-280.

Gilbertson, M. and R. Hale. 1974a. Characteristics of the breeding failure of a colony of Herring Gulls in Lake Ontario. Can. Field-Nat. 88: 356-358.

Gill, G. 1953. An unusual nest of the Common Tern (Sterna hirundo). Auk 70: 80.

Gill, R. E., Jr. 1976. Notes on the foraging of nesting Caspian Terns Hydroprogne caspia (Pallas). Calif. Fish Game 62: 155.

_____. 1977. Breeding avifauna of the South San Francisco Bay Estuary. West. Birds 8: 1-12.

Gill, R., Jr. and L. R. Mewaldt. 1979. Dispersal and migratory patterns of San Francisco Bay produced herons, egrets, and terns. N. Am. Bird Bander 4: 4-13.

Gillespie, J. A. 1931. Rynchops nigra, the Black Skimmer: some returns and recoveries. Bird-Banding 2: 52-58.

Gillespie, M. 1961. Travels of Herring Gulls. EBBA News 24: 88.

Gilman, A. P., G. A. Fox, D. B. Peakall, S. M. Teeple, T. R. Carroll and G. T. Haymes. 1977. Reproductive parameters and egg contaminant levels of Great Lakes Herring Gulls. J. Wildl. Manage. 41: 458-468.

Glegg, W. E. 1925a. On the nesting of the Gull-billed Tern in the Camargue. Brit. Birds 18: 202-209.

Gloe, P. 1974. Die Lachseeschwalbe (Gelochelidon nilotica) im Dithmarschen. Ornithol. Mitt. 26: 47-51. [In German.]

Glutz von Blotzheim, U. N., K. M. Bauer and E. Bezzel. 1977. Handbuch der Vogel Mitteleuropas. Band 7. Charadriiformes (2 Teil). Akademische Verlagsgesellschaft, Wiesbaden. 893 pp. [In German.]

Gochfeld, M. 1974a. Waterbird colonies of Long Island, New York. 2. Wantagh Parkway colony. Kingbird 24: 47-50.

_____. 1976. Waterbird colonies of Long Island, New York. 3. Cedar Beach ternery. Kingbird 26: 62-80.

Gochfeld, M. 1978a. Colony and nest site selection by Black Skimmers. Proc. 1977 Conf. Colonial Waterbird Group 1: 78-90.

_____. 1978b. Observations on feeding ecology and behavior of Common Terns. Kingbird 28: 84-90.

_____. 1979a. Prevalence of oiled plumage of terns and skimmers on western Long Island, New York: baseline data prior to petroleum exploration. Environ. Pollut. 20: 123-130.

_____. 1980a. Tissue distribution of mercury in normal and abnormal young Common Terns. Mar. Pollut. Bull. 11: 362-366.

_____. 1980b. Learning to eat by young Common Terns: consistency of presentation as an early cue. Proc. 1979 Conf. Colonial Waterbird Group 3: 108-118.

_____. 1981a. Differences in behavioral responses of young Common Terns and Black Skimmers to intrusion and handling. Colonial Waterbirds 4: 47-53.

_____. 1983. The Roseate Tern: world distribution and status of a threatened species. Biol. Conserv. 25: 103-125.

Gochfeld, M. and D. B. Ford. 1974. Reproductive success in Common Tern colonies near Jones Beach, Long Island, New York, in 1972: a hurricane year. Proc. Linn. Soc. N.Y. 72: 63-76.

Godfrey, W. E. 1966. The birds of Canada. Natl. Mus. Can. Bull. 203. 408 pp.

Goethe, F. 1956a. Die Silbermowe. Wittenberg Lutherstadt: A. Ziemsen Verlag. 95 pp. [In German.]

_____. 1970. Black Terns feeding after ploughs. Brit. Birds 63: 34.

Goldman, L. C. and F. Watson. 1952. The changing seasons; the fall migration: August 16-November 30, 1951; South Texas Region. Audubon Field Notes 6: 26-29.

_____. 1953a. The changing seasons; the fall migration: August 16-November 30, 1952; South Texas Region. Audubon Field Notes 7: 39-40.

_____. 1953b. The changing seasons; the winter season: December 1, 1952-March 31, 1953; South Texas Region. Audubon Field Notes 7: 223-225.

Goldman, P. 1971. Herring Gull predation on common water snake in Lake Erie. Wilson Bull. 83: 196-197.

Gorski, W., B. Jakuczun, C. Nitecki and A. Petryna. 1977. Badania smiertelnosci ptakow wodnych z powodu zanieczyszcen ropopochodnych ni polskim wybrzezu Battyku w sezonie 1974/1975. [The investigation on the oil pollution on the Polish Baltic coast in 1974/1975.] Przegl. Zool. 21: 20-23. [In Polish with English summary.]

Gould, G. I., Jr. 1974. Breeding success of piscivorous birds at Eagle Lake, California. M.S. thesis, Humboldt State Univ./Arcata, CA.

Gould, P. J. 1967. Nocturnal feeding of Sterna fuscata and Puffinus pacificus. Condor 69: 529.

_____. 1974. Sooty Tern (Sterna fuscata). Pp. 6-52 in W. B. King (ed.). Pelagic studies of seabirds in the central and eastern Pacific Ocean. Smithson. Contrib. Zool. 158.

Grace, J. W. 1980. Kleptoparasitism by Ring-billed Gulls of wintering waterfowl. Wilson Bull. 92: 246-248.

Grandjean, P. 1981. Praeriemage Larus pipixcan ved Faeroerne 1976. Dan. Ornithol. Foren. Tidsskr. 75: 146-147. [In Danish with English summary.]

Grant, G. S. 1973. Second Bridled Tern specimen from North Carolina. Chat 37: 23-24.

_____. 1979. Ring-billed Gulls feeding on date fruits. Condor 81: 432-433.

Grant, G. S. and N. Hogg. 1976. Behavior of late-nesting Black Skimmers at Salton Sea, California. West. Birds 7: 73-80.

Grant, P. J. 1978. Field identification of west Palearctic gulls. Brit. Birds 71: 145-176.

_____. 1979. Field identification of west Palearctic gulls. Part 2. Common, Mediterranean, Ring-billed, Laughing and Franklin's Gulls. Brit. Birds 72: 142-182.

Grant, R. H. 1963. Bridled Terns off the North Carolina coast. Chat 27: 21-22.

Green, L. L. and H. W. Kale, II. 1976. Roof nesting by Black Skimmers. Fla. Field Nat. 4: 15-17.

Greenwood, J. J. D. and J. P. F. Keddie. 1968. Birds killed by oil in the Tay Estuary, March and April 1968. Scott. Birds 5: 189-196.

Greenwood, J. J. D., R. J. Donally, C. J. Feare, N. J. Gordon and G. Waterston. 1971. A massive wreck of oiled birds: northeast Britain, winter 1970. Scott. Birds 6: 235-250.

Grey, J. 1940. Unusual records in 1939. Chat 4: 1-5.

Grimes, S. A. 1951. Tern and tropic bird records from northeastern Florida. Fla. Nat. 24: 30-31.

Grinnell, J. 1919. Notes on the Elegant Tern as a bird of California. Condor 21: 230-234.

Gross, W. A. O. 1935. The life history cycle of Leach's Petrel (*Oceanodroma leucorhoa leucorhoa*) on the outer sea islands of the Bay of Fundy. Auk 52: 382-399.

_____. 1937. Birds of the Bowdoin-MacMillan Arctic Expedition. Auk 54: 12-42.

Gross, [W.] A. O. 1940. The migration of Kent Island Herring Gulls. Bird-Banding 11: 129-155.

_____. 1944. Herring Gull recoveries. Bowdoin Coll. Bull. 9. Brunswick, ME.

Guay, J. W. 1968. The breeding biology of Franklin's Gull (*Larus pipixcan*). Ph.D. thesis, Univ. Alberta/Edmonton, AB. 119 pp.

Gudmundsson, F. 1954. Islenzkir fuglar. X. Svartbakur (*Larus marinus* L.). [Icelandic birds. X. The Great Black-backed Gull (*Larus marinus* L.).] Natturufraedingurinn 24: 177-183. [In Icelandic with English summary.]

_____. 1956. Islenzikir fuglar. XIV. Kria (*Sterna paradisaea*). [Icelandic Birds. XIV. The Arctic Tern (*Sterna paradisaea*).] Natturufraedingurinn 26: 206-217. [In Icelandic with English summary.]

Hafner, J., A. Johnson and J. Walmsey. 1980. Compte rendu ornithologique Camarguais pour les annees 1978 et 1979. Terre Vie 34: 621-647. [In French with English summary.]

Hagar, J. 1937. Least Tern studies--1935 and 1936. Bull. Mass. Audubon Soc. 21: 5-8.

_____. 1946. Black Skimmer breeding in Massachusetts. Auk 63: 594-595.

Hahn, D. G. 1981. Asynchronous hatching in the Laughing Gull: cutting losses and reducing rivalry. Anim. Behav. 29: 421-427.

Hailman, J. P. 1960a. Ring-billed Gulls following the plow. Raven 31: 109.

_____. 1960b. Destruction of Pea Island Laughing Gull colony in 1960. Chat 24: 98.

_____. 1963. Herring Gull extends breeding range south to North Carolina. Auk 80: 375-376.

Hainard, R. 1959. Les canards savent eviter l'huile. Nos Oiseaux 25: 62. [In French.]

Halliday, K. C. R. 1977. Great Black-backed Gull killing Wigeon. Scott. Birds 9: 348.

Hallman, R. C. 1960. Gull-billed Tern (Gelochelidon nilotica) nesting in Gulf County, Florida. Fla. Nat. 33: 224.

Hamilton, R. B. 1974. The changing seasons; the winter season: December 1, 1973-March 31, 1974; Central Southern Region. Am. Birds 28: 649-653.

______. 1975. The changing seasons; the winter season: December 1, 1974-March 31, 1975; Central Southern Region. Am. Birds 29: 700-705.

______. 1976. The changing seasons; the winter season: December 1, 1975-March 31, 1976; Central Southern Region. Am. Birds 30: 728-732.

______. 1977. The changing seasons; the winter season: December 1, 1976-February 28, 1977; Central Southern Region. Am. Birds 31: 339-343.

______. 1978. The changing seasons; the winter season: December 1, 1977-February 28, 1978; Central Southern Region. Am. Birds 32: 361-365.

______. 1979. The changing seasons; the winter season: December 1, 1978-February 28, 1979; Central Southern Region. Am. Birds 33: 287-290.

______. 1980. The changing seasons; the winter season: December 1, 1979-February 29, 1980; Central Southern Region. Am. Birds 34: 279-282.

Hamilton, R. E. 1969. Summary of Christmas Bird Counts on Sapelo Island, 1958-68. Oriole 34: 33-34.

Harber, D. D. and M. Johns. 1947. Great Black-backed Gull dropping rat. Brit. Birds 40: 317.

Hardin, W. D. 1971. Ring-billed Gull steals fish from coot. Bull. Okla. Ornithol. Soc. 4: 5-6.

Hardy, A. V. 1974. The climate of North Carolina. Pp. 281-299 in National Oceanic and Atmospheric Administration, U.S. Dep. Commerce. Climates of the states. Vol. I--eastern states. Water Information Center Inc., Port Washington, NY. 486 pp.

Hardy, J. W. 1957. The Least Tern in the Mississippi Valley. Publ. Mus. Mich. State Univ. Biol. Ser. 1: 1-60.

Harper, S. A. 1950. Ring-billed Gulls feeding on fruit of cabbage palmetto. Auk 67: 236-237.

Harrington, B. A. 1974. Colony visitation behaviour and breeding ages of Sooty Terns (Sterna fuscata). Bird-Banding 45: 115-144.

Harrington-Tweit, B. 1979. A seabird die-off on the Washington coast in mid-winter 1976. West. Birds 10: 49-56.

Harris, M. P. 1964a. Aspects of the breeding biology of the gulls Larus argentatus, L. fuscus, and L. marinus. Ibis 106: 432-456.

_____. 1965. The food of some Larus gulls. Ibis 107: 43-53.

_____. 1975. Additions to the Galapagos avifauna. Condor 77: 355.

Harris, M. P. and C. S. Lloyd. 1977. Variations in counts of seabirds from photographs. Brit. Birds 70: 200-205.

Harrison, C. S. and T. S. Hida. 1980. The status of seabird research in the Northwestern Hawaiian Islands. Pp. 17-31 in R. W. Grigg and R. T. Pfund (eds.). Proc. Symp. on Status of Resource Investigations in the Northwestern Hawaiian Islands. Sea Grant Misc. Rep. UNIHI-SEAGRANT-MR-80-04.

Harrison, C. S. and D. Stoneburner. 1979. Radiotelemetry of the Brown Noddy (Anous stolidus) of Manana Island (Oahu), Hawaii. (Abstract only.) Pac. Seabird Group Bull. 6: 45.

Harrison, G. R. 1979. Franklin's Gull in Norfolk. Brit. Birds 72: 476-478.

Harrison, J. G. and W. F. A. Buck. 1967. Peril in perspective. An account of oil pollution in the Medway Estuary. Kent Bird Rep. 16, Spec. Suppl. 24 pp.

Harrisson, T. H. and H. G. Hurrell. 1933. Numerical fluctuations of the Great Black-backed Gull (Larus marinus Linn.) in England and Wales. Proc. Zool. Soc. Lond. 103: 191-209.

Hartley, C. H. and J. Fisher. 1936. The marine foods of birds in an inland fjord region in West Spitsbergen. Part 2. Birds. J. Anim. Ecol. 5: 370-389.

Hartman, F. A. 1955. Heart weights in birds. Condor 57: 221-238.

Hartung, R. 1965. Some effects of oiling on reproduction of ducks. J. Wildl. Manage. 29: 872-874.

Hatch, J. J. 1970. Predation and piracy by gulls at a ternery in Maine. Auk 87: 244-254.

_____. 1975. Piracy by Laughing Gulls Larus atricilla: an example of the selfish group. Ibis 117: 357-365.

Haverschmidt, F. 1969. Black Terns taking flies disturbed from dung. Brit. Birds 62: 156.

_____. 1978. Die Trauerseeschwalbe Chlidonias niger. [The Black Tern Chlidonias niger.] Die Neue Brehm-Bucheri. A. Ziemsen Verlag, Wittenberg Lutherstadt. 74 pp. [In German.]

Hawksley, O. 1957. Ecology of a breeding population of Arctic Terns. Bird-Banding 28: 57-92.

Hay, K. G. 1979. Petroleum industry's role in marine bird conservation. Pp. 251-258 in J. C. Bartonek and D. N. Nettleship (eds.). Conservation of marine birds of North America. U.S. Fish Wildl. Serv. Wildl. Res. Rep. 11. ix and 319 pp.

Haycock, K. A. and W. Threlfall. 1975. The breeding biology of the Herring Gull in Newfoundland. Auk 92: 678-697.

Haymes, G. T. and H. Blokpoel. 1978a. Reproductive success of larids nesting on the Eastern Headland of the Toronto Outer Harbour in 1977. Ont. Field Biol. 32: 1-17.

_____. 1978b. Food of Ring-billed Gull chicks at the Eastern Headland of the Toronto Outer Harbour in 1977. Can. Field-Nat. 92: 393-395.

_____. 1978c. Seasonal distribution and site tenacity of the Great Lakes Common Tern. Bird-Banding 49: 142-151.

_____. 1980. The influence of age on the breeding biology of Ring-billed Gulls. Wilson Bull. 92: 221-228.

Hays, H. 1970a. Common Terns pirating fish on Great Gull Island. Wilson Bull. 82: 99-100.

_____. 1970b. Great Gull Island report on nesting species 1967-68. Proc. Linn. Soc. N.Y. 71: 105-119.

Hays, H., E. Dunn and A. Poole. 1973. Common, Arctic, Roseate, and Sandwich Terns carrying multiple fish. Wilson Bull. 85: 233-236.

Hays, M. B. 1979. First record of the Bridled Tern in Mississippi. Mississippi Kite 9: 39.

_____. 1980. Breeding biology of the Least Tern, Sterna albifrons, on the Gulf coast of Mississippi. M.S. thesis, Mississippi State Univ./Mississippi State, MS. ix and 69 pp.

Hebard, F. F. 1940. Roseate Tern in Western Camden County. Oriole 5: 48, 53.

Hebard, F. V. 1952. Sight record of Arctic Tern in Florida. Fla. Nat. 25: 126.

Heinroth, O. and M. Heinroth. 1928. Die Vogel Mitteleuropas. Vol. 3. Berlin.

Helminen, M. 1959. A nest probably common to two pairs of Common Tern (Sterna hirundo). Ornis Fenn. 36: 42-44.

Helmuth, W. T. 1920. Extracts from notes made while in Naval Service. Auk 37: 255-261.

Henderson, A. D. 1926. Bonaparte's Gull nesting in northern Alberta. Auk 43: 288-294.

Herman, J. F., R. A. Schmidt and K. J. Wilson. 1978. First nesting record of the Caspian Tern in North Dakota. Prairie Nat. 10: 23-24.

Hickey, J. J. 1952. Survival studies of banded birds. U.S. Fish Wildl. Serv. Spec. Sci. Rep. Wildl. 15. 177 pp.

Hildon, O. and S. Vuolanto. 1972. Breeding biology of the Red-necked Phalarope Phalaropus lobatus in Finland. Ornis Fenn. 49: 57-85.

Hinchman, R. M. 1934. A few Herring Gull recoveries. Bird-Banding 5: 189-190.

Hitchcock, W. B. 1965. Geography and seasonal movements of the Common Tern in Australia. Emu 64: 157-171.

Hitchcock, W. B. and N. J. Favaloro. 1951. Victorian records of Sterna striata Gm. and Sterna hirundo longipennis Nordm. Mem. Nat. Hist. Mus. Melbourne Vict. 17: 207-214.

Hobbs, J. N. 1959. Gulls attacking migrant thrushes. Brit. Birds 52: 313.

_____. 1975. Nests of the Gull-billed Tern. Austr. Bird Watcher 6: 117.

_____. 1976. Birds feeding on house mice. Emu 76: 219-220.

Hodges, M. F. and J. A. Toups. 1981. A flock of Franklin's Gulls in Bay St. Louis, Mississippi. Mississippi Kite 11: 17.

Hoffman, D. J. and W. C. Eastin, Jr. 1981. Effects of industrial effluents, heavy metals, and organic solvents on Mallard embryo development. Toxicol. Lett. 9: 35-40.

Hoffman, W., W. B. Robertson, Jr., and P. C. Patty. 1979. Short-eared Owl on Bush Key, Dry Tortugas, Florida. Fla. Field Nat. 7: 29-30.

Hofslund, P. B. 1959. Fall migration of Herring Gulls from Knife Island, Minnesota. Bird-Banding 30: 104-114.

Hohn, E. O. 1965. Die Wassertreter. Neue Brehm-Bucheri 359. Ziemsen Verlag, Wittenberg. 60 pp.

_____. 1966. Ringing (banding) and recoveries of phalaropes--a summary of presently available information. Bird-Banding 37: 197-200.

Hohn, E. O. 1968. Some observations on the breeding of Northern Phalaropes at Scammon Bay, Alaska. Auk 85: 316-317.

_____. 1969. The phalarope. Sci. Am. 220: 104-111.

_____. 1971. Observations on the breeding behaviour of Grey and Red-necked Phalaropes. Ibis 113: 335-348.

Holmes, W. N. and J. Cronshaw. 1977. Biological effects of petroleum on marine birds. Pp. 359-398 in D. C. Malins (ed.). Effects of petroleum on arctic and subarctic marine environments and organisms. Academic Press, New York, NY. 500 pp.

Holt, E. G. 1924. Phalaropus fulicarius: a new bird for Alabama. Auk 41: 601.

Hope-Jones, P., J.-Y. Monat, C. J. Cadbury and T. J. Stowe. 1978. Birds oiled during the AMOCO CADIZ incident--an interim report. Mar. Pollut. Bull. 9: 307-310.

Hopkins, C. D. and R. H. Wiley. 1972. Food parasitism and competition in two terns. Auk 89: 583-594.

Houde, P. 1977a. Low productivity of terns on Hicks Island, 1975. Proc. Linn. Soc. N.Y. 73: 49-57.

_____. 1977b. Gull-tern interactions on Hicks Island, 1975. Proc. Linn. Soc. N.Y. 73: 58-64.

Houston, C. S. 1962. Common Tern recovery from Cook Islands. Blue Jay 20: 58-59.

_____. 1963. Common Tern recovery from the Cook Islands. Bird-Banding 34: 160-161.

_____. 1972. Recoveries of Saskatchewan Common Terns. Blue Jay 30: 216-217.

Howell, A. H. 1928. Birds of Alabama. Ala. Dep. Game Fish, Montgomery, AL. 383 pp.

_____. 1932. Florida bird life. Fla. Dep. Game Fish, Montgomery, AL. 597 pp.

Hubbard, J. P. 1970. Check-list of the birds of New Mexico. N. M. Ornithol. Soc. Publ. 3. 108 pp.

Hubbard, L. S. 1959. Observations at Key West. Fla. Nat. 32: 202, 211.

Hulsman, K. 1974. Notes on the behaviour of terns at One Tree Island. Sunbird 5: 44-49.

Hulsman, K. 1976. The robbing behavior of gulls and terns. Emu 76: 143-149.

_____. 1977a. Breeding success and mortality of terns at One Tree Island, Great Barrier Reef. Emu 77: 49-60.

_____. 1980. Feeding and breeding strategies of sympatric terns on tropical islands. Proc. Internatl. Ornithol. Congr. 17: 984-988.

Hume, P. A. 1973. Ring-billed Gull in Glamorgan: a species new to Britain and Ireland. Brit. Birds 66: 509-512.

Hundley, M. H. and F. Hames. 1960-62. Birdlife of the Lower Florida Keys. Fla. Nat. 33: 14-24, 56, 91-94, 149-155, 209-214; 34: 25-34, 74-80, 128-135, 164, 203-207; 35: 17-19, 30, 55-56, 78-81, 123-128.

Hunn, E. S. and P. W. Mattocks, Jr. 1978. The changing seasons; the winter season: December 1, 1977-February 28, 1978; Northern Pacific Coast Region. Am. Birds 32: 390-394.

Hunt, G. L., Jr. 1972a. Influence of food distribution and human disturbance on the reproductive success of Herring Gulls. Ecology 53: 1051-1061.

Hunt, G. L., Jr. and M. W. Hunt. 1973. Habitat partitioning by foraging gulls in Maine and northwestern Europe. Auk 90: 827-839.

Hunter, M. L., Jr. 1975. Least Tern breeding range extension in Maine. Auk 92: 143-145.

Hunter, R. A. 1976. A study of selected factors influencing the reproductive success of the Common Tern (Sterna hirundo) at Port Colborne, Ontario, in 1973 and 1974. M.S. thesis, Brock Univ./St. Catharines, ON. 132 pp.

Hunter, R. A. and R. D. Morris. 1976. Nocturnal predation by a Black-crowned Night Heron at a Common Tern colony. Auk 93: 629-633.

Hutchinson, A. E. 1980. Estimating numbers of colonially nesting seabirds: a comparison of techniques. Proc. 1979 Colonial Waterbird Group 3: 235-244.

Hutson, A. M. 1975. Observations on the birds of Diego Garcia, Chagos Archipelago, with notes on other vertebrates. Atoll Res. Bull. 175. 25 pp.

Imhof, T. A. 1960. The changing seasons; the nesting season: June 1-August 15, 1960; Central Southern Region. Audubon Field Notes 14: 454-456.

_____. 1962a. The changing seasons; the fall migration: August 16-November 30, 1961; Central Southern Region. Audubon Field Notes 16: 473-475.

_____. 1962b. Alabama birds. State of Alabama, Dep. of Conserv. Univ. of Alabama Press, Montgomery, AL. xxx and 591 pp.

Imhof, T. A. 1969. The changing seasons; the spring migration: April 1-May 31, 1969; Central Southern Region. Audubon Field Notes 23: 597-601.

_____. 1971. The changing seasons; the spring migration: April 1-May 31, 1971; Central Southern Region. Audubon Field Notes 25: 753-758.

_____. 1972. The changing seasons; the spring migration: April 1-May 31, 1972; Central Southern Region. Am. Birds 26: 769-774.

_____. 1973. The changing seasons; the spring migration: April 1-May 31, 1973; Central Southern Region. Am. Birds 27: 782-785.

_____. 1974. The changing seasons; the spring migration: April 1-May 31, 1974; Central Southern Region. Am. Birds 28: 810-814.

_____. 1976a. The changing seasons; the spring migration: April 1-May 31, 1976; Central Southern Region. Am. Birds 30: 851-855.

_____. 1976b. Alabama birds. 2nd edition. Univ. Alabama Press, Montgomery, AL. xv and 445 pp.

_____. 1977. The changing seasons; the spring migration: March 1-May 31, 1977; Central Southern Region. Am. Birds 31: 1010-1013.

_____. 1978. The changing seasons; the spring migration: March 1-May 31, 1978; Central Southern Region. Am. Birds 32: 1017-1021.

_____. 1979. The changing seasons; the spring migration: March 1-May 31, 1979; Central Southern Region. Am. Birds 33: 779-781.

Ingolfsson, A. 1967. The feeding ecology of five species of large gulls (Larus) in Iceland. Ph.D. thesis, Univ. Michigan/Ann Arbor, MI. xii and 186 pp.

_____. 1969a. Behaviour of gulls robbing eiders. Bird Study 16: 45-52.

_____. 1976. The feeding habits of Great Black-backed Gulls, Larus marinus, and Glaucous Gulls, L. hyperboreus, in Iceland. Acta Nat. Isl. 24. 19 pp.

Ingolfsson, A. and B. T. Estrella. 1978. The development of shell-cracking behavior in Herring Gulls. Auk 95: 577-579.

International Council for Bird Protection, British Section (ICBP). 1960. Pp. 16-21 in Annual Report for 1960. London, England.

Isenmann, P. 1972a. Aire de repartition de la Sterne caugek Sterna sandvicensis en Mediterranee et donnees sur la biologie en Camargue. Nos Oiseaux 31: 150-162. [In French with English summary.]

Jackson, J. A. (comp.). 1976a. Birds around the state. Mississippi Kite 6: 14-19.

_____. 1981. Birds around the state: June 1980-May 1981. Mississippi Kite 11: 18-34.

Jackson, J. A. and C. D. Cooley (comps.). 1978a. Birds around the state - December 1977 through November 1978. Mississippi Kite 8: 48-64.

_____. 1978b. The changing seasons; the nesting season: June 1-July 31, 1978; Central Southern Region. Am. Birds 32: 1171-1175.

_____. 1979. The changing seasons; the nesting season: June 1-July 31, 1979; Central Southern Region. Am. Birds 33: 869-872.

Jackson, J. A. and C. D. Cooley. 1980. A Noddy Tern from Horn Island, Mississippi. Mississippi Kite 10: 4-5.

Jackson, J. A. and B. Schardien. 1980. Birds around the state: August 1979-May 1980. Mississippi Kite 10: 10-20.

Jackson, J. A. and W. C. Weber (comps.). 1976. Birds around the state - winter 1976-77. Mississippi Kite 6: 47-54.

Jackson, J. A., C. D. Cooley and B. J. Schardien. 1978. Sooty Terns on Horn Island, Mississippi. Mississippi Kite 8: 42.

Jackson, J. A., B. J. Schardien and C. D. Cooley. 1979 ms a. Dispersion, phenology, and population sizes of nesting colonial seabirds on the Mississippi Gulf coast. 13 pp.

_____. 1979 ms b. Status review of endangered and threatened species of Gulf Islands National Seashore, Mississippi. 16 pp.

_____. 1980. Dispersion, phenology, and population sizes of nesting colonial seabirds on the Mississippi Gulf coast. Proc. 1979 Colonial Waterbird Group 3: 145-155.

Jacobs, S. 1975. The Black Tern near Perth. West. Austr. Nat. 13: 61-62.

James, D. and F. C. James. 1961. The changing seasons; the nesting season: June 1-August 15, 1961; Central Southern Region. Audubon Field Notes 15: 473-475.

James, F. C. 1962. The changing seasons; the winter season: December 1, 1961-March 31, 1962; Central Southern Region. Audubon Field Notes 16: 336-339, 342.

_____. 1964. The changing seasons; the winter season: December 1, 1963-March 31, 1964; Central Southern Region. Audubon Field Notes 18: 361-364.

James, F. C. 1968. The changing seasons; the winter season: December 1, 1967-March 31, 1968; Central Southern Region. Audubon Field Notes 22: 445-448.

_____. 1970. The changing seasons; the winter season: December 1, 1969-March 31, 1970; Central Southern Region. Am. Birds 24: 511-515.

_____. 1972. The changing seasons; the winter season: December 1, 1971-March 31, 1972; Central Southern Region. Am. Birds 26: 614-619.

Jarvis, W. L. and W. E. Southern. 1976. Food habits of Ring-billed Gulls breeding in the Great Lakes region. Wilson Bull. 88: 621-631.

Jehl, J. R. 1971. Patterns of hatching success in subarctic birds. Ecology 52: 169-173.

Jehl, J. R. and B. A. Smith. 1970. Birds of the Churchill region, Manitoba. Manit. Mus. Man Nat. Spec. Publ. 1. 86 pp.

Jensen, P. V. 1946. Nogle Iagttagelser over Sandternens (*Gelochelidon nilotica* (Gm.)) biologi. [Observations on the biology of the Gull-billed Tern, *Gelochelidon nilotica* (Gm.).] Dan. Ornithol. Foren. Tidsskr. 40: 80-96. [In Danish with English summary.]

Jensen, R. A. C. and H. W. Berry. 1972. The Black Tern *Chlidonias nigra* (L.) in South West Africa. Madoqua (Ser. I) 5: 53-56.

Jernigan, L. S., Jr., R. E. Soots, Jr., J. F. Parnell and T. L. Quay. 1978. Nesting habitats and breeding populations of the Least Tern (*Sterna albifrons antillarum*) in North Carolina. Univ. N. C. Contrib. Mar. Sci. 814. vii and 39 pp.

Joensen, A. H. 1973. Danish seabird disasters in 1972. Mar. Pollut. Bull. 4: 117-118.

Joensen, A. H. and E. B. Hansen. 1977. Oil pollution and seabirds in Denmark 1971-1976. Dan. Rev. Game Biol. 10. No. 5. 31 pp.

Johnston, D. W. and M. E. Foster. 1954. Interspecific relations of breeding gulls at Honey Lake, California. Condor 56: 38-42.

Jones, A. 1980. The effects of weather on a Caspian Tern colony. Notornis 27: 405-406.

Jones, H. L. 1965. Seabirds off the North Carolina coast in late April. Chat 29: 86-87.

Jones, L. 1906. A contribution to the life history of the Common (*Sterna hirundo*) and Roseate (*S. dougallii*) Terns. Wilson Bull. 18: 35-47.

Jonkel, G. M. and O. S. Pettingill, Jr. 1974. Retraction of a longevity record for a 36-year-old Herring Gull. Auk 91: 432.

Jonsson, P. E. and O. Wennberg. 1981. Prariemasen Larus pipixcan patraffad i Sverige. [Records of Franklin's Gull Larus pipixcan in Sweden.] Var Fagelvarld 40: 263-269. [In Swedish with English summary.]

Jorgensen, H. I. 1958. Nomina avium europaearum. Ejnar Munksgaard, Copenhagen, Denmark. xi and 288 pp.

Joyner, J. W. E. 1959. Sooty Terns at Cape Lookout, N.C. Chat 23: 66.

Kadlec, J. A. and W. H. Drury. 1968a. Structure of the New England Herring Gull population. Ecology 49: 644-676.

Kadlec, J. A., W. H. Drury, Jr., and D. K. Onion. 1969. Growth and mortality of Herring Gull chicks. Bird-Banding 40: 222-233.

Kale, H. W., II. 1967. Recoveries of Black Skimmers banded on Little Egg Island, Georgia. Oriole 32: 13-16.

_____. 1970. The changing seasons; the spring migration: April 1-May 31, 1970; Florida Region. Audubon Field Notes 24: 591-595.

_____. 1971. The changing seasons; the spring migration: April 1-May 31, 1971; Florida Region. Am. Birds 25: 723-725.

_____. 1972. The changing seasons; the spring migration: April 1-May 31, 1972; Florida Region. Am. Birds 26: 751-754.

_____. 1973. The changing seasons; the spring migration: April 1-May 31, 1973; Florida Region. Am. Birds 27; 761-765.

_____. 1974. The changing seasons; the spring migration: April 1-May 31, 1974; Florida Region. Am. Birds 28: 790-794.

_____. 1975. The changing seasons; the spring migration: April 1-May 31, 1975; Florida Region. Am. Birds 29: 839-843.

_____. 1976. The changing seasons; the spring migration: April 1-May 31, 1976; Florida Region. Am. Birds 30: 828-832.

_____. 1977. The changing seasons; the spring migration: March 1-May 31, 1977; Florida Region. Am. Birds 31: 988-992.

_____. 1978a. The changing seasons; the spring migration: March 1-May 31, 1978; Florida Region. Am. Birds 32: 993-997.

_____. (ed.). 1978b. Rare and endangered biota of Florida. Vol. 2. Birds. Univ. Presses of Florida, Gainesville, FL. xix and 121 pp.

Kale, H. W., II. 1978c. Species of special concern. Sandwich Tern. Pp. 92-95 *in* H. W. Kale, II (ed.). Rare and endangered biota of Florida. Vol. 2. Birds. Univ. Presses of Florida, Gainesville, FL. xix and 121 pp.

_____. 1979. The changing seasons; the spring migration: March 1-May 31, 1979; Florida Region. Am. Birds 33: 762-765.

_____. 1979 ms a. Data on selected groups of birds on the Atlantic coast of Florida. Rep. to Shell Oil Corp., Environmental Affairs, and the Florida Audubon Society. 50 [and 25] pp.

_____. 1979 ms b. Data on selected groups of birds on the Gulf coast of Florida. Rep. to Shell Oil Corp., Environmental Affairs, and the Florida Audubon Society. 50 pp.

_____. 1980. The changing seasons; the spring migration: March 1-May 31, 1980; Florida Region. Am. Birds 34: 767-770.

Kale, H. W., II, G. W. Sciple and I. R. Tomkins. 1965. The Royal Tern colony of Little Egg Island, Georgia. Bird-Banding 36: 21-27.

Karmborg, T. 1979. Trutar dodar koltrast. [Herring Gull and Great Black-backed Gull killing Blackbird.] Var Fagelvarld 38: 50. [In Swedish with English summary.]

Keith, J. A. 1966a. Reproduction in a population of Herring Gulls (*Larus argentatus*) contaminated by DDT. J. Appl. Ecol. 3 (Suppl.): 57-70.

Kennard, J. H. 1975. Longevity records of North American birds. Bird-Banding 46: 55-73.

Kennedy, P. J. 1955. Royal Tern in Dublin: a new British bird. Brit. Birds 48: 116-117.

Kennedy, R. S. 1973. The changing seasons; the nesting season: June 1-July 31, 1973; Central Southern Region. Am. Birds 27: 878-882.

_____. 1974. The changing seasons; the nesting season: June 1-July 31, 1974; Central South Region. Am. Birds 28: 911-915.

Kennerley, P. R. 1979. Goeland atricille (*Larus atricilla*) au Maroc. [Laughing Gull *Larus atricilla* in Morocco.] Alauda 47: 214-215. [In French.]

Kent, B. W. 1981. Prey dropped by Herring Gulls (*Larus argentatus*) on soft sediments. Auk 98: 350-354.

Kerautret, L. 1981. Une Mouette de Franklin (*Larus pipixcan*) dans le Pas-de-Calais. Oiseau Rev. Fr. Ornithol. 51: 337-338.

Kilpi, M., H. Puntii and T. Toivonen. 1980. Numbers of gulls nesting on the northern coast of the Gulf of Finland. Ornis Fenn. 57: 153-160. [In English with Finnish summary.]

King, B. 1973. Bonaparte's Gull in Cornwall "foot-paddling" to disturb organisms. Brit. Birds 66: 447.

_____. 1976. Further records of foot-paddling by gulls on grassland. Brit. Birds 69: 180-181.

King, B. and E. C. Dickinson. 1975. A field guide to the birds of Southeast Asia. Collins, London. 480 pp.

King, J. E. 1955. Annotated list of birds observed on Christmas Island, October to December 1953. Pac. Sci. 9: 42-48.

King, J. G. and G. A. Sanger. 1979. Oil vulnerability index for marine oriented birds. Pp. 227-239 in J. C. Bartonek and D. N. Nettleship (eds.). Conservation of marine birds of northern North America. U.S. Fish Wildl. Serv. Wildl. Res. Rep. 11. ix and 319 pp.

King, K. A. and C. A. LeFever. 1979. Effects of oil transferred from incubating gulls to their eggs. Mar. Pollut. Bull. 10: 319-321.

King, W. B. (ed.). 1967. Seabirds of the tropical Pacific Ocean. Preliminary Smithsonian identification manual. U.S. Natl. Mus., Smithson. Inst., Washington, DC. xxxii and 126 pp.

_____. 1970. The trade wind zone oceanography pilot study. Part VII. Observations of sea birds March 1964 to June 1965. U.S. Fish Wildl. Serv. Spec. Sci. Rep. Fish. 586. 136 pp.

Kirkham, I. R. and R. D. Morris. 1979. Feeding ecology of Ring-billed Gull (Larus delawarensis) chicks. Can. J. Zool. 57: 1086-1090.

Kist, J. 1961. Waarnemingen van de Kleine Kokmeeuw, Larus philadelphia (Ord), bij Scheveningen. [Observations of the Bonaparte's Gull, Larus philadelphia (Ord), at Scheveningen.] Limosa 34: 220-224. [In Dutch with English summary.]

Kistchinski, A. A. 1975. Breeding biology and behaviour of the Grey Phalarope Phalaropus fulicarius in East Siberia. Ibis 117: 285-301.

Kleen, V. M. 1975. The changing seasons; the nesting season: June 1-July 31, 1975; Middlewest Prairie Region. Am. Birds 29: 978-982.

Knight, R. 1961. Donna's Tern displacements. Fla. Nat. 34: 43.

Kobayashi, K. 1953. Occurrence of Sterna albifrons sinensis and Sterna hirundo longipennis at Osaka Bay, Japan. Emu 53: 146-148.

Kock, K. H. 1974. Nahrungsokologische Untersuchungen an Mantelmowen (Larus marinus) auf Helgoland. [Studies on the feeding ecology of the Great Black-backed Gull (Larus marinus) on Helgoland.] Helgol. Wiss. Meersunters 26: 88-95. [In German with English abstract.]

Koli, L. and M. Soikkeli. 1974. Fish prey of breeding Caspian Terns in Finland. Ann. Zool. Fenn. 11: 304-308.

Komarek, E. V. 1929. Strangulation of gulls. Wilson Bull. 41: 41.

Kopman, H. H. 1908a. Inspection of Breton Island Reservation, Louisiana. Bird-Lore 10: 229-231.

_____. 1908b. Inspection of East Timbalier Reservation, Louisiana, August 3, 1908. Bird-Lore 10: 231.

Korschgen, C. E. 1979. Coastal waterbird colonies: Maine. U.S. Fish Wildl. Serv. Biol. Serv. Progr. FWS/OBS-79/09. 83 pp.

Kovacs, K. M. and J. P. Ryder. 1981. Nest site tenacity and mate fidelity in female-female pairs of Ring-billed Gulls. Auk 98: 625-627.

Kozlova, E. V. 1961. Fauna SSSR (Waders, Pt. 1). Akad Nauk SSR. Moscos-Leningrad Nov. Ser. 80. (translated).

Kramer, E. Y. and Q. Kramer. 1945. Long-tailed Jaeger and other birds at Island Beach, New Jersey. Auk 62: 635.

Kuerzi, R. G. 1937. The Black-backed Gull as a predator. Proc. Linn. Soc. N.Y. 48: 97-98.

Kushlan, J. A. and D. A. White. 1977. Laughing Gull colonies in extreme southern Florida. Fla. Field Nat. 5: 44-46.

Lamont, S. M. 1980. Atypical nest of Bonaparte's Gull. Blue Jay 38: 44-45.

Lamore, D. 1953. Ring-billed Gulls stealing fish from female American Mergansers. Wilson Bull. 65: 210-211.

Landers, H. 1974. The climate of South Carolina. Pp. 353-369 in National Oceanic and Atmospheric Administration, U.S. Dep. Commerce. Climates of the states. Vol. I--eastern states. Water Information Center, Inc., Port Washington, NY. 486 pp.

Langham, N. P. E. 1968. The comparative biology of terns, Sterna spp. Ph.D. thesis, Univ. Durham/Durham, England.

_____. 1971. Seasonal movements of British terns in the Atlantic Ocean. Bird Study 18: 155-175.

Langham, N. P. E. 1972. Chick survival in terns (Sterna spp.) with particular reference to the Common Tern. J. Anim. Ecol. 41: 385-395.

_____. 1974. Comparative breeding biology of the Sandwich Tern. Auk 91: 255-277.

Latham, R. 1936. The rise and fall of a tern colony. Univ. State New York Bull. Schools 22: 135-136.

Lauro, A. J. 1977. Gull predation on an ant swarm. Kingbird 27: 87-88.

_____. 1980. The winter ecology of Bonaparte's Gull on the south shore of Long Island. Linn. Newsl. 34(1): 1-3.

Leavitt, B. B. 1957. Food of the Black Skimmer (Rynchops nigra). Auk 74: 394.

Leck, C. F. 1968. An additional observation of Laughing Gulls robbing a Black Skimmer. Cassinia 50: 27.

_____. 1971. Nocturnal habits of Ring-billed Gulls (Larus delawarensis) at Thimble Shoal, Virginia. Chesapeake Sci. 12: 188.

_____. 1973. Attempts of gulls to rob a Common Egret and an Osprey. Cassinia 54: 32.

LeCroy, M. 1972. Young Common and Roseate Terns learning to fish. Wilson Bull. 84: 201-202.

_____. 1976. Bird observations in Los Roques, Venezuela. Am. Mus. Novit. 2599. 30 pp.

LeCroy, M. and C. T. Collins. 1972. Growth and survival of Roseate and Common Tern chicks. Auk 89: 595-611.

LeCroy, M. and S. LeCroy. 1974. Growth and fledging in the Common Tern (Sterna hirundo). Bird-Banding 45: 326-340.

Lee, D. S. and J. Booth. 1979. Seasonal distribution of offshore and pelagic birds in North Carolina waters. Am. Birds 33: 715-721.

Lee, D. S. and B. A. Rowlett. 1979. Additions to the fauna of North Carolina. Chat 43: 1-9.

Le Faucheux, O. 1963. Contribution a l'etude de la biologie de la reproduction chez les Lariformes du genre Sterna L. D.E.S. Faculte de Rennes.

LeGrand, H. E., Jr. 1975. Franklin's Gull in South Carolina. Chat 39: 92.

LeGrand, H. E., Jr. 1976. The changing seasons; the nesting season: June 1-July 31, 1976; Southern Atlantic Coast Region. Am. Birds 30: 942-945.

_____. 1977a. The changing seasons; the winter season: December 1, 1976-February 28, 1977; Southern Atlantic Coast Region. Am. Birds 31: 319-322.

_____. 1977b. The changing seasons; the nesting season: June 1-July 31, 1977; Southern Atlantic Coast Region. Am. Birds 31: 1124-1128.

_____. 1978. The changing seasons; the winter season: December 1, 1977-February 28, 1978; Southern Atlantic Coast Region. Am. Birds 32: 335-338.

_____. 1979a. The changing seasons; the autumn migration: August 1-November 30, 1978; Southern Atlantic Coast Region. Am. Birds 33: 165-168.

_____. 1979b. The changing seasons; the winter season: December 1, 1978-February 28, 1979; Southern Atlantic Coast Region. Am. Birds 33: 272-274.

_____. 1979c. The changing seasons; the spring migration: March 1-May 31, 1979; Southern Atlantic Coast Region. Am. Birds 33: 760-762.

_____. 1979d. Briefs for the files. Chat 43: 21-24, 37-43, 70-73, 96-101.

_____. 1979e. The changing seasons; the nesting season: June 1-July 31, 1979; Southern Atlantic Coast Region. Am. Birds 33: 853-855.

_____. 1980a. The changing seasons; the autumn migration: August 1-November 30, 1979; Southern Atlantic Coast Region. Am. Birds 34: 149-152.

_____. 1980b. Briefs for the files. Chat 44: 21-25, 45-53, 66-69, 83-87, 113-118.

_____. 1980c. The changing seasons; the spring migration: March 1-May 31, 1980; Southern Atlantic Coast Region. Am. Birds 34: 765-767.

_____. 1981. The changing seasons; the autumn migration: August 1-November 30, 1980; Southern Atlantic Coast Region. Am. Birds 35: 170-172.

Lemmetyinen, R. 1963. Lokkien esiintymisesta ja ravinnosta Gullkronan selan koillisosassa. [Occurrence and feeding habits of gulls in the northeast part of the area of Gullkrona.] Suomen Riista 16: 69-82. [In Finnish with English summary.]

_____. 1968. The migration routes of Finnish Common and Arctic Terns (Sterna hirundo and S. paradisaea) in Scandinavia. Ornis Fenn. 45: 114-124.

_____. 1973a. Feeding ecology of Sterna paradisaea Pontopp. and S. hirundo L. in the archipelago of southwestern Finland. Ann. Zool. Fenn. 10: 507-525.

Lemmetyinen, R. 1973b. Breeding success in Sterna paradisaea Pontopp. and S. hirundo L. in southern Finland. Ann. Zool. Fenn. 10: 526-535.

_____. 1976. Feeding segregation in the Arctic and Common Terns in southern Finland. Auk 93: 636-640.

Leveque, R. 1956. Une colonie de Sternes hansel en Camargue. Nos Oiseaux 23: 233-246. [In French.]

Levy, E. M. 1980. Oil pollution and seabirds: Atlantic Canada 1976-77 and some implications for northern environments. Mar. Pollut. Bull. 11: 51-56.

Lewis, B. 1979. Franklin's Gull in Greenwood County, S.C. Chat 43: 63-64.

Lewis, B. and A. Lewis. 1977. Franklin's Gull at Huntington Beach State Park, S.C. Chat 41: 96-97.

Lewis, H. F. 1941. Ring-billed Gulls of the Atlantic coast. Wilson Bull. 53: 22-30.

Ligas, F. J. 1952. Migration, nesting, and food studies of the piscivorous birds of the island region of Lake Erie. M.S. thesis, Ohio State Univ./ Columbus, OH. 107 pp.

Lincoln, F. C. 1928a. The migration of young North American Herring Gulls. Auk 45: 49-59.

_____. 1936. Trans-Atlantic flight of the Gull-billed Tern. Auk 53: 331.

Lind, H. 1963a. The reproductive behavior of the Gull-billed Tern, Sterna nilotica Gmelin. Vidensk. Medd. Dan. Naturhist. Foren. 125: 407-448.

Lloyd, C. S. 1976. Birdkill. Birds (Lond.) 6: 2 pp. (unpaginated).

Lloyd, C. S., J. A. Bogan, W. R. P. Bourne, P. Dawson and J. L. F. Parslow. 1974. Seabird mortality in the North Irish Sea and Firth of Clyde early in 1974. Mar. Pollut. Bull. 5: 136-140.

Locke, L. N., L. J. Blus and E. Cromartie. 1974. Aspergillosis in a Royal Tern from Cape Romain National Wildlife Refuge, S.C. Chat 38: 24-25.

Lockley, R. M. 1932. Incubation-periods of Lesser and Great Black-backed and Herring Gulls. Brit. Birds 25: 310-313.

Loftin, R. W. 1973. Another inland colony of the Least Tern. Fla. Field Nat. 1: 21.

_____. 1977. A tern prey sample. Fla. Field Nat. 5: 47-48.

Loftin, R. W. 1982. Diet of Black Skimmers and Royal Terns in northeastern Florida. Fla. Field Nat. 10: 19-20.

Loftin, R. W. and S. Sutton. 1975. Sandwich Tern breeds on the Atlantic coast of Florida. Fla. Field Nat. 3: 18.

Lohrer, F. E. and C. E. Lohrer. 1973. Inland nesting of the Least Tern. Fla. Field Nat. 1: 3-5.

Longley, W. L. and R. G. Jackson. 1980. Managing impacts of petroleum development in brackish marshes. Pp. 157-174 in P. L. Fore and R. D. Peterson (eds.). Proc. Gulf of Mexico coastal ecosystems workshop. U.S. Fish Wildl. Serv., Albuquerque, NM. FWS/OBS-80/30. 214 pp.

Longstreet, R. J. and L. Longstreet. 1924. Bird-Lore's Twenty-fourth Christmas Census. Daytona Beach, Fla. Bird-Lore 26: 33.

Loomis, L. M. 1880. The Northern Phalarope in Chester County, South Carolina. Bull. Nuttall Ornithol. Club 5: 242.

Lovell, H. B. 1945. Reaction of American Mergansers to Herring Gull depredations. Wilson Bull. 57: 202.

Lovenskiold, H. L. 1964. Avifauna svalbardensis, with a discussion on the geographical distribution of the birds in Spitsbergen and adjacent islands. Skr. Nor. Polarinst. 129. 460 pp.

Lowery, G. H., Jr. 1950. The changing seasons; the winter season: December 1, 1949-March 31, 1950; Central Southern Region. Audubon Field Notes 4: 205-207.

______. 1974. Louisiana birds. 3rd edition. Louisiana State Univ. Press, Baton Rouge, LA. xxx and 651 pp.

Ludwig, C. C. 1962. Herring Gulls--1961 recoveries. Inl. Bird Banding News 34: 55-56.

Ludwig, C. C. and F. E. Ludwig. 1961. Herring Gulls and Caspian Terns--1960 recoveries. Inl. Bird Banding News 33: 28-29.

Ludwig, J. P. 1962a. Banded Common Terns in the Pacific. Ring 3: 109-110.

______. 1965a. Biology and structure of the Caspian Tern (*Hydroprogne caspia*) population of the Great Lakes from 1896-1964. Bird-Banding 36: 217-233.

______. 1966. Herring and Ring-billed Gull populations of the Great Lakes 1960-1965. Great Lakes Res. Div. Univ. Mich. Publ. 15: 80-89.

______. 1974. Recent changes in the Ring-billed Gull population and biology in the Laurentian Great Lakes. Auk 91: 575-594.

Ludwig, J. P. and C. S. Tomoff. 1966. Reproductive success and insecticide residues in Lake Michigan Herring Gulls. Jack-Pine Warbler 44: 77-85.

Lugovoi, A. E. 1961. Pitanie chaek-iktiofagov v nizov'yakh del'ty Volgi. [The diet of fish-eating gulls in the lower reaches of the Volga Delta.] Tr. Astrakh. Gos. Zapov. 5.

Lynch, J. M. 1972. Inland record of a Black Skimmer at Roanoke Rapids, N.C. Chat 36: 62.

Lyon, W. I. 1927. The Fox Snake feeds on the eggs of the Common Tern. Wilson Bull. 39: 186.

Macdonald, S. M. and C. F. Mason. 1973. Predation of migrant birds by gulls. Brit. Birds 66: 361-363.

MacFarlane, A. 1977. Roof-nesting by Common Terns. Wilson Bull. 89: 475-476.

Mack, B. 1969. The Roseate Tern in the Carolinas. Chat 33: 85-87.

Mackworth-Praed, C. W. and C. H. B. Grant. 1970. Birds of west central and western Africa. Vol. I. Longman, Green, and Co., London. xxvii and 671 pp.

MacMillen, R. E., G. C. Whittow, E. A. Christopher and R. J. Ebisu. 1977. Oxygen consumption, evaporative water loss, and body temperature in the Sooty Tern. Auk 94: 72-79.

MacRoberts, M. H. and B. R. MacRoberts. 1972a. The relationship between laying date and incubation in Herring and Lesser Black-backed Gulls. Ibis 114: 93-97.

Maedgen, J. L., C. S. Hacker, G. D. Schroder and F. M. Weir. 1982. Bioaccumulation of lead and cadmium in the Royal Tern and Sandwich Tern. Arch. Environ. Contam. Toxicol. 11: 99-102.

Mansueti, R. J. 1961. Waterfowl predation by and records of the Great Black-backed Gull in Chesapeake Bay during winter and spring. Chesapeake Sci. 2: 102-104.

Manuel, C. G. 1931a. The relation of gulls and terns to the commercial fisheries of Saginaw Bay, Michigan, with particular reference to the Common Tern, Sterna hirundo Linnaeus. Ph.D. thesis, Univ. Michigan/Ann Arbor, MI.

Manuwal, D. A., P. W. Mattocks, Jr. and K. O. Richter. 1979. First Arctic Tern colony in the contiguous western United States. Am. Birds 33: 144-145.

Marchant, S. 1958. The birds of the Santa Elena Peninsula, S.W. Ecuador. Ibis 100: 349-387.

Markuze, V. K. 1965. [Effect of fish-eating birds on the spawning-rearing farms of the delta of Volga.] Pp. 90-115. in [Fish-eating birds and their significance in fish economy.] [1976 translation for the U.S. Fish Wildl. Serv. and Natl. Sci. Foundation by Franklin Book Programs, Inc., Cairo.]

Marshall, N. 1942. Night desertion by nesting Common Terns. Wilson Bull. 54: 25-31.

Marshall, W. H. and A. B. Erickson. 1945. Weights of some Minnesota birds. Flicker 17: 32-36.

Martini, E. 1964. Otolithen in Gewollen der Raubseeschwalbe (Hydroprogne caspia). [Otoliths in pellets of the Caspian Tern (Hydroprogne caspia).] Bonn. Zool. Beitr. 15: 59-71. [In German with English summary.]

Massey, B. W. 1971. A breeding study of the California Least Tern. Wildl. Manage. Branch Admin. Rep. 71-9, Calif. State Resour. Agency, Calif. Dep. Fish Game.

_____ . 1974. Breeding biology of the California Least Tern. Proc. Linn. Soc. N.Y. 72: 1-24.

_____. 1977. Occurrence and nesting of the Least Tern and other endangered species in Baja California, Mexico. West. Birds 8: 67-70.

Massey, B. W. and J. L. Atwood. 1978. Plumages of the Least Tern. Bird-Banding 49: 360-371.

_____. 1981. Second-wave nesting of the California Least Tern: age composition and reproductive success. Auk 98: 596-605.

Masters, G. 1968. Black-necked Stilts and Northern Phalaropes at Jekyll Island, Ga. Oriole 33: 50-51.

Mather, J. R. 1974. [Comment on] Oiled seabirds successfully cleaning their plumage. Brit. Birds 67: 483-484.

Mayfield, H. F. 1979. Red Phalaropes breeding on Bathurst Island. Living Bird 17: 7-39.

Mayr, E. 1948. Gulls feeding on flying ants. Auk 65: 600.

McAtee, W. L. and F. E. L. Beal. 1912. Some common game, aquatic, and rapacious birds in relation to man. U.S. Dep. Agric. Farmer's Bull. 497. 30 pp.

McCaskie, G. 1969. The changing seasons; the fall migration: August 16-November 30, 1968; Southern Pacific Coast States. Audubon Field Notes 2: 106-112.

McCaskie, G., S. Liston and W. A. Rapley. 1974. First nesting of Black Skimmer in California. Condor 76: 337-338.

McClanahan, R. C. 1941. Franklin's Gull an addition to the Florida list. Auk 58: 405-406.

McDaniel, B. and S. McDaniel. 1963. Feeding of Least Terns over land. Auk 80: 544.

McDaniel, T. H. and T. A. Beckett, III. 1971. Caspian Tern nesting in South Carolina. Chat 35: 39-41.

McGill, P. A. and M. E. Richmond. 1979. Hatching success of Great Black-backed Gull eggs treated with oil. Bird-Banding 50: 108-113.

McGowan, A. F. 1969. Common Tern, _Sterna hirundo_, nesting on roof in Pompano Beach. Fla. Nat. 42: 172.

McNicholl, M. K. 1971. The breeding biology and ecology of Forster's Tern (_Sterna forsteri_) at Delta, Manitoba. M.S. thesis, Univ. Manitoba/Winnipeg, MB. xiii and 652 pp.

Mead, C. 1981. The black death. Brit. Trust Ornithol. News 112: 1.

Mead, C. and S. Baillie. 1981. Seabirds and oil: the worst winter. Nature 292: 10-11.

Meinertzhagen, R. 1925. The distribution of the phalaropes. Ibis (12th Ser.) 1: 325-344.

_____. 1954. The birds of Arabia. Oliver and Boyd, London. xiii and 624 pp.

Melville, D. 1974. Analysis of Herring Gull pellets collected in Co. Antrim. Seabird Rep. 4: 40-46.

Mendall, H. L. 1935. The relationship of certain sea birds to the fishing industry of the state of Maine. Bull. Dep. Sea Shore Fish. Maine 28 pp.

_____. 1939. Food habits of the Herring Gull in relation to freshwater game fishes in Maine. Wilson Bull. 51: 223-226.

Miller, B. and C. Lalas. 1974. A Black Tern photographed in inland N.S.W. Austr. Birds 9: 14.

Miller, L. and J. Confer. 1982. A study of the feeding of young Common Terns at one site in Oneida Lake during 1980. Kingbird 32: 167-172.

Mills, D. H. 1957. Herring Gulls and Common Terns as possible predators of lobster larvae. J. Fish Res. Board Can. 14: 729-730.

Minsky, D. 1980. Preventing fox predation at a Least Tern Colony with an electric fence. J. Field Ornithol. 51: 180-181.

Moffitt, J. 1942. A nesting colony of Ring-billed Gulls in California. Condor 44: 105-107.

Moller, A. P. 1975a. Sandternens *Gelochelidon n. nilotica* Gm. ynglebiologi i Danmark. [The breeding biology of the Gull-billed Tern *Gelochelidon n. nilotica* Gm. in Denmark.] Dan. Ornithol. Foren. Tidsskr. 69: 9-18. [In Danish with English summary.]

_____. 1975b. Europaeiske Sandternens (*Gelochelidon nilotica nilotica*) traek belyst ved hjaelp af ringmaerking. [Migration of European Gull-billed Terns (*Gelochelidon nilotica nilotica*) according to recoveries.] Dan. Fugle 27: 61-77. [In Danish with English summary.]

_____. 1975d. Ynglebstanden af Sandterne *Gelochelidon nilotica nilotica* Gmel. i 1972 i Europa, Afrika og det vestlige Asien med en oversight over bestandsaendringer i dette arhundrede. [The breeding population of Gull-billed Terns *Gelochelidon nilotica nilotica* Gmel. in 1972 in Europe, Africa and Western Asia, with a review of fluctuations during the present century.] Dan. Ornithol. Foren. Tidsskr. 69: 1-8. [In Danish with English summary.]

_____. 1977. Sandternens *Gelochelidon n. nilotica* Gmel. fode i yngletiden i Nordjylland og Camargue, Frankrig, med en oversigt over fodeeminer i andre dele af artens udbredelsesomrade. [Food composition of the Gull-billed Tern *Gelochelidon n. nilotica* Gmel. during breeding in North Jutland, Denmark, and Camargue, France, with a review of food items in other areas.] Dan. Ornithol. Foren. Tidsskr. 71: 103-111. [In Danish with English summary.]

_____. 1981a. Breeding cycle of the Gull-billed Tern *Gelochelidon nilotica* Gmel., especially in relation to colony size. Ardea 69: 193-198.

_____. 1981b. En analyse af ringmaerknings- og genmeldingsoplysinger for Sandterne *Gelochelidon nilotica* (Gmel.). [An analysis of ringing and recovery information for the Gull-billed Tern *Gelochelidon nilotica* (Gmel.).] Dan. Ornithol. Foren. Tidsskr. 75: 127-130. [In Danish with English summary.]

_____. 1982. Coloniality and colony structure in Gull-billed Terns *Gelochelidon nilotica*. J. Ornithol. 123: 41-53. [In German.]

Monaghan, P. and J. C. Coulson. 1977. Status of large gulls nesting on buildings. Bird Study 24: 89-104.

Monroe, B., Jr. 1959. Franklin's Gull. Fla. Nat. 32: 95-96.

_____. 1968. A distributional survey of the birds of Honduras. AOU Ornithol. Monogr. 7. 458 pp.

Montevecchi, W. A. 1977. Predation in a salt marsh Laughing Gull colony. Auk 94: 583-585.

_____. 1978a. Nest site selection and its survival value among Laughing Gulls. Behav. Ecol. Sociobiol. 4: 143-161.

Montevecchi, W. A., M. Impekoven, A. Segre-Terkel and C. G. Beer. 1979. The seasonal timing and dispersion of egg-laying among Laughing Gulls *Larus atricilla*. Auk 121: 337-344.

Moore, F. R. 1973. Herring Gull postbreeding dispersal and related chick orientation behavior. M.S. thesis, N. Illinois Univ./Dekalb, IL. 80 pp.

_____. 1976. The dynamics of seasonal distribution of Great Lakes Herring Gulls. Bird-Banding 47: 141-159.

Moore, J. R., T. Fairley, D. Hamilton and P. Rodriguez. 1981. Observations of a Red Phalarope in Hattiesburg, Mississippi. Mississippi Kite 11: 15-17.

Morris, R. D. and G. T. Haymes. 1977. The breeding biology of two Lake Erie Herring Gull colonies. Can. J. Zool. 55: 796-805.

Morris, R. D. and R. A. Hunter. 1976. Factors influencing desertion of colony sites by Common Terns (*Sterna hirundo*). Can. Field-Nat. 90: 137-143.

Morris, R. D., R. A. Hunter and J. F. McElman. 1976. Factors affecting the reproductive success of Common Tern (*Sterna hirundo*) colonies on the lower Great Lakes during the summer of 1972. Can. J. Zool. 54: 1850-1862.

Morris, R. D., I. R. Kirkham and J. W. Chardine. 1980. Management of a declining Common Tern colony. J. Wildl. Manage. 44: 241-245.

Morrison, R. I. G. 1978. Herring Gulls stealing prey from Parasitic Jaegers. Wilson Bull. 90: 649-650.

Morton, J. W. 1976. Ecological impacts of dredging and dredge spoil dispersal: a literature review. M.S. thesis, Cornell Univ./Ithaca, NY. 112 pp.

Morzer Bruyns, W. F. J. and K. H. Voous. 1965. Night-feeding by Sooty Tern (*Sterna fuscata*). Ardea 53: 79.

Moseley, L. J. 1976. Behavior and communication in the Least Tern. Ph.D. thesis, Univ. North Carolina/Chapel Hill, NC. 164 pp.

Mott, S. 1982. First Michigan record of a Black Skimmer. Jack-Pine Warbler 60: 29-30.

Moyle, P. 1966. Feeding behavior of the Glaucous-winged Gull on an Alaskan salmon stream. Wilson Bull. 78: 175-190.

Mueller, H. C. 1976. Common Terns feed on mole crabs. Wilson Bull. 88: 675-676.

Mueller, H. C. and D. D. Berger. 1965. Ring-billed Gulls feed on flying ants. Auk 82: 504.

Mullarney, K. 1980. Ring-billed Gulls in Co. Mayo. A species new to Ireland. Irish Birds 1: 517-525.

Muller, H. 1959. Die Zugverhaltnisse der europaischen Brandseeschwalben (*Sterna sandvicensis*) nach Beringungsergebnissen. Vogelwarte 20: 91-115. [In German.]

Mulvihill, E. L., C. A. Francisco, J. B. Glad, K. B. Kaster and R. E. Wilson. 1980. Biological impacts of minor shoreline structures on the coastal environment: state of the art review. U.S. Fish Wildl. Serv. Biol. Serv. Progr. FWS/OBS-77/51. 2 volumes.

Mumford, R. E. 1962. Specimens of unusual Indiana birds. Wilson Bull. 74: 288-289.

Munro, J. A. 1936. A study of the Ring-billed Gull in Alberta. Wilson Bull. 48: 169-180.

Murphy, R. C. 1936. Oceanic birds of South America. Volumes I and II. Am. Mus. Nat. Hist., New York, NY. xxiv and 1245 pp.

Muse, C. J. and S. Muse. 1981. First gull record for Samoa. Elepaio 41: 130-131.

Muse, C., S. Muse and D. Muse. 1980. First record of a gull (*Larus atricilla*) for the Samoan Islands. Am. Birds 34: 848-849.

Myers, M. 1971. Chandeleur-Ho. La. Ornithol. Soc. News 60: 3-4.

Mylne, C. K. 1960. Techniques of Herring Gulls and Jackdaws preying on Puffins. Brit. Birds 53: 86-88.

Nakamura, K. 1972. [A Black Tern *Sterna nigra* L., observed in Sagami Bay; new to Japan.] Bull. Kanagawa Prefect. Mus. 1: 19-24. [In Japanese with English summary.]

National Environmental Research Council (NERC). 1977. The report of a working group in ecological research on seabirds. Natl. Environ. Res. Coun. Publ. Ser. C. 18. iv and 48 pp.

Nelson-Smith, A. 1973. Oil pollution and marine ecology. Plenum Press, New York, NY. ix and 260 pp.

Nero, R. W. 1961. Dry land gull colony. Blue Jay 19: 166-168.

Nettleship, D. N. 1976. Census techniques for seabirds of arctic and eastern Canada. Can. Wildl. Serv. Occas. Pap. 25. 33 pp.

_____. 1977. Seabird resources of Eastern Canada: status, problems and prospects. Pp. 96-108 in T. Mosquin and C. Suchal (eds.). Proc. Symp. on Canada's threatened species and habitats. Can. Wildl. Serv., Bedford Inst. Oceanogr., Dartmouth, Nova Scotia.

Nettleship, D. N. and L. E. Tull. 1970. Seabird transects between Valleyfield and Funk Island, Newfoundland, summer, 1969. Can. Field-Nat. 84: 369-376.

Newell, J. G. 1968. Black Skimmer in Oklahoma. Bull. Okla. Ornithol. Soc. 1: 25.

Newman, R. J. 1954. The changing seasons; the spring migration: April 1-May 31, 1954; Central Southern Region. Audubon Field Notes 8: 316-319.

_____. 1955. The changing seasons; the winter season: December 1, 1954-March 31, 1955; Central Southern Region. Audubon Field Notes 9: 262-265.

_____. 1956a. The changing seasons; the spring migration: April 1-May 31, 1956; Central Southern Region. Audubon Field Notes 10: 338-341.

_____. 1956b. The changing seasons; the nesting season: June 1-August 15, 1956; Central Southern Region. Audubon Field Notes 10: 387-390.

_____. 1957a. The changing seasons; the winter season: December 1, 1956-March 31, 1957; Central Southern Region. Audubon Field Notes 11: 270-274.

_____. 1957b. The changing seasons; the spring migration: April 1-May 31, 1957; Central Southern Region. Audubon Field Notes 11: 350-257.

_____. 1958a. The changing seasons; the fall migration: August 16-November 30, 1957; Central Southern Region. Audubon Field Notes 12: 30-34.

_____. 1958b. The changing seasons; the winter season: December 1, 1957-March 31, 1958; Central Southern Region. Audubon Field Notes 12: 284-287.

Newman, R. J. 1958c. The changing seasons; the spring migration: April 1-May 31, 1958; Central Southern Region. Audubon Field Notes 12: 358-362.

_____. 1959. The changing seasons; the fall migration: August 16-November 30, 1958; Central Southern Region. Audubon Field Notes 13: 37-41.

_____. 1960. The changing seasons; the fall migration: August 1-November 30, 1959; Central Southern Region. Audubon Field Notes 14: 41-47.

Newman, R. J. and S. L. Warter. 1959a. The changing seasons; the winter season: December 1, 1958-March 31, 1959; Central Southern Region. Audubon Field Notes 13: 298-302.

_____. 1959b. The changing seasons; the nesting season: June 1-August 15, 1959; Central Southern Region. Audubon Field Notes 13: 434-437.

Nicholson, D. J. 1948a. Fresh-water nesting of the Gull-billed Tern in Florida. Auk 65: 139-140.

_____. 1948b. Nocturnal fresh-water wandering of the Black Skimmer. Auk 65: 299-300.

_____. 1948c. Berry-feeding of the Ring-billed Gull. Auk 65: 601.

Nickell, W. P. 1966. Common Terns nest on muskrat lodges and floating cattail mats. Wilson Bull. 78: 123-124.

Niethammer, G. 1942. Handbuck der Deutschen Vogelkunde. Vol. 3. Liepzig.

Nisbet, I. C. T. 1971a. The Laughing Gull in the northeast. Am. Birds 25: 677-683.

_____. 1972. Disaster year for terns. Man Nat., Dec. 1972: 16-21.

_____. 1974a. Unusual prey of Common Terns: swim-bladders of large fish. Wilson Bull. 86: 170-171.

_____. 1975. Selective effects of predation in a tern colony. Condor 77: 221-226.

_____. 1976a. Early stages in postfledging dispersal of Common Terns. Bird-Banding 47: 163-164.

_____. 1976b. The colonization of Monomoy by Laughing Gulls. Cape Nat. 5: 4-8.

_____. 1977. Courtship-feeding and clutch size in Common Terns. Pp. 101-109 in B. Stonehouse and C. Perrins (eds.). Evolutionary ecology. (Vol. 2. Biology and environment.) 310 pp.

Nisbet, I. C. T. 1980. Status and trends of the Roseate Tern *Sterna dougallii* in North America and the Caribbean. Unpubl. rep. U.S. Fish Wildl. Serv., Office of Endangered Species, Massachusetts, U.S.A. 131 pp.

_____. 1981a. Biological characteristics of the Roseate Tern *Sterna dougallii*. Unpubl. rep. U.S. Fish Wildl. Serv., Office of Endangered Species, Massachusetts, U.S.A. i-viii, 1-112 and A1-A24 pp.

_____. 1981b. Behavior of Common and Roseate Terns after trapping. Colonial Waterbirds 4: 44-46.

Nisbet, I. C. T. and M. E. Cohen. 1975. Asynchronous hatching in Common and Roseate Terns, *Sterna hirundo* and *S. dougallii*. Ibis 117: 374-379.

Nisbet, I. C. T. and W. H. Drury. 1972. Measuring breeding success in Common and Roseate Terns. Bird-Banding 43: 97-106.

Norris, R. 1939. Ring-billed Gulls at St. Simons Island during June. Oriole 4: 31.

Norris, R. A. and D. W. Johnston. 1958. Weights and weight variations in summer birds from Georgia and South Carolina. Wilson Bull. 70: 114-129.

Norton, R. L. 1981. The changing seasons; the nesting season: June 1-July 31, 1981; West Indies Region. Am. Birds 35: 981.

Numme, G. 1977. Kongeterne i Vestfold, en ny art for Norge. [Royal Tern in Vestfold, first record in Norway.] Sterna 16: 93-97. [In Norwegian with English summary.]

Nunnally, S., D. Nunnally, R. Needham and R. Lennon. 1979. Nocturnal feeding of gulls at a lighted pier. Chat 43: 63.

Oberholser, H. C. 1938. The bird life of Louisiana. Publ. in cooperation with the Biological Survey, U.S. Dep. Agric., by the U.S. Dep. Conserv. T. J. Moran's Sons, New Orleans, LA. 834 pp.

_____. 1963 ms. The bird life of Texas. Microfilm copy of manuscript in files of the natural history library of the Smithsonian Institution, Washington, D.C. 11,754 pp.

_____. 1974. The bird life of Texas. Volume I. Univ. Texas Press, Austin, TX. 530 pp.

Ogden, J. C. 1970. The changing seasons; the nesting season: June 1-August 15, 1970; Florida Region. Audubon Field Notes 24: 673-677.

_____. 1971. The changing seasons; the nesting season: June 1-August 15, 1971; Florida Region. Am. Birds 25: 846-851.

_____. 1972. The changing seasons; the nesting season: June 1-August 15, 1972; Florida Region. Am. Birds 26: 847-852.

_____. 1973. The changing seasons; the nesting season: June 1-July 31, 1973; Florida Region. Am. Birds 27: 859-863.

_____. 1974. The changing seasons; the nesting season: June 1-July 31, 1974; Florida Region. Am. Birds 28: 892-896.

_____. 1975. The changing seasons; the nesting season: June 1-July 31, 1975; Florida Region. Am. Birds 29: 960-963.

_____. 1976. The changing seasons; the nesting season: June 1-July 31, 1976; Florida Region. Am. Birds 30: 945-948.

_____. 1977. The changing seasons; the nesting season: June 1-July 31, 1977; Florida Region. Am. Birds 31: 1128-1130.

_____. 1978. The changing seasons; the nesting season: June 1-July 31, 1978; Florida Region. Am. Birds 32: 1150-1152.

_____. 1979. The changing seasons; the nesting season: June 1-July 31, 1979; Florida Region. Am. Birds 33: 855-858.

Ogden, J. C. and H. M. Stevenson. 1965. The changing seasons; the spring migration: April 1-May 31, 1965; Florida Region. Audubon Field Notes 19: 534-537.

Ohlendorf, H. M., R. W. Risebrough and K. Vermeer. 1978. Exposure of marine birds to environmental pollutants. U.S. Fish Wildl. Serv. Wildl. Res. Rep. 9. 40 pp.

O'Keeffe, C. 1978. Oil pollution and seabirds on Irish coasts. Irish Birds 1: 206-210.

Onno, S. 1968. Ornithological research in Matsalu Bay. Pp. 39-48 _in_ E. Kumari (ed.). Birdlife in Matsalu Bay. Acad. Sci. Estonian S.S.R. Inst. Zool. Bot. Tallinn. 59 pp.

OSJ (Ornithological Society of Japan). 1974. Check-list of the Japanese birds. Fourth and rev. ed. Yamashina Inst. Ornithol. Zool., Tokyo. 264 pp.

Owens, E. H. and G. A. Robilliard. 1981. Shoreline sensitivity and oil spills --a re-evaluation for the 1980's. Mar. Pollut. Bull. 12: 75-78.

Palmer, R. S. 1938. Tern mortality along the Maine coast. Bird-Banding 9: 117-123.

_____. 1941a. A behavior study of the Common Tern. Proc. Boston Soc. Nat. Hist. 42: 1-119.

Palmer, R. S. (ed.). 1976a. Handbook of North American birds. Vol. II: Waterfowl (Part I). Yale University Press, New Haven, CT. 521 pp.

_____. 1976b. Handbook of North American birds. Vol. III: Waterfowl (Part II). Yale University Press, New Haven, CT. 560 pp.

Paludan, K. 1951. Contributions to the breeding biology of *Larus argentatus* and *Larus fuscus*. Vidensk. Medd. Dan. Naturhist. Foren. 114: 1-128.

Pangburn, C. H. 1919. A three-months list of the birds of Pinellas County, Florida. Auk 36: 393-405.

Pantelidis, N. and V. Pantelidis. 1969. Terns seen during and after passage of Hurricane Abbey at Fort Pierce, June 4-5, 1968. Fla. Nat. 42: 40.

Pantelidis, [V.] 1966. Roseate Tern at Fort Pierce. Fla. Nat. 39: 30.

Pantelidis, V. S. and H. M. Stevenson. 1969. The changing seasons; the spring migration: April 1-May 31, 1969; Florida Region. Audubon Field Notes 23: 581-583.

Parmalee, D. F. 1961. A nesting colony of Black Terns in Kansas. Bull. Kansas Ornithol. Soc. 12: 25-27.

Parmalee, D. F. and S. D. MacDonald. 1960. The birds of West-Central Ellesmere Island and adjacent areas. Bull. Natl. Mus. Can. 169.

Parnell, J. F. 1965a. The changing seasons; the fall migration: August 16-November 30, 1964; Southern Atlantic Coast Region. Audubon Field Notes 19: 25-28.

_____. 1965b. The changing seasons; the winter season: December 1, 1964-March 31, 1965; Southern Atlantic Coast Region. Audubon Field Notes 19: 368-376.

_____. 1965c. The changing seasons; the spring migration: April 1-May 31, 1965; Southern Atlantic Coast Region. Audubon Field Notes 19: 460-462.

_____. 1966a. The changing seasons; the fall migration: August 16-November 30, 1965; Southern Atlantic Coast Region. Audubon Field Notes 20: 27-30.

Parnell, J. F. 1966b. The changing seasons; the spring migration: April 1-May 31, 1966; Southern Atlantic Coast Region. Audubon Field Notes 20: 493-495.

_____. 1967a. The changing seasons; the fall migration: August 16-November 30, 1966; Southern Atlantic Coast Region. Audubon Field Notes 21: 19-22.

_____. 1967b. The changing seasons; the winter season: December 1, 1966-March 31, 1967; Southern Atlantic Coast Region. Audubon Field Notes 21: 404-407.

_____. 1968. The changing seasons; the fall migration: August 16-November 30, 1967; Southern Atlantic Coast Region. Audubon Field Notes 22: 22-25.

_____. 1969. The changing seasons; the winter season: December 1, 1968-March 31, 1969; Southern Atlantic Coast Region. Audubon Field Notes 23: 466-468.

_____. 1970. The changing seasons; the fall migration: August 16-November 30, 1969; Southern Atlantic Coast Region. Audubon Field Notes 24: 31-33.

Parnell, J. F. and R. F. Soots (eds.). 1975. Proceedings of a conference on management of dredge islands in North Carolina estuaries. Sea Grant Program, N.C. State Univ., Raleigh, NC. 142 pp.

_____. 1976. Caspian Tern nesting in North Carolina. Chat 40: 14-15.

_____. 1979 ms. Atlas of colonial waterbirds of North Carolina estuaries. Univ. N. C. Sea Grant Publ. UNC-SG-78. 269 pp.

Parrack, J. D. 1967. The wreck of oiled birds in the north-east early in 1966. Seabird Bull 3: 12-17.

Parsons, J. 1972. Egg size, laying date and incubation period in the Herring Gull. Ibis 114: 536-541.

_____. 1976a. Factors determining the number and size of eggs laid by the Herring Gull. Condor 78: 481-492.

Patten, S., Jr. and A. R. Weisbrod. 1974. Sympatry and interbreeding of Herring and Glaucous-winged Gulls in southeastern Alaska. Condor 76: 343-344.

Patton, S. R. 1979. Short and long-term effects of Red Fox nocturnal predation on the nesting success of colonial breeding Herring and Ring-billed Gulls. M.S. thesis, N. Ill. Univ./Dekalb, IL. vi and 107 pp.

Paulson, D. R. and H. M. Stevenson. 1962. The changing seasons; the spring migration: April 1-May 31, 1962; Florida Region. Audubon Field Notes 16: 398-404.

Payne, R. B. and H. F. Howe. 1976. Cleptoparasitism by gulls of migrating shorebirds. Wilson Bull. 88: 349-351.

Paynter, R. A., Jr. 1947a. The fate of banded Kent Island Herring Gulls. Bird-Banding 18: 156-170.

_____. 1949. Clutch-size and the egg and chick mortality of Kent Island Herring Gulls. Ecology 30: 146-166.

_____. 1955. The ornithogeography of the Yucatan peninsula. Peabody Mus. Nat. Hist. Yale Univ. Bull. 9. 347 pp.

Peakall, D. B., D. S. Miller, G. Lambert, J. Kahn and W. B. Kinter. 1978. Effects of crude oil fractions on Herring Gull chicks (*Larus argentatus*). Bull. Mt. Desert Isl. Biol. Lab. 18: 74-75.

Pearson, T. G. 1908. Cabot's Tern (*Sterna sandvicensis acuflavida*) breeding in North Carolina. Auk 25: 312.

Pearson, T. G., C. S. Brimley and H. H. Brimley. 1919. Birds of North Carolina. N.C. Geol. Econ. Surv. Vol. IV. Raleigh, NC. xxiii and 380 pp.

_____. 1942. Birds of North Carolina. N.C. Dep. Agric., Raleigh, NC. 416 pp.

Pearson, T. H. 1968. The feeding biology of sea-bird species breeding on the Farne Islands, Northumberland. J. Anim. Ecol. 37: 521-552.

Pelzl, H. W. 1969. Birds of the British Honduras Keys. Unpubl. rep. Am. Mus. Nat. Hist., N.Y.

Pemberton, J. R. 1927. The American Gull-billed Tern breeding in California. Condor 29: 253-258.

Penland, S. 1976a. The natural history and current status of the Caspian Tern (*Hydroprogne caspia*) in Washington State. M.S. thesis, Univ. Puget Sound/ Tacoma, WA. 101 pp.

Penland, S. T. and S. F. Jeffries. 1977. New breeding records for the Ring-billed Gull in Washington. Murrelet 58: 86-87.

Perry, M. C., F. Ferrigno and F. H. Settle. 1979. Rehabilitation of birds oiled on two mid-Atlantic estuaries. Proc. 32nd Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies: 318-325.

Peters, J. L. 1934. Check-list of birds of the world. Volume II. Harvard Univ. Press, Cambridge, MA. xvii and 401 pp.

Peterson, R. T. and G. E. Watson. 1971. Franklin's Gull and Bridled Tern in southern Chile. Auk 88: 670-671.

Petrovic, C. A. and J. King. 1973. Bird records from the Dry Tortugas. Fla. Field Nat. 1: 5-8.

Pettingill, O. S., Jr. 1937. Behavior of Black Skimmers at Cardwell Island, Virginia. Auk 54: 237-244.

_____. 1958a. Ring-billed Gulls hawking may-flies. Jack-Pine Warbler 36: 154.

_____. 1967. A 36-year-old Herring Gull. Auk 84: 123.

Phillips, J. 1974. Oiled seabirds successfully cleaning their plumage. Brit. Birds 67: 483.

Phillips, W. W. A. 1967. Oiled seabirds in Pagham Harbour in January and February 1967. Seabird Bull. 3: 17.

Pierotti, R. 1982. Habitat selection and its effect on reproductive output in the Herring Gull in Newfoundland. Ecology 63: 854-868.

Pimlott, D. H. 1952. The economic status of the Herring Gulls of the Grand Manan Archipelago, New Brunswick, 1949. Can. Wildl. Serv. Wildl. Manage. Bull. Ser. 2. Vol. 5: 1-76.

Pinkowski, B. C. 1980. Adaptations of Common Terns nesting on an inland reservoir. Prairie Nat. 12: 111-113.

Pittman, H. H. 1927. The Black Terns of Saskatchewan. Condor 29: 140-143.

Pocklington, R., P. R. Willis and M. Palmieri. 1972. Birds seen at sea and on an island in the Cargadas Carajos Shoals. Atoll Res. Bull. 158. 8 pp.

Poor, H. H. 1943. Color-banded immature Herring Gulls in the New York region. Bird-Banding 14: 101-115.

Portenko, L. A. 1972. Ptisy Chukotskogo poluostrova i ostrova Vrangelya. [Birds of the Chukchii Peninsula and Wrangel Island.] Vol. I. [1981 translation by Amerind Publ. Co., New Delhi.] xv and 446 pp.

Portnoy, J. W. 1977. Nesting colonies of seabirds and wading birds--coastal Louisiana, Mississippi, and Alabama. U.S. Fish Wildl. Serv. Biol. Serv. Progr. FWS/OBS-77/07. 126 pp.

_____. 1978 ms. North Gulf of Mexico coastal waterbird colonies: changes in breeding abundance and distribution from 1976 to 1978. 46 pp.

_____. 1978. Black Skimmer abundance on the Louisiana-Mississippi-Alabama coast. Wilson Bull. 90: 438-441.

_____. 1980. Census methods for Gulf coast waterbirds. Trans. Linn. Soc. N.Y. 9: 127-133.

Portnoy, J. W., R. M. Erwin and T. W. Custer. 1981. Atlas of gull and tern colonies: North Carolina to Key West, Florida (including pelicans, cormorants and skimmers). U.S. Fish Wildl. Serv. Off. Biol. Serv., Washington, D.C. FWS/OBS-80/05. vi and 121 pp.

Poslawski, A. N. and G. A. Kriwonosow. 1978. Die Brandseeschwalbe (Sterna sandvicensis) am Kaspischen Meer. Ihre spezielle Anpassung an extreme Bedingungen an der Grenze des Verbreitungsgebiets. Ornithol. Mitt. 30: 211-222. [In German.]

Post, P. W. and M. Gochfeld. 1979. Recolonization by Common Terns at Breezy Point, New York. Proc. 1978 Conf. Colonial Waterbird Group 2: 128-136.

Post, P. [W.] and D. Riepe. 1980. Laughing Gulls colonize Jamaica Bay. Kingbird 30: 11-13.

Post, W., Jr. 1967. Least Tern nesting at Lake Marion, S.C. Chat 31: 96-97.

Potter, E. F., J. F. Parnell and R. P. Teulings. 1980. Birds of the Carolinas. Univ. of North Carolina Press, Chapel Hill, NC. viii and 408 pp.

Power, G. 1964. Breeding success of the Common Tern on the north shore of the Gulf of St. Lawrence in 1961 and 1962. Arctic 17: 51-53.

Powers, K. D. and W. R. Rummage. 1978. Effect of the Argo Merchant oil spill on bird populations off the New England coast, 15 December 1976-January 1977. Pp. 142-148 in In the wake of the ARGO MERCHANT. Cent. Ocean Manage. Stud., Univ. R.I./Narragansett, RI.

Powers, K. D., G. L. Pittman and S. J. Fitch. 1980. Distribution of marine birds on the Mid- and North-Atlantic U.S. Outer Continental Shelf. Summary of activities from: January 1978 - July 1980. Manomet Bird Observatory Tech. Prog. Rep. viii and 165 pp. [Prepared for the U.S. Dep. Energy under DOE Contract Number DE-AC02-78EV04706.A002.]

Preston, F. W. 1962. A nesting of Amazonian terns and skimmers. Wilson Bull. 74: 286-287.

Preston, J. W. 1886. Breeding of Franklin's Gull in Minnesota. Ornithol. Oolog. 11: 54-55.

Preston, K. 1975. Laughing Gull in Co. Cork. Brit. Birds 68: 158-159.

Provost, M. W. 1947. Nesting of birds in the marshes of northwest Iowa. Am. Midl. Nat. 38: 485-503.

Prys-Jones, O. E. 1973. Interactions between gulls and eiders in St. Andrews Bay, Fife. Bird Study 20: 311-313.

Pujals, J. J. 1973. First photograph of Bonaparte's Gull in Panama. Am. Birds 27: 840.

Purrington, R. D. 1969. The changing seasons; the fall migration: August 16-November 30, 1968; Central Southern Region. Audubon Field Notes 23: 65-70.

_____. 1973a. The changing seasons; the fall migration: August 16-November 30, 1972; Central Southern Region. Am. Birds 27: 70-75.

_____. 1973b. The changing seasons; the winter season: December 1, 1972-March 31, 1973; Central Southern Region. Am. Birds 27: 626-630.

_____. 1974. The changing seasons; the fall migration: August 1-November 30, 1973; Central Southern Region. Am. Birds 28: 63-67.

_____. 1975. The changing seasons; the fall migration: August 1-November 30, 1974; Central Southern Region. Am. Birds 29: 68-74.

_____. 1976. The changing seasons; the fall migration: August 1-November 30, 1975; Central Southern Region. Am. Birds 30: 82-87.

_____. 1977. The changing seasons; the autumn migration: August 1-November 30, 1976; Central Southern Region. Am. Birds 31: 186-190.

_____. 1978. The changing seasons; the autumn migration: August 1-November 30, 1977; Central Southern Region. Am. Birds 32: 215-220.

_____. 1979. The changing seasons; the autumn migration: August 1-November 30, 1978; Central Southern Region. Am. Birds 33: 185-188.

_____. 1980. The changing seasons; the autumn migration: August 1-November 30, 1979; Central Southern Region. Am. Birds 34: 170-172.

Quinney, T. E., B. N. Miller, and K. R. S. Quinney. 1981. Gulls robbing prey from Great Blue Herons (Ardea herodias). Can. Field-Nat. 95: 205-206.

Radford, M. C. 1961. A study of the British ringing records of the Common Tern and Arctic Tern and comparison with some foreign records. Bird Study 8: 174-184.

Raffaele, H. A. 1981. New records of bird species for Puerto Rico and one for the West Indies. Am. Birds 35: 142-143.

Randall, R. M. and B. M. Randall. 1978. Diet of Roseate Terns during the breeding season at St. Croix Is., Algoa Bay. Cormorant 5: 4-10.

_____. 1980. Status and distribution of the Roseate Tern in South Africa. Ostrich 51: 14-20.

_____. 1981. Roseate Tern breeding biology and factors responsible for low chick production in Algoa Bay, South Africa. Ostrich 52: 17-24.

Rankin, M. N. and A. G. Duffey. 1948. A study of the bird-life of the North Atlantic. Brit. Birds 41: 3-42.

Ray, G. E. 1971. Second Black Skimmer record for Oklahoma. Bull. Okla. Ornithol. Soc. 4: 33-34.

Raynor, G. S. 1970. An African recovery of a North American Common Tern. Bird-Banding 41: 310-311.

Ree, V. 1974. Kanadisk hettemake observert i Norge. [Bonaparte's Gull observed in Norway.] Sterna 13: 109-115. [In Norwegian with English summary.]

Reimold, R. J. 1977. Mangals and salt marshes of the eastern United States. Pp. 157-166 in V. J. Chapman (ed.). Ecosystems of the world I: wet coastal ecosystems. Elsevier Sci. Publ. Co., Amsterdam, The Netherlands. xi and 428 pp.

Reynolds, J. F. 1977. Attempted food piracy by Gull-billed Terns. Brit. Birds 70: 392-393.

Ricklefs, R. E., D. C. Hahn and W. A. Montevecchi. 1978. The relationship between egg size and chick size in the Laughing Gull and Japanese Quail. Auk 95: 135-144.

Ridley, M. W. 1980. The breeding behavior and feeding ecology of Grey Phalaropes *Phalaropus fulicarius* in Svalbard. Ibis 122: 210-226.

Ridley, M. W. and R. Percy. 1958. The exploitation of sea birds in Seychelles. Colon. Res. Stud. 25: 1-78.

Riisgard, H. U. 1979. Danish marine oil pollution policy. Mar. Pollut. Bull. 10: 250-253.

Rittinghaus, H. 1956. Etwas ober die "indirecte" Verbreitung der Olpest in einem Seevogelschutzgebiet. [On the "indirect" spread of oil pollution in a seabird sanctuary.] Ornithol. Mitt. 8: 43-46.

Robbins, S. 1977. The breeding bird survey in Wisconsin 1966-1975. Passenger Pigeon 39: 225-247.

Roberts, R. 1934. Notes on the birds on central and south east Iceland with special reference to food habits. Ibis (13th Ser.) 4: 239-264.

Roberts, T. S. 1900. An account of the nesting habits of Franklin's Rosy Gull (*Larus franklinii*), as observed at Heron Lake in southwestern Minnesota. Auk 17: 272-283.

Robertson, M. J. and W. B. Robertson, Jr. 1978 ms. Occurrence and effects of chronic, low-level oil contamination in a population of Sooty Terns (Sterna fuscata). Unpubl. ms. in files of S. Fla. Res. Cent., Everglades Natl. Park, Fla. 42 pp.

Robertson, W. B., Jr. 1961. The changing seasons; the nesting season: June 1-August 15, 1961; Florida Region. Audubon Field Notes 15: 461-464.

_____. 1962. The changing seasons; the nesting season: June 1-August 15, 1962; Florida Region. Audubon Field Notes 16: 468-473.

_____. 1964. The terns of the Dry Tortugas. Bull. Fla. State Mus. 8: 1-94.

_____. 1967 ms a. Distant recoveries (i.e., more than 100 miles) of Sooty Terns (Sterna fuscata) banded at Dry Tortugas, Florida. Unpubl. ms. in files of S. Fla. Res. Cent., Everglades Natl. Park, Fla. 11 pp.

_____. 1967. The changing seasons; the winter season: Dec. 1, 1966-March 31, 1967; Florida Region. Audubon Field Notes 21: 407-413.

_____. 1968. The changing seasons; the spring migration: April 1-May 31, 1968; Florida Region. Audubon Field Notes 22: 516-520.

_____. 1969. Transatlantic migration of juvenile Sooty Terns. Nature 223: 632-634.

_____. 1970. The changing seasons; the fall migration: August 16-November 30, 1969; Florida Region. Audubon Field Notes 24: 33-38.

_____. 1971. The changing seasons; the fall migration: August 16-November 30, 1970; Florida Region. Am. Birds 25: 44-49.

_____. 1972. The changing seasons; the fall migration: August 16-November 30, 1971; Florida Region. Am. Birds 26: 50-54.

_____. 1978a. Roseate Tern. Pp. 39-40 in H. W. Kale, II (ed.). Rare and endangered biota of Florida. Vol. 2. Birds. Univ. Presses of Florida, Gainesville, FL. xix and 121 pp.

_____. 1978b. Species of special concern. Sooty Tern. Pp. 89-90 in H. W. Kale, II (ed.). Rare and endangered biota of Florida. Vol. 2. Birds. Univ. Presses of Florida, Gainesville, FL. xix and 121 pp.

_____. 1978c. Species of special concern. Noddy Tern. Pp. 95-96 in H. W. Kale, II (ed.). Rare and endangered biota of Florida. Vol. 2. Birds. Univ. Presses of Florida, Gainesville, FL. xix and 121 pp.

Robertson, W. B., Jr. and C. F. Mason. 1965. Additional bird records from the Dry Tortugas. Fla. Nat. 38: 131-138.

Robertson, W. B., Jr. and J. C. Ogden. 1968. The changing seasons; the fall migration: August 16-November 30, 1967; Florida Region. Audubon Field Notes 22: 25-31.

Robertson, W. B., Jr. and D. R. Paulson. 1961. The changing seasons; the fall migration: August 16-November 30, 1960; Florida Region. Audubon Field Notes 15: 26-35.

Robertson, W. B., Jr. and H. M. Stevenson. 1957. The changing seasons; the spring migration: April 1-May 31, 1957; Florida Region. Audubon Field Notes 11: 337-342.

Robertson, W. B., Jr. and D. L. Stoneburner. 1980. Radio-tracking of nesting Sooty Terns (Sterna fuscata). (Abstract only.) Proc. 1979 Conf. Colonial Waterbird Group 3: 260.

Robinson, H. W. 1910. Marked Sandwich Tern apparently nesting in its first year. Brit. Birds 4: 88.

_____. 1923. Great Black-backed Gull killing Razorbill. Brit. Birds 17: 67-68.

_____. 1930. Size of clutches in Sandwich Terns. Brit. Birds 24: 132-133.

_____. 1933. Great mortality among young terns in Lancashire. Brit. Birds 27: 138-139.

_____. 1934a. Mortality among young Common Terns in Lancashire. Brit. Birds 28: 211-212.

Rockwell, R. B. 1911. Notes on the nesting of Forster's and Black Terns in Colorado. Condor 13: 57-63.

Rogers, A. E. F. 1969a. Common Tern recovery in Australia. Austr. Bird Bander 7: 36.

Rogers, M. J. 1972. Franklin's Gull in Sussex. Brit. Birds 65: 81-82.

Rogers, M. J. and the Rarities Committee. 1981. Report on rare birds in Great Britain in 1980. Brit. Birds 74: 453-495.

_____. 1982. Report on rare birds in Great Britain in 1981. Brit. Birds 75: 482-533.

Rohwer, S. A. and G. E. Woolfenden. 1968. The varied diet of the Gull-billed Tern includes a shrub-inhabiting lizard. Wilson Bull. 80: 330-331.

Roland, J. V., G. E. Moore and M. A. Bellanca. 1977. The Chesapeake Bay Oil Spill--February 2, 1976: a case history. Pp. 523-527 in Proc. Oil Spill Conf., 8-10 March 1977, New Orleans, LA. Am. Petroleum Inst., Washington, DC.

Rossignol, G. R., Jr. 1913. Another Bridled Tern for South Carolina. Auk 30: 105.

Rothwiler, R. A. 1960. Food habits, movements and nesting of gulls on a waterfowl area, Freezeout Lake, Teton County, Montana. M.S. thesis, Montana State Coll./Bozeman, MT. 29 pp.

Rowlett, R. A. 1978. A massive flight of Cory's Shearwaters at Cape Hatteras. Chat 42: 45-46.

_____. 1980. Observations of marine birds and mammals in the Northern Chesapeake Bight. U.S. Fish Wildl. Serv. Biol. Serv. Progr. FWS/OBS-80/04. 87 pp.

Royal Commission on Environmental Pollution. 1981. Oil pollution of the seas. Her Majesty's Stationary Office, London.

Russell, J. C. 1939. Bridled Tern on Marquese Islands. Fla. Nat. 12: 44.

Russell, S. M. 1964. A distributional study of the birds of British Honduras. AOU Ornithol. Monogr. 1. 195 pp.

Ryder, J. P. 1975. Egg-laying, egg size, and success in relation to immature-plumage of Ring-billed Gulls. Wilson Bull. 87: 534-542.

_____. 1976. The occurrence of unused Ring-billed Gull nests. Condor 78: 415-418.

_____. 1978. Sexing Ring-billed Gulls externally. Bird-Banding 49: 218-222.

Ryder, J. P. and T. R. Carroll. 1978. Reproductive success of Herring Gulls on Granite Island, northern Lake Superior, 1975 and 1976. Can. Field-Nat. 92: 51-54.

Ryder, J. P. and P. L. Sompii. 1979. Female-female pairing in Ring-billed Gulls. Auk 96: 1-5.

Ryder, J. P., D. E. Orr and G. H. Saedi. 1977. Egg quality in relation to nest location in Ring-billed Gulls. Wilson Bull. 89: 473-475.

Ryder, P. L. and J. P. Ryder. 1981a. Reproductive performance of Ring-billed Gulls in relation to nest location. Condor 83: 57-60.

Rydzewskii, W. 1978. The longevity of ringed birds. Ring 96-97: 218-262.

Sabinevskii, B. V. 1958. Khozyaistvennoe znachenie chaiki-khokhotun'i v usloviyakh Chernomorskogo zapovednika. [Economic importance of Larus fuscus under the conditions in the Black Sea Reservation.] Tr. Chernomorsk. Gos. Zapov. 2.

Sage, B. L. 1968. Ornithological transects in the North Atlantic. Ibis 110: 1-16.

Salomonsen, F. 1955. The evolutionary significance of bird migration. Dan. Biol. Medd. 22: 1-62.

_____. 1967. Migratory movements of the Arctic Tern (Sterna paradisaea Pontoppidan) in the southern ocean. K. Dan. Vidensk. Selsk. Biol. Medd. 24: 1-42.

_____. 1979. Marine birds in the Danish monarchy and their conservation. Pp. 267-287 in J. C. Bartonek and D. N. Nettleship (eds.). Conservation of marine birds of northern North America. U.S. Fish Wildl. Serv. Wildl. Res. Rep. 11. ix and 319 pp.

Salt, G. W. and D. E. Willard. 1971. The hunting behavior and success of Forster's Tern. Ecology 52: 989-998.

Sanders, J. A. 1976. A Northern Phalarope in Attala County, Mississippi. Mississippi Kite 6: 36.

Saugstad, S. 1940. Feeding habits of the Franklin's Gull in North Dakota. N. Dak. Agric. Exp. Stn. Bimon. Bull. 2: 14-16.

Savell, W. E. 1972. Gull-billed Terns in New Jersey. Cassinia 53: 47-48.

Savile, D. B. O. and C. E. Savile. 1976. Sight record of Laughing Gulls (Larus atricilla) in Saskatchewan. Can. Field-Nat. 90: 187.

Schamel, D. and D. Tracy. 1977. Polyandry, replacement clutches and site tenacity in the Red Phalarope (Phalaropus fulicarius) at Barrow, Alaska. Bird-Banding 48: 314-324.

Scharf, W. C. 1978. Colonial birds nesting on man-made and natural sites in the U.S. Great Lakes. U.S. Army Engineer Waterways Exp. Stn., Vicksburg, MS. Tech. Rep. D-78-10, and U.S. Fish Wildl. Serv. Rep. FWS/OBS-78/15. 136 [and 29] pp.

_____. 1979. Nesting and migration areas of birds of the U.S. Great Lakes (30 April to 25 August 1976). U.S. Fish Wildl. Serv. Off. Biol. Serv. FWS/OBS-77/2. 113 pp.

_____. 1981. The significance of deteriorating man-made island habitats to Common Terns and Ring-billed Gulls in the St. Mary's River, Michigan. Colonial Waterbirds 4: 155-159.

Scharringa, J. 1979. American Sandwich Tern *Sterna sandvicensis acuflavidus* in the Netherlands. Dutch Birding 1: 60.

Schiemann, H. 1972. Uber Winterquartiere nordeuropaischer Odinshuhnchen. [On wintering areas of northern Red-necked Phalaropes (*Phalaropus lobatus*).] Vogelwarte 26: 329-336. [In German with English summary.]

Schmidt, G. 1954. Zum Rauben der Schmarotzer-Raubmowe. Vogelwelt 75: 147-151. [In German.]

Schmitt, M. B., P. le S. Milstein, H. C. Hunter and C. J. Hopecroft. 1973. Black Terns in the Transvaal. Bokmakierie 25: 91-92.

Schonert, C. 1961. Zur Brutbiologie und Ethologie der Zwergseeschwalbe (*Sterna albifrons albifrons* Pallas). Pp. 131-187 *in* H. Schildmacher (ed.). Beitragzur Kenntnis deutscher Vogel. Jena, Gustav Fischer Verlag. [In German.]

Schreiber, E. A. and R. W. Schreiber. 1977. Gulls wintering in Florida: Christmas Bird Count analysis. Fla. Field Nat. 5: 35-40.

_____. 1980. Breeding biology of Laughing Gulls in Florida. Part II: Nestling parameters. J. Field Ornithol. 51: 340-355.

Schreiber, E. A., R. W. Schreiber and J. J. Dinsmore. 1979. Breeding biology of Laughing Gulls in Florida. Part I: Nesting, egg, and incubation parameters. Bird-Banding 50: 304-321.

Schreiber, R. W. 1978. Species of special concern. Caspian Tern. P. 94 *in* H. W. Kale, II (ed.). Rare and endangered biota of Florida. Vol. 2. Birds. Univ. Presses of Florida, Gainesville, FL. xix and 121 pp.

Schreiber, R. W. and N. P. Ashmole. 1970. Sea-bird breeding seasons on Christmas Island, Pacific Ocean. Ibis 112: 363-394.

Schreiber, R. W. and J. M. Lawrence. 1976. Organic material and calories in Laughing Gull eggs. Auk 93: 46-52.

Schreiber, R. W. and E. A. Schreiber. 1978. Colonial bird use and plant succession on dredged material islands in Florida. Vol. I: Sea and wading bird colonies. U.S. Army Engineer Waterways Exp. Stn., Vicksburg, MS. Tech. Rep. D-78-14. 63 [and 63] pp.

_____. 1979. Notes on measurements, mortality, molt, and gonad condition in Florida west coast Laughing Gulls. Fla. Field Nat. 7: 19-23.

Schreiber, R. W. and S. N. Young. 1974. Evidence for learning to feed in Laughing Gulls. Fla. Field Nat. 2: 16-17.

Sciple, G. W. 1951. Noddy Terns observed at Pawley's Island, S.C. Chat 15: 33.

_____. 1963. Sandwich Terns present on outer coastal islands and offshore. Oriole 28: 11-12.

Scott, C. M. 1977. Food stealing behavior in the Ring-billed Gull. Bull. Okla. Ornithol. Soc. 10: 33.

Scott, D. M. 1959. Observations of marine birds off southwestern Nova Scotia. Can. Field-Nat. 73: 15-20.

Scott, T. G., P. H. Eschmeyer, and H. C. Schultz (eds.). 1978. Fisheries and wildlife research 1978. U. S. Fish Wildl. Serv., Washington, D.C. iv and 107 pp.

Sears, H. F. 1978. Nesting behavior of the Gull-billed Tern. Bird-Banding 49: 1-16.

_____. 1979. Colonial nesting as an anti-predator adaptation in the Gull-billed Tern. Auk 96: 202-203.

Segre, A., J. P. Hailman, and C. G. Beer. 1968. Complex interactions between Clapper Rails and Laughing Gulls. Wilson Bull. 80: 213-219.

Selander, R. K., R. F. Johnston, B. F. Wilks, and G. G. Raun. 1962. Vertebrates from the barrier island of Tamaulipas, Mexico. Univ. Kans. Mus. Nat. Hist. Publ. 12: 309-345.

Selous, E. 1915. A diary of ornithological observations made in Iceland during June and July, 1912. Zoologist 19 (Ser. 4): 54-56, 169-174, 303-307; 20: 54-68, 139-152, 267-272.

Serventy, D. L. and H. M. Whittell. 1976. Birds of Western Australia. Univ. West. Austr. Press, Perth, Western Australia. 481 pp.

Serventy, D. L., V. Serventy and J. Warham. 1971. The handbook of Australian seabirds. A. H. and A. W. Reed, Sydney, Australia. 254 pp.

Seton, G. 1931. Great Black-backed Gull preying on Storm-Petrels. Brit. Birds 25: 60.

Seymour, N. R. 1972. Success of three gull species feeding on swarming ants in Antigonish County, Nova Scotia. Can. Field-Nat. 86: 391-392.

_____. 1974. Great Black-backed Gulls feeding on live eels. Can. Field-Nat. 88: 352-353.

Shelley, L. O. 1934a. Herring Gull recovery from Panama. Bird-Banding 5: 189.

Sheppard, R. W. 1945. Gulls and terns hawking flying insects. Wilson Bull. 57: 204.

_____. 1952. The Black Tern as an insect-eater. Can. Field-Nat. 66: 129.

Shepperd, J. 1951. Black Tern plunging into water. Brit. Birds 44: 71.

Shugart, G. W. 1977a. A method for externally sexing gulls. Bird-Banding 48: 118-121.

_____. 1977b. Resident Red Fox predation upon an island gull colony. Jack-Pine Warbler 55: 199-205.

Shugart, G. W., W. C. Scharf, and F. J. Cuthbert. 1979. Status and reproductive success of the Caspian Tern (Sterna caspia) in the U. S. Great Lakes. Proc. 1978 Conf. Colonial Waterbird Group 2: 146-156.

Shuler, J. B. 1964. Sight record of a Red Phalarope in Charleston County, South Carolina. Chat 28: 30.

Sibley, C. G. 1953. Forster Terns breeding on San Francisco Bay, California. Condor 55: 278-279.

Sibley, F. C. and J. A. Spendelow. 1978 ms. Falkner's Island tern project--1978. Peabody Mus., Yale Univ./New Haven, CT. 4 pp.

Siegfried, W. R. 1972. Ring-billed Gulls robbing Lesser Scaup of food. Can. Field-Nat. 86: 86.

Silcocks, T. 1958. Black Terns feeding on mud-worms. Brit. Birds 51: 121.

Simons, M. 1981. Atlantic and Gulf Coast Beach Bird Survey Project Bull. 25. 1 p.

_____. 1981 ms. Beached bird surveys on southeastern and Florida Gulf coasts. Unpubl. ms. in the files of the Museum Section, Denver Wildl. Res. Cent., U.S. Fish Wildl. Serv., Washington, D.C. 10 pp.

Simpson, R. C. 1940. Birds of the Beaufort Region. Chat 4: 65-83.

Sims, H. W., Jr. 1970. Operation bird wash. Fla. Nat. 43: 43-45.

Sinclair, J. C. 1981. Notes on sea-birds 66. Eight previously unreported seabirds at Marion Island, Indian Ocean. Ardea 69: 217-218.

Skipnes, K. 1977a. Dognrytme hos rednebbterna, Sterna paradisaea, i tiden for egglegging. [The daily activity of Arctic Terns, Sterna paradisaea, in the pre-laying period.] Fauna 30: 201-213. [In Norwegian with English summary.]

Smail, J., D. G. Ainley and H. Strong. 1972. Notes on the birds killed in the 1971 San Francisco Bay oil spill. Calif. Birds 3: 25-32.

Small, A. 1974. The birds of California. Winchester Press, NY. xxiv and 310 pp.

Smith, A. D. 1979. Roseate Terns in Atlantic Canada. Unpubl. rep. Can. Wildl. Serv., Environ. Canada, Sackville, NB.

Smith, A. J. M. 1975. Studies of breeding Sandwich Terns. Brit. Birds 68: 142-156.

Smith, D. C., R. M. Erwin, T. W. Custer and J. O. Fussell, III. 1981. Common Tern colonies along the mid-Atlantic coast. I. Nesting chronology. Colonial Waterbirds 4: 160-165.

Smith, E. D. 1961. Northern Phalarope on Lake Murray, South Carolina. Chat 25: 68.

Smith, J. L. and D. R. Mudd. 1978. Food of the Caspian Tern in Grays Harbor, Washington. Murrelet 59: 105-106.

Smith, K. D. 1951. Notes on the Bridled Tern in the Red Sea. Brit. Birds 44: 325-326.

Smith, N. G. 1966. Adaptations to cliff-nesting in some Arctic gulls (Larus). Ibis 108: 68-83.

Smith, T. C. 1978. Franklin's Gull near Savannah River mouth. Oriole 43: 54.

Smith, W. J. 1959. Movements of Michigan Herring Gulls. Bird-Banding 30: 69-104.

Snell, R. R. 1981. Herring Gull attacks and eats adult male Oldsquaw. Wilson Bull. 93: 110-111.

Snyder, D. E. 1960. Great Black-backed Gulls killing Dovekies. Auk 77: 476-477.

Soikkeli, M. 1970. Mortality rates of Finnish Caspian Terns Hydroprogne caspia. Ornis Fenn. 47: 177-179.

_____. 1973a. Breeding success of the Caspian Tern in Finland. Bird-Banding 44: 196-204.

_____. 1973b. Long-distance fishing flights of the breeding Caspian Tern Hydroprogne caspia. Ornis Fenn. 50: 47-48.

Somppi, P. L. 1978. Reproductive performance of Ring-billed Gulls in relation to nest location. M.S. thesis, Lakehead Univ./Thunder Bay, ON.

Soots, R. F., Jr. and J. F. Parnell. 1975a. Ecological succession of breeding birds in relation to plant succession on dredge islands in North Carolina. N. C. Sea Grant Publ. UNC-SG-75-27. viii and 91 pp.

_____. 1975b. First record of the Roseate Tern nesting in North Carolina. Chat 39: 20-21.

Southern, L. K. and W. E. Southern. 1979. Absence of nocturnal predator defense mechanisms in breeding gulls. Proc. 1978 Conf. Colonial Waterbird Group 2: 157-162.

_____. 1982a. Effect of habitat decimation on Ring-billed Gull colony- and nest-site tenacity. Auk 99: 328-331.

Southern, W. E. 1967a. Dispersal and migration of Ring-billed Gulls from a Michigan population. Jack-Pine Warbler 45: 102-111.

_____. 1968. Dispersal patterns of subadult Herring Gulls in central Maine. Bird-Banding 39: 81-106.

_____. 1974a. Florida distribution of Ring-billed Gulls from the Great Lakes region. Bird-Banding 45: 341-352.

_____. 1974b. Seasonal distribution of Great Lakes region Ring-billed Gulls. Jack-Pine Warbler 52: 155-179.

_____. 1977. Colony selection and colony site tenacity in Ring-billed Gulls at a stable colony. Auk 84: 469-478.

_____. 1980a. Comparative distribution and orientation of North American gulls. Pp. 449-498 in J. Burger, B. C. Olla and H. E. Winn (eds.). Behavior of Marine Animals. Vol. 4: Marine Birds. Plenum Press, NY. xvii and 515 pp.

Southern, W. E. and F. R. Moore. 1974. Range extremes for Ring-billed Gulls from the Great Lakes region. Inl. Bird Banding News 46: 83-87.

Southern, W. E., S. R. Patton, and L. A. Hanners. 1980. Differential response of Ring-billed Gulls and Herring Gulls to fox predation. Proc. 1979 Conf. Colonial Waterbird Group 3: 119-127.

Sowls, A. L., S. A. Hatch and C. J. Lensink. 1978. Catalog of Alaskan seabird colonies. U.S. Fish Wildl. Serv. Biol. Serv. Prog. FWS/OBS-78/78. vi and 32 pp. + maps and tables.

Sowls, A. L., A. R. DeGange, J. W. Nelson and G. S. Lester. 1980. Catalog of California seabird colonies. U.S. Fish Wildl. Serv. Biol. Serv. Prog. FWS/OBS-80/37. iv and 371 pp.

Spendelow, J. A. 1982. An analysis of temporal variation in, and the effects of habitat modification on, the reproductive success of Roseate Terns. Colonial Waterbirds 5: 19-31.

Spillner, W. 1975. Zur Fortpflanzungsbiologie der Trauerseeschwalbe (Chlidonias niger). Beitr. Vogelkd. 21: 172-215. [In German.]

Spitzer, G. 1976. Zur Ernahrung gelbfussiger Silbermowen (Larus argentatus michahellis) in der Adria und im Binnenland. [On the nutrition of the Yellow-legged Herring Gull (Larus argentatus michahellis) in the Adriatic area and in the inland.] Vogelwarte 28: 298-306. [In German with English summary.]

Sprunt, A., Jr. 1933. Second occurrence of Northern Phalarope in South Carolina. Auk 50: 358-359.

_____. 1934. The Red Phalarope off South Carolina. Auk 51: 374.

_____. 1935. The Noddy at Charleston, South Carolina. Auk 52: 309.

_____. 1940. Gull-billed Tern breeding in Florida. Auk 57: 251-252.

_____. 1941. Bridled Tern in Florida Bay. Auk 58: 259-260.

_____. 1945. First nesting of Forster's Tern in South Carolina. Auk 62: 639.

_____. 1947a. The Bridled Tern again in south Florida waters. Auk 64: 141-142.

_____. 1950. Bridled Tern, Sterna a. melanoptera, taken at Dry Tortugas. Auk 67: 514.

_____. 1954. Florida bird life. Coward-McCann, Inc., and the National Audubon Society, New York, NY. 527 pp.

_____. 1963. Addendum to Florida bird-life (1954). Fla. Audubon Society, Maitland, FL. 24 pp.

Sprunt, A., Jr. and E. B. Chamberlain. 1949. South Carolina bird life. Contrib. Charleston Mus. XI. Univ. S. C. Press, Columbia, SC. xx and 585 pp.

Sprunt, A., Jr. and A. Sprunt, IV. 1952. Bridled Tern on the South Carolina coast. Chat 16: 98-99.

Staav, R. 1979. Dispersal of Caspian Terns (Sterna caspia) in the Baltic. Ornis Fenn. 56: 13-17.

Stager, K. E. 1964. The birds of Clipperton Island, Eastern Pacific. Condor 66: 357-371.

Stedman, S. and A. Stedman. 1979. Feeding association between Bonaparte's Gull and Red-breasted Mergansers. Fla. Field Nat. 7: 27.

Steiniger, F. 1952. Bilder vom Tauchen der Silbermowe. Vogelwelt 73: 157-159.

Stelfox, H. A. and G. J. Brewster. 1979. Colonial-nesting Herring Gulls and Common Terns in northeastern Saskatchewan. Can. Field-Nat. 93: 132-138.

Stevenson, H. M. 1953a. The changing seasons; the winter season: December 1, 1952-March 31, 1953; Florida Region. Audubon Field Notes 7: 210-212.

_____. 1953b. The changing seasons; the nesting season: June 1-August 15, 1953; Florida Region. Audubon Field Notes 7: 304-306.

_____. 1954a. The changing seasons; the spring migration: April 1-May 31, 1954; Florida Region. Audubon Field Notes 8: 307-309.

_____. 1954b. The changing seasons; the nesting season: June 1-August 15, 1954; Florida Region. Audubon Field Notes 8: 340-342.

_____. 1955a. The changing seasons; the fall migration: August 16-November 30, 1954; Florida Region. Audubon Field Notes 9: 19-22.

_____. 1955b. The changing seasons; the winter season: December 1, 1954-March 31, 1955; Florida Region. Audubon Field Notes 9: 250-254.

_____. 1955c. The changing seasons; the nesting season: June 1-August 15, 1955; Florida Region. Audubon Field Notes 9: 373-375.

_____. 1956a. The changing seasons; the fall migration: August 16-November 30, 1955; Florida Region. Audubon Field Notes 10: 18-22.

_____. 1956b. The changing seasons; the winter season: December 1, 1955-March 31, 1956; Florida Region. Audubon Field Notes 10: 244-248.

_____. 1956c. The changing seasons; the spring migration: April 1-May 31, 1956; Florida Region. Audubon Field Notes 10: 325-329.

_____. 1956d. The changing seasons; the nesting season: June 1-August 15, 1956; Florida Region. Audubon Field Notes 10: 379-381.

_____. 1957a. The changing seasons; the fall migration: August 16-Nov. 30, 1956; Florida Region. Audubon Field Notes 11: 18-22.

_____. 1957b. The changing seasons; the winter season: December 1, 1956-March 31, 1957; Florida Region. Audubon Field Notes 11: 257-263.

_____. 1957c. The changing seasons; the nesting season: June 1-August 15, 1957; Florida Region. Audubon Field Notes 11: 399-402.

Stevenson, H. M. 1958a. The changing seasons; the fall migration: August 16-November 30, 1957; Florida Region. Audubon Field Notes 12: 21-26.

_____. 1958b. The changing seasons; the winter season: December 1, 1957-March 31, 1958; Florida Region. Audubon Field Notes 12: 271-276.

_____. 1958c. The changing seasons; the spring migration: April 1-May 31, 1958; Florida Region. Audubon Field Notes 12: 344-348.

_____. 1959a. The changing seasons; the winter season: December 1, 1958-March 31, 1959; Florida Region. Audubon Field Notes 13: 285-289.

_____. 1959b. The changing seasons; the spring migration: April 1-May 31, 1959; Florida Region. Audubon Field Notes 13: 363-365.

_____. 1959c. The changing seasons; the nesting season: June 1-August 15, 1959; Florida Region. Audubon Field Notes 13: 426-429.

_____. 1960a. The changing seasons; the fall migration: August 16-November 30, 1959; Florida Region. Audubon Field Notes 14: 25-29.

_____. 1960b. The changing seasons; the winter season: December 1, 1959-March 31, 1960; Florida Region. Audubon Field Notes 14: 301-305.

_____. 1960c. The changing seasons; the spring migration: April 1-May 31, 1960; Florida Region. Audubon Field Notes 14: 379-383.

_____. 1960d. The changing seasons; the nesting season: June 1-August 15, 1960; Florida Region. Audubon Field Notes 14: 444-446.

_____. 1961. The changing seasons; the winter season: December 1, 1960-March 31, 1961; Florida Region. Audubon Field Notes 15: 320-325.

_____. 1962a. The changing seasons; the fall migration: August 16-November 30, 1961; Florida Region. Audubon Field Notes 16: 21-25.

_____. 1962b. The changing seasons; the winter season: December 1, 1961-March 31, 1962; Florida Region. Audubon Field Notes 16: 321-324.

_____. 1963a. The changing seasons; the fall migration: August 16-November 30, 1962; Florida Region. Audubon Field Notes 17: 24-28.

_____. 1963b. The changing seasons; the spring migration: April 1-May 31, 1963; Florida Region. Audubon Field Notes 17: 397-399.

_____. 1963c. The changing seasons; the nesting season: June 1-August 15, 1963; Florida Region. Audubon Field Notes 17: 454-457.

_____. 1964a. The changing seasons; the winter season: December 1, 1963-March 31, 1964; Florida Region. Audubon Field Notes 18: 346-351.

Stevenson, H. M. 1964b. The changing seasons; the nesting season: June 1-August 15, 1964; Florida Region. Audubon Field Notes 18: 503-505.

______. 1965. The changing seasons; the nesting season: June 1-August 15, 1965; Florida Region. Audubon Field Notes 19: 534-537.

______. 1966a. The changing seasons; the fall migration: August 16-November 30, 1965; Florida Region. Audubon Field Notes: 20: 30-35.

______. 1966b. The changing seasons; the nesting season: June 1-August 15, 1966; Florida Region. Audubon Field Notes 20: 561-565.

______. 1967a. The changing seasons; the fall migration: August 16-November 30, 1966; Florida Region. Audubon Field Notes 21: 22-25.

______. 1967b. The changing seasons; the spring migration: April 1-May 31, 1967; Florida Region. Audubon Field Notes 21: 497-500.

______. 1967c. The changing seasons; the nesting season: June 1-August 15, 1967; Florida Region. Audubon Field Notes 21: 558-561.

______. 1968a. The changing seasons; the winter season: December 1, 1967-March 31, 1968; Florida Region. Audubon Field Notes 22: 430-434.

______. 1968b. The changing seasons; the nesting season: June 1-August 15, 1968; Florida Region. Audubon Field Notes 22: 599-602.

______. 1970. The changing seasons; the winter season: December 1, 1969-March 31, 1970; Florida Region. Audubon Field Notes 24: 493-497.

______. 1971. The changing seasons; the winter season: December 1, 1970-March 31, 1971; Florida Region. Am. Birds 25: 567-570.

______. 1972a. The changing seasons; the winter season: December 1, 1971-March 31, 1972; Florida Region. Am. Birds 26: 592-596.

______. 1972b. Recent breeding of the Sandwich Tern (Thalasseus sandvicensis) in Florida. Fla. Nat. 45: 94-95.

______. 1973. The changing seasons; the fall migration: August 16-November 30, 1972; Florida Region. Am. Birds 27: 45-49.

______. 1974. The changing seasons; the winter season: December 1, 1973-March 31, 1974; Florida Region. Am. Birds 28: 628-632.

______. 1975. The changing seasons; the winter season: December 1, 1974-March 31, 1975; Florida Region. Am. Birds 29: 679-683.

______. 1976. The changing seasons; the winter season: December 1, 1975-March 31, 1976; Florida Region. Am. Birds 30: 708-711.

Stevenson, H. M. 1977. The changing seasons; the winter season: December 1, 1976-March 31, 1977; Florida Region. Am. Birds 31: 322-325.

_____. 1978. The changing seasons; the winter season: December 1, 1977-March 31, 1978; Florida Region. Am. Birds 32: 339-342.

_____. 1979a. The changing seasons; the winter season: December 1, 1978-March 31, 1979; Florida Region. Am. Birds 33: 274-276.

_____. 1979b. First nesting of the Caspian Tern in the Florida Panhandle. Fla. Field Nat. 7: 8.

_____. 1980. The changing seasons; the winter season: December 1, 1979-February 29, 1980; Florida Region. Am. Birds 34: 265-267.

_____. 1981. The changing seasons; the winter season: December 1, 1980-February 28, 1981; Florida Region. Am. Birds 35: 293-295.

Stewart, J. R., Jr. 1962. The changing seasons; the nesting season: June 1-August 15, 1962; Central Southern Region. Audubon Field Notes 16: 480-486.

_____. 1963. The changing seasons; the nesting season: June 1-August 15, 1963; Central Southern Region. Audubon Field Notes 17: 465-467.

_____. 1964. The changing seasons; the nesting season: June 1-August 15, 1964; Central Southern Region. Audubon Field Notes 18: 512-515.

_____. 1965. The changing seasons; the nesting season: June 1-August 15, 1965; Central Southern Region. Audubon Field Notes 19: 552-554.

_____. 1967. The changing seasons; the nesting season: June 1-August 15, 1967; Central Southern Region. Audubon Field Notes 21: 578-581.

_____. 1969. The changing seasons; the nesting season: June 1-August 15, 1969; Central Southern Region. Audubon Field Notes 23: 666-669.

_____. 1970. The changing seasons; the nesting season: June 1-August 15, 1970; Central Southern Region. Audubon Field Notes 24: 691-693.

_____. 1971. The changing seasons; the nesting season: June 1-August 15, 1971; Central Southern Region. Am. Birds 25: 865-869.

_____. 1972. The changing seasons; the nesting season: June 1-August 15, 1972; Central Southern Region. Am. Birds 26: 867-869.

_____. 1975. The changing seasons; the nesting season: June 1-July 31, 1975; Central Southern Region. Am. Birds 29: 983-984, 993-995.

_____. 1976. The changing seasons; the nesting season: June 1-July 31, 1976; Central Southern Region. Am. Birds 30: 965-969.

Stewart, P. A. and R. W. Skinner. 1967. Weights of birds from Alabama and North Carolina. Wilson Bull. 79: 37-42.

Stewart, R. E. 1975. Breeding birds of North Dakota. Tri-College Center for Environmental Studies, Fargo, ND. 295 pp.

Stickel, L. F. and M. P. Dieter. 1979. Ecological and physiological/toxicological effects of petroleum on aquatic birds. U.S. Fish Wildl. Serv. Biol. Serv. Prog. FWS/OBS-79/23. 14 pp.

Stimson, L. A. 1955. Northern Phalarope. Fla. Nat. 28: 29.

_____. 1959. Roseate Terns (Sterna dougallii). Fla. Nat. 32: 202.

Stoddart, D. R. and M. E. D. Poore. 1970a. Geography and ecology of Farquhar Atoll. Atoll Res. Bull. 136: 7-26.

_____. 1970b. Geography and ecology of African Banks. Atoll Res. Bull. 136: 187-191.

Stone, W. 1909. The birds of New Jersey and their nests and eggs. Annu. Rep. N. J. State Mus. 1908, Trenton, NJ. 432 pp.

_____. 1921. Fish-catching by the Black Skimmer. Auk 38: 595-596.

Stoneburner, D. L. and C. S. Harrison. 1981. Heavy metal residues in Sooty Tern tissues from the Gulf of Mexico and north central Pacific Ocean. Sci. Total Environ. 17: 51-58.

Stonehouse, B. 1962. Ascension Island and the British Ornithologists' Union Centenary Expedition 1957-59. Ibis 103b: 107-123.

Storey, A. 1978. Adaptations in Common Terns and Forster's Terns for nesting in the salt marsh. Ph.D. thesis, Rutgers Univ./Newark, NJ. 194 pp.

Stowe, T. J. 1982. An oil spillage at a Guillemot colony. Mar. Pollut. Bull. 13: 237-239.

Stowe, T. [J.] and R. Morgan. 1979. Oil, oil, oil. Brit. Trust Ornithol. News 98: 3.

Stromar, L. 1972. [Oological investigations of the species Sterna hirundo L. on the Croatian coast.] Larus 24: 103-105. [English translation from Serbo-Croatian.]

Studer-Thiersch, A. and P. Studer-Thiersch. 1968. Sobres aves aquaticas en una laguna del interior de Andalucia (observaciones de marzo a junio de 1967). Ardeola 14: 166-174.

Swennen, D. C. and A. L. Spaans. 1970. Der Sterfte van Zeevogels dor die in Februari 1969 in het Waddengibied. Vogeljaar 18: 233-245. [In Dutch.]

Swickard, D. K. 1972. Status of the Least Tern at Camp Pendleton, California. Calif. Birds 3: 49-58.

Switzer, B., V. Lewin and F. H. Wolfe. 1971. Shell thickness, DDE levels in eggs, and reproductive success in Common Terns (Sterna hirundo) in Alberta. Can. J. Zool. 49: 69-73.

Sykes, P. W., Jr. 1963. Some observations off the North Carolina coast. Chat 27: 77-78.

_____. 1966. More pelagic observations off the Carolinas. Chat 30: 26-27.

_____. (comp.). 1972. Christmas Bird Count - 1971. Bodie-Pea Island, N.C. Chat 36: 21-22.

_____ 1973. Christmas Bird Count - 1972. Bodie-Pea Island, N.C. Chat 37: 15-16.

Symons, R. D. 1968. Atypical nesting of Bonaparte's Gull in Saskatchewan. Blue Jay 26: 70-74.

Taning, A. V. 1944. Ynglefuglenes traek til og fra Tipperne. Dan. Ornithol. Foren. Tidsskr. 38: 168-217.

Tarr, H. E. 1960. Nesting of the Caspian Tern. Austr. Bird Watcher 1: 78-81.

Tate, J., Jr. and D. J. Tate. 1982. The blue list for 1982. Am. Birds 36: 126-135.

Taylor, G. K. 1979. Playful interactions between resident Herring Gull Larus argentatus and migrating birds over the Isle of May. Ibis 121: 516-517.

Taylor, I. R. 1979a. The kleptoparasitic behaviour of the Arctic Skua Stercorarius parasiticus with three species of terns. Ibis 121: 274-282.

_____. 1979b. Prey selection during courtship feeding in the Common Tern. Ornis. Scand. 10: 142-144.

Taylor, R. H. 1979. Predation on Sooty Terns at Raoul Island by rats and cats. Notornis 26: 199-202.

Taylor, W. B. 1978. Seasonal status, population size, and habitat utilization of Red and Northern Phalaropes in the Southern California Bight. (Abstract only.) Pac. Seabird Group Bull. 5: 74.

Teeple, S. M. 1977. Reproductive success of Herring Gulls nesting on Brothers Island, Lake Ontario, in 1973. Can. Field-Nat. 91: 148-157.

Telfer, T. C. and J. K. Shisler. 1981. Record movement of a Laughing Gull to Hawaii from New Jersey. J. Field Ornithol. 52: 340-341.

Tessen, D. D. 1975. The changing seasons; the nesting season: June 1-July 31, 1975; Western Great Lakes Region. Am. Birds 29: 974-978.

Teulings, R. P. 1970a. The changing seasons; the spring migration: April 1-May 31, 1970; Southern Atlantic Coast Region. Audubon Field Notes 24: 588-590.

_____. 1970b. The changing seasons; the nesting season, June 1-Aug. 15, 1970; Southern Atlantic Coast Region. Audubon Field Notes 24: 670-673.

_____. 1971a. The changing seasons; the fall migration: August 15-November 30, 1970; Southern Atlantic Coast Region. Am. Birds 25: 40-44.

_____. 1971b. The changing seasons; the winter season: December 1, 1970-March 31, 1971; Southern Atlantic Coast Region. Am. Birds 25: 562-567.

_____. 1971c. The changing seasons; the spring migration: April 1-May 31, 1971; Southern Atlantic Coast Region. Am. Birds 25: 719-723.

_____. 1971d. The changing seasons; the nesting season: June 1-August 15, 1971; Southern Atlantic Coast Region. Am. Birds 25: 843-846.

_____. 1972a. The changing seasons; the fall migration: August 16-November 30, 1971; Southern Atlantic Coast Region. Am. Birds 26: 45-50.

_____. 1972b. The changing seasons; the winter season: December 1, 1971-March 31, 1972; Southern Atlantic Coast Region. Am. Birds 26: 589-592.

_____. 1972c. The changing seasons; the spring migration: April 1-May 31, 1972; Southern Atlantic Coast Region. Am. Birds 26: 748-751.

_____. 1972d. The changing seasons; the nesting season: June 1-August 15, 1972; Southern Atlantic Coast Region. Am. Birds 26: 844-847.

_____. 1972e. Briefs for the files. Chat 36: 28, 33-37, 93-97, 111-115.

_____. 1973a. The changing seasons; the fall migration: August 16-November 30, 1972; Southern Atlantic Coast Region. Am. Birds 27: 40-45.

_____. 1973b. The changing seasons; the winter season: December 1, 1972-March 31, 1973; Southern Atlantic Coast Region. Am. Birds 27: 601-603.

_____. 1973c. The changing seasons; the spring migration: April 1-May 31, 1973; Southern Atlantic Coast Region. Am. Birds 27: 758-760.

_____. 1973d. The changing seasons; the nesting season: June 1-July 31, 1973; Southern Atlantic Coast Region. Am. Birds 27: 856-859.

Teulings, R. P. 1973e. Briefs for the files. Chat 37: 29-33, 52-54, 85-89, 108-110.

______. 1974a. The changing seasons; the fall migration: August 1-November 30, 1973; Southern Atlantic Coast Region. Am. Birds 28: 37-40.

______. 1974b. The changing seasons; the winter season: December 1, 1973-March 31, 1974; Southern Atlantic Coast Region. Am. Birds 28: 626-628.

______. 1974c. The changing seasons; the nesting season: June 1-July 31, 1974; Southern Atlantic Coast Region. Am. Birds 28: 889-892.

______. 1974d. Briefs for the files. Chat 38: 3, 25-29, 46-48, 78-81, 96-98.

______. 1975a. The changing seasons; the fall migration: August 1-November 30, 1974; Southern Atlantic Coast Region. Am. Birds 29: 40-43.

______. 1975b. The changing seasons; the winter season: December 1, 1974-March 31, 1975; Southern Atlantic Coast Region. Am. Birds 29: 676-679.

______. 1975c. The changing seasons; the spring migration: April 1-May 31, 1975; Southern Atlantic Coast Region. Am. Birds 29: 837-839.

______. 1975d. The changing seasons; the nesting season: June 1-July 31, 1975; Southern Atlantic Coast Region. Am. Birds 29: 957-960.

______. 1976a. The changing seasons; the fall migration: August 1-November 30, 1975; Southern Atlantic Coast Region. Am. Birds 30: 51-54.

______. 1976b. The changing seasons; the winter season: December 1, 1975-March 31, 1976; Southern Atlantic Coast Region. Am. Birds 30: 705-707.

______. 1976c. The changing seasons; the spring migration: April 1-May 31, 1976; Southern Atlantic Coast Region. Am. Birds 30: 826-828.

______. 1976d. Briefs for the files. Chat 40: 17-21, 46-51, 71-73, 101-105, 110.

______. 1977a. The changing seasons; the fall migration: August 1-November 30, 1976; Southern Atlantic Coast Region. Am. Birds 31: 163-166.

______. 1977b. The changing seasons; the spring migration: March 1-May 31, 1977; Southern Atlantic Coast Region. Am. Birds 31: 987-988.

______. 1978a. The changing seasons; the spring migration: March 1-May 31, 1978; Southern Atlantic Coast Region. Am. Birds 32: 992-993.

______. 1978b. Briefs for the files. Chat 42: 36-38, 86-88.

Therres, G. D., J. S. Weske, and M. A. Byrd. 1978. Breeding status of Royal Tern, Gull-billed Tern, and Black Skimmer in Maryland. Md. Birdlife 34: 75-77.

Thomas, L. P. and S. B. Thomas. 1965. Herring Gulls diving for starfish. Q. J. Fla. Acad. Sci. 28: 195-196.

Thomsen, J. B. and H. Meltofte. 1980. Svartbage *Larus marinus* draeber og aeder Blishons *Fulica atra*. [Great Black-backed Gulls *Larus marinus* killing and eating Coots *Fulica atra*.] Dan. Ornithol. Foren. Tidsskr. 74: 147-154.

Threlfall, W. 1968a. The food of three species of gulls in Newfoundland. Can. Field-Nat. 82: 176-180.

_____. 1978. Dispersal of Herring Gulls from the Witless Bay Sea Bird Sanctuary, Newfoundland. Bird-Banding 49: 116-124.

Threlfall, W. and D. D. Jewer. 1978. Notes on the standard body measurements of two populations of Herring Gulls (*Larus argentatus*). Auk 95: 749-753.

Tilghman, N. G. 1980. The Black Tern survey, 1979. Passenger Pigeon 42: 1-8.

Tima, C. B. 1961. [The composition of the food of gulls in Latvia.] Pp. 123-128 *in* Z. V. Spurin (ed.). [Birds of the Baltic Region: ecology and migrations.] [1968 translation from the Russian for the U.S. Dep. Int. and Natl. Sci. Foundation by the Israel Progr. Sci. Transl., Jerusalem.]

Tinbergen, N. 1953. The Herring Gull's world. Collins, London. New. Nat. Monogr. xvi and 255 pp.

_____. 1961. The Herring Gull's world. (Revised edition.) Basic Books, New York.

Todd, D. M. 1977. *In* Warman, S. R. 1979. Aride Island Nature Reserve, Seychelles. First Report to SPNC. (cyclostyled.)

Tolonen, K. E. 1970. Ring-billed Gull and Laughing Gull catch fish by "ploughing" and "skimming". Wilson Bull. 82: 222-223.

_____. 1976. Behavioural ecology of *Larus argentatus* and *Larus marinus*: age specific differential in feeding efficiency, a probable factor in the evolution of delayed breeding. Ph.D. thesis, Yale Univ./New Haven, CT. 275 pp.

Tomkins, I. R. 1933. Ways of the Black Skimmer. Wilson Bull. 45: 147-151.

_____. 1951a. Method of feeding of the Black Skimmer, *Rynchops nigra*. Auk 68: 236-239.

Tomkins, I. R. 1951b. Notes from the Savannah area. Oriole 16: 39.

_____. 1958. The birdlife of the Savannah River Delta. Gaviiformes through Charadriiformes. Ga. Ornithol. Soc. Occas. Pap. 4. 68 pp.

_____. 1959. Life history notes on the Least Tern. Wilson Bull. 71: 313-322.

_____. 1964. The Ring-billed Gull "skimming" on foot. Oriole 29: 62.

Trautman, M. B. 1956. Unusual bird records for Ohio. Auk 73: 272-276.

Trautman, M. B. and M. A. Trautman. 1945. Ring-billed Gulls fly-catching. Wilson Bull. 57: 77.

Tuck, L. M. 1968. Laughing Gulls (Larus atricilla) and Black Skimmers (Rynchops nigra) brought to Newfoundland by hurricane. Bird-Banding 39: 200-208.

Twomey, A. C. 1934. Breeding habits of Bonaparte's Gull. Auk 51: 291-296.

Udvardy, M. D. F., C. S. de Beausset and M. Ruby. 1973. New tern records from Caribbean Honduras. Auk 90: 440-442.

U.S. Coast Guard. 1980. Polluting incidents in and around U. S. waters. Calendar year 1978 and 1979. U.S. Govt. Printing Office, Washington, D.C. (341-428/431). iii and 44 pp.

_____. 1981. Polluting incidents in and around U.S. waters. Calendar year 1979 and 1980. U.S. Govt. Printing Office, Washington, D.C. (341-428/1160). iii and 44 pp.

USNFWL [U.S. National Fish and Wildlife Laboratory.] 1980. Selected vertebrate endangered species of the seacoast of the United States--California Least Tern. U.S. Fish Wildl. Serv. Biol. Serv. Progr. FWS/OBS-80/01.20. 8 pp.

Vaisanen, R. A. 1973. Establishment of colonies of Caspian Tern Hydroprogne caspia by deserting flights in the northern Gulf of Bothnia. Ornis Scand. 4: 47-53.

van der Werf, P. A., J. S. Zaneveld and K. H. Voous. 1958. Field observations on the birds of the Islas Las Aves in the southern Caribbean Sea. Ardea 46: 37-58.

van Dobben, W. H. 1934. Bijdrage tot het meeuwenvraagstuk. Org. Club Ned. Vogelkd. 7: 63-78.

van Halewijn, R. 1973. Black Tern Chlidonias niger in the south Caribbean Sea. Ardea 61: 189-191.

Vaurie, C. 1965. The birds of the palearctic fauna. Volume I: non-passerines. H. F. and G. Witherby, Ltd., London. xx and 763 pp.

Veen, J. 1977. Functional and causal aspects of nest distribution in colonies of the Sandwich Tern (Sterna s. sandvicensis Lath.). Behaviour (Suppl.) 20. 193 pp.

Verbeek, N. A. M. 1979. Some aspects of the breeding biology and behavior of the Great Black-backed Gull. Wilson Bull. 91: 575-582.

Verheyen, R. 1967. Oologia Belgica. 2 vol. Brussels.

Vermeer, K. 1970. Breeding biology of California and Ring-billed Gulls: a study of ecological adaptation to the inland habitat. Can. Wildl. Serv. Rep. Ser. 12. 52 pp.

_____. 1971a. Some breeding aspects of Herring Gulls at Kawinaw Lake, Manitoba. Blue Jay 29: 207-208.

_____. 1973a. Comparison of food habits and mercury residues of Caspian and Common Terns. Can. Field-Nat. 87: 305.

_____. 1973b. Food habits and breeding range of Herring Gulls in the Canada prairie provinces. Condor 75: 478-480.

_____. 1973c. Comparison of egg-laying chronology of Herring and Ring-billed Gulls at Kawinaw Lake, Manitoba. Can. Field-Nat. 87: 306-308.

Vermeer, K. and G. G. Anweiler. 1975. Oil threat to aquatic birds along the Yukon coast. Wilson Bull. 87: 467-480.

Vermeer, K. and R. Vermeer. 1975. Oil threat to birds on the Canadian west coast. Can. Field-Nat. 89: 278-298.

Vermeer, R. and K. Vermeer. 1974. Oil pollution of birds. An abstracted bibliography. Pesticide Section, Can. Wildl. Serv. Manuscript Rep. 29. 68 pp.

Verrall, K. 1977. Laughing Gull in Argyllshire. Scott. Birds 9: 381-382.

Virginia Society of Ornithology. 1979. Virginia's birdlife: an annotated checklist. Va. Soc. Ornithol., Lynchburg, VA. iv and 117 pp.

Voous, K. H. 1960. Atlas of European birds. T. Nelson and Sons, Ltd., Amsterdam, Netherlands. 284 pp.

_____. 1963. Tern colonies in Aruba, Curacao, and Bonaire, South Caribbean Sea. Proc. Internatl. Ornithol. Congr. 13: 1214-1216.

_____. 1966. The terns of the Dry Tortugas. Auk 83: 145-146.

Voous, K. H. 1977. Northern gulls in Aruba, Netherlands Antilles. Ardea 65: 80-82.

Waldichuk, M. 1980. Retrospect of the Ixtoc I blowout. Mar. Pollut. Bull. 11: 184-186.

Wallace, H. E. 1970. Operation Dirty Bird. Fla. Wildl., April 1970: 4-7.

Waller, R. H. 1955. Reverse migration of Black Terns off Italy. Ibis 97: 145.

Wamer, N. O., H. M. Stevenson and J. E. Cavenagh, Jr. 1980. Sight records of the Arctic Tern on the Gulf coast of Florida. Fla. Field Nat. 8: 49.

Wander, W. 1981. Red Phalarope eating carrion. Wilson Bull. 93: 557.

Warburton, F. E. 1947. Common Tern's nest with seven eggs. Auk 64: 459.

Warham, J. 1958. Photographic studies of some less familiar birds. XCI. Bridled Tern. Brit. Birds 51: 303-308.

Warinner, J. E., M. Nolan, C. G. Becker, R. W. Middleton and W. M. Rizzo. 1976. Coastal and nearshore environments. Pp. 1-49 in An assessment of estuarine and nearshore marine environments. Special report in applied science and ocean engineering (revised). Va. Inst. Mar. Sci., Gloucester Point, VA. xvi and 132 pp.

Warman, S. R. 1979. The Roseate Tern *Sterna dougallii arideensis* on Aride Island, Seychelles. Bull. Br. Ornithol. Club 99: 124-128.

Warner, D. W. and D. A. Beimborn. 1969. First Caspian Tern nesting in Minnesota. Loon 41: 83-84.

Warner, L. 1976. The status of the barrier islands of the southeastern coast. A summary of the barrier island inventory. Open Space Institute, New York, NY. i and 43 pp.

Watson, F. G. 1955. The changing seasons; the fall migration: Aug. 16-Nov. 30, 1954; South Texas Region. Audubon Field Notes 9: 38-41.

Watson, F. G. and L. C. Goldman. 1952. The changing seasons; the spring migration: April 1-May 31, 1952; South Texas Region. Audubon Field Notes 6: 254-257.

Watson, G. E. 1966. Seabirds of the tropical Atlantic Ocean. Smithsonian Press, Washington, DC. xxix and 120 pp.

_____. 1975. Birds of the Antarctic and sub-Antarctic. William Byrd Press, Richmond, VA. xvii and 350 pp.

Watson, J. B. 1908. The behavior of Noddy and Sooty Terns. Publl. Carnegie Inst. 2: 189-255.

Wayne, A. T. 1905. Notes on certain birds taken or seen near Charleston, South Carolina. Auk 22: 395-400.

______. 1910. Birds of South Carolina. Contrib. Charleston Mus. 1. 254 pp.

Wayne, A. T. and F. Sherman. 1927. Two birds new to the fauna of South Carolina. Auk 44: 94.

Weber, W. C. and J. A. Jackson (comps.). 1977. Birds around the state - spring migration and breeding season, 1977. Mississippi Kite 7: 42-53.

______. 1978. Birds around the state - fall migration, 1977. Mississippi Kite 8: 19-27.

Webster, F. S., Jr. 1956a. The changing seasons; the fall migration: August 16-November 30, 1955; South Texas Region. Audubon Field Notes 10: 37-40.

______. 1956b. The changing seasons; the spring migration: April 1-May 31, 1956; South Texas Region. Audubon Field Notes 10: 345-350.

______. 1957a. The changing seasons; the fall migration: August 16-November 30, 1956; South Texas Region. Audubon Field Notes 11: 38-43.

______. 1957b. The changing seasons; the spring migration: April 1-May 31, 1957; South Texas Region. Audubon Field Notes 11: 360-365.

______. 1958a. The changing seasons; the fall migration: August 16-November 30, 1957; South Texas Region. Audubon Field Notes 12: 41-44.

______. 1958b. The changing seasons; the spring migration: April 1-May 31, 1958; South Texas Region. Audubon Field Notes 12: 365-370.

______. 1959. The changing seasons; the spring migration: April 1-May 31, 1959; South Texas Region. Audubon Field Notes 13: 383-388.

______. 1960a. The changing seasons; the fall migration: August 16-November 30, 1959; South Texas Region. Audubon Field Notes 14: 52-56.

______. 1960b. The changing seasons; the spring migration: April 1-May 31, 1960; South Texas Region. Audubon Field Notes 14: 401-407.

______. 1960c. The changing seasons; the nesting season: June 1-August 15, 1960; South Texas Region. Audubon Field Notes 14: 461-465.

______. 1961a. The changing seasons; the fall migration: August 16-November 30, 1960; South Texas Region. Audubon Field Notes 15: 56-59.

Webster, F. S., Jr. 1961b. The changing seasons; the spring migration: April 1-May 31, 1961; South Texas Region. Audubon Field Notes 15: 424-427.

______. 1962a. The changing seasons; the fall migration: August 16-November 30, 1961; South Texas Region. Audubon Field Notes 16: 52-58.

______. 1962b. The changing seasons; the spring migration: April 1-May 31, 1962; South Texas Region. Audubon Field Notes 16: 428-433.

______. 1963. The changing seasons; the spring migration: April 1-May 31, 1963; South Texas Region. Audubon Field Notes 17: 415-419.

______. 1964. The changing seasons; the winter season: December 1, 1963-March 31, 1964; South Texas Region. Audubon Field Notes 18: 369-372.

______. 1965. The changing seasons; the fall migration: August 16-November 30, 1964; South Texas Region. Audubon Field Notes 19: 56-60.

______. 1966a. The changing seasons; the fall migration: August 16-November 30, 1965; South Texas Region. Audubon Field Notes 20: 66-72.

______. 1966b. The changing seasons; the spring migration: April 1-May 31, 1966; South Texas Region. Audubon Field Notes 20: 525-532.

______. 1967a. The changing seasons; the fall migration: August 16-November 30, 1966; South Texas Region. Audubon Field Notes 21: 54-59.

______. 1967b. The changing seasons; the winter season: December 1, 1966-March 31, 1967; South Texas Region. Audubon Field Notes 21: 433-440.

______. 1968a. The changing seasons; the fall migration: August 16-November 30, 1967; South Texas Region. Audubon Field Notes 22: 60-69.

______. 1968b. The changing seasons; the spring migration: April 1-May 31, 1968; South Texas Region. Audubon Field Notes 22: 550-557.

______. 1969a. The changing seasons; the fall migration: August 16-November 30, 1968; South Texas Region. Audubon Field Notes 23: 77-81.

______. 1969b. The changing seasons; the winter season: December 1, 1968-March 31, 1969; South Texas Region. Audubon Field Notes 23: 495-498.

______. 1969c. The changing seasons; the nesting season: June 1-August 15, 1969; South Texas Region. Audubon Field Notes 23: 673-675.

______. 1970a. The changing seasons; the fall migration: August 16-November 30, 1969; South Texas Region. Audubon Field Notes 24: 66-69.

______. 1970b. The changing seasons; the winter season: December 1, 1969-March 31, 1970; South Texas Region. Audubon Field Notes 24: 518-521.

Webster, F. S., Jr. 1971a. The changing seasons; the winter season: December 1, 1970-March 31, 1971; South Texas Region. Am. Birds 25: 600-603.

______. 1971b. The changing seasons; the spring migration: April 1-May 31, 1971; South Texas Region. Am. Birds 25: 768-771.

______. 1972a. The changing seasons; the fall migration: August 16-November 30, 1971; South Texas Region. Am. Birds 26: 84-88.

______. 1972b. The changing seasons; the winter season: December 1, 1971-March 31, 1972; South Texas Region. Am. Birds 26: 627-629.

______. 1972c. The changing seasons; the spring migration: April 1-May 31 1972; South Texas Region. Am. Birds 26: 780-783.

______. 1973a. The changing seasons; the fall migration: August 16-November 30, 1972; South Texas Region. Am. Birds 27: 82-85.

______. 1973b. The changing seasons; the winter season: December 1, 1972-March 31, 1973; South Texas Region. Am. Birds 27: 637-639.

______. 1973c. The changing seasons; the spring migration: April 1-May 31, 1973; South Texas Region. Am. Birds 27: 793-795.

______. 1974a. The changing seasons; the fall migration: August 16-November 30, 1973; South Texas Region. Am. Birds 28: 76-78.

______. 1974b. The changing seasons; the winter season: December 1, 1973-March 31, 1974; South Texas Region. Am. Birds 28: 661-663.

______. 1974c. The changing seasons; the spring migration: April 1-May 31, 1974; South Texas Region. Am. Birds 28: 822-825.

______. 1974d. The changing seasons; the nesting season: June 1-July 31, 1974; South Texas Region. Am. Birds 28: 922-925.

______. 1975a. The changing seasons; the fall migration: August 1-November 30, 1974; South Texas Region. Am. Birds 29: 82-85.

______. 1975b. The changing seasons; the winter season: December 1, 1974-March 31, 1975; South Texas Region. Am. Birds 29: 711-714.

______. 1975c. The changing seasons; the spring migration: April 1-May 31, 1975; South Texas Region. Am. Birds 29: 875-878.

______. 1975d. The changing seasons; the nesting season: June 1-July 31, 1975; South Texas Region. Am. Birds 29: 1003-1006.

______. 1976a. The changing seasons; the fall migration: August 1-November 30, 1975; South Texas Region. Am. Birds 30: 95-97.

Webster, F. S., Jr. 1976b. The changing seasons; the winter season: December 1, 1975-March 31, 1976; South Texas Region. Am. Birds 30: 739-741.

_____. 1976c. The changing seasons; the spring migration: April 1-May 31, 1976; South Texas Region. Am. Birds 30: 863-865.

_____. 1976d. The changing season; the nesting season: June 1-July 31, 1976; South Texas Region. Am. Birds 30: 975-978.

_____. 1977a. The changing seasons; the fall migration: August 1-November 30, 1976; South Texas Region. Am. Birds 31: 197-199.

_____. 1977b. The changing seasons; the winter season: December 1, 1976-February 28, 1977; South Texas Region. Am. Birds 31: 349-351.

_____. 1977c. The changing seasons; the spring migration: March 1-May 31, 1977; South Texas Region. Am. Birds 31: 1020-1021.

_____. 1977d. The changing seasons; the nesting season: June 1-July 31, 1977; South Texas Region. Am. Birds 31: 1158-1160.

_____. 1978a. The changing seasons; the autumn migration: August 1-November 30, 1977; South Texas Region. Am. Birds 32: 227-230.

_____. 1978b. The changing seasons; the winter season: December 1, 1977-February 28, 1978; South Texas Region. Am. Birds 32: 373-375.

_____. 1978c. The changing seasons; the spring migration: March 1-May 31, 1978; South Texas Region. Am. Birds 32: 1028-1031.

_____. 1979a. The changing seasons; the autumn migration: August 1-November 30, 1978; South Texas Region. Am. Birds 33: 193-195.

_____. 1979b. The changing seasons; the winter season: December 1, 1978-February 28, 1979; South Texas Region. Am. Birds 33: 295-296.

_____. 1979c. The changing seasons; the spring migration: March 1-May 31, 1979; South Texas Region. Am. Birds 33: 787-789.

Wells, L. A. and R. Wells. 1965. Franklin's Gull at Columbus. Oriole 30: 93-94.

Weseloh, D. V., S. Brechtel and R. D. Burns. 1978. Recent population changes in Double-crested Cormorants and California and Ring-billed Gulls in Alberta, Canada, with a note on White Pelicans. Proc. 1977 Conf. Colonial Waterbird Group 1: 10-18.

Weseloh, D. V., P. Mineau, and D. J. Hallett. 1979. Organochlorine contaminants and trends in reproduction in Great Lakes Herring Gulls, 1974-1978. Trans. 44th N. Am. Wildl. Nat. Resour. Conf.: 543-557.

Weske, J. S. 1977 ms. The status, dispersal, and survival of the Royal Tern (Sterna maxima). Unpubl. Progr. Rep., Natl. Fish Wildl. Lab., Natl. Mus. Nat. Hist., Washington, D.C. 22 pp.

Weske, J. S., R. B. Clapp, and J. M. Sheppard. 1977. Breeding records of Sandwich and Caspian Terns in Virginia and Maryland. Raven 48: 59-66.

West, R. C. 1977. Tidal salt-marsh and mangal formations of Middle and South America. Pp. 193-213 in V. J. Chapman (ed.). Ecosystems of the world. I: wet coastal ecosystems. Elsevier Sci. Publ. Co., Amsterdam, The Netherlands. xi and 428 pp.

Weston, F. M. 1933. Gull-billed Tern nesting at Pensacola, Florida. Auk 50: 215-216.

_____. 1947. Fall migration Pensacola (Florida) Region. Audubon Field Notes 1: 6-7.

_____. 1948. The changing seasons; the winter season: December 1, 1947-March 31, 1948; Pensacola (Florida) Region. Audubon Field Notes 2: 137-138.

_____. 1953. Red Phalarope (Phalaropus fulicarius) wintering near Pensacola, Florida. Auk 70: 491-492.

Weston, F. M. and L. E. Pate. 1954. Bridled Tern, Sterna anaethetus, in winter at Pensacola. Fla. Nat. 27: 60, 64.

Wetmore, A. 1925. Food of American phalaropes, avocets, and stilts. U.S. Dep. Agric. Bull. 1359. 20 pp.

_____. 1926. Observations on the birds of Argentina, Paraguay, Uruguay and Chile. U.S. Natl. Mus. Bull. 133. iv and 448 pp.

_____. 1965. The birds of the Republic of Panama. Part I. Tinimidae (tinamous) to Rynchopidae (skimmers). Smithson. Misc. Collect. 150. 483 pp.

White, C. M. N. 1965. A revised checklist of African non-passerine birds. Dep. Game Fish., Gov. Printer, Lusaka, Zambia. v and 299 pp.

White, D. H., K. A. King and N. C. Coon. 1979a. Effects of No. 2 fuel oil on hatchability of marine and estuarine bird eggs. Bull. Environ. Contam. Toxicol. 21: 7-10.

White, D. H., K. A. King, C. A. Mitchell, E. F. Hill, and T. G. Lamont. 1979b. Parathion causes secondary poisoning in a Laughing Gull breeding colony. Bull. Environ. Contam. Toxicol. 23: 281-284.

White, S. C., W. B. Robertson, Jr. and R. E. Ricklefs. 1976. The effect of Hurricane Agnes on growth and survival of tern chicks in Florida. Bird-Banding 47: 54-71.

Wierenga, H. L. 1976. Maryland's first Franklin's Gulls. Md. Birdlife 32: 113-114.

Wiggins, I. L. 1965. Galapagos Finch captured in flight by Laughing Gull., Condor 67: 82.

Williams, G. G. 1950. The changing seasons; the fall migration: August 16-November 30, 1949; South Texas Region. Audubon Field Notes 4: 24-25.

_____. 1951. The changing seasons; the winter season: December 1, 1950-March 31, 1951; South Texas Region. Audubon Field Notes 5: 214-216.

Williams, L. E., Jr. 1962a. Notes on nesting of certain coastal birds in Mississippi. Miss. Ornithol. Soc. Newsl. 7: 17-20.

Williams, L. E. and S. G. Clawson. 1963. First specimens of ten species of birds for Mississippi. Auk 80: 199-201.

Williamson, F. S. L. 1957. Ecological distribution of birds in the Napaskick area of the Kuskokwim River delta, Alaska. Condor 59: 317-338.

Witherby, H. F., F. C. R. Jourdain, N. F. Ticehurst and B. W. Tucker. 1941. The handbook of British birds. Vol. V (terns to game-birds). H. F. & G. Witherby, Ltd., London. xi and 356 pp.

Wolf, L. L. and F. B. Gill. 1961. Flock feeding behavior in migrant Bonaparte's Gulls. Wilson Bull. 73: 389-390.

Wolford, J. W. 1966. An ecological study of the Black-crowned Night Heron in southern Alberta. M.S. thesis, Univ. Alberta/Edmonton, AB. 60 pp.

Wolk, R. G. 1954. Some preliminary observations on the reproductive behavior of the Least Tern (Sterna albifrons antillarum Lesson). M.S. thesis, Cornell Univ./Ithaca, NY.

_____. 1959a. Laughing Gulls following the plow. Wilson Bull. 71: 387-388.

Wood, H. B. 1949. Laughing Gulls tread out their food. Bird-Banding 20: 103.

Woodward, P. W. 1972. The natural history of Kure Atoll, Northwestern Hawaiian Islands. Atoll Res. Bull. 164. xxi and 318 pp.

Woolfenden, G. E. 1973. The changing seasons; the winter season: December 1, 1972-March 31, 1973; Florida Region. Am. Birds 27: 603-607.

Woolfenden, G. E. and A. J. Meyerriecks. 1963. Caspian Tern breeds in Florida. Auk 80: 365-366.

Woolfenden, G. E. and W. B. Robertson, Jr. 1974. Least Terns nest at Dry Tortugas. Fla. Field Nat. 2: 19-20.

Woolfenden, G. E. and R. W. Schreiber. 1973. The common birds of the saline habitats of the eastern Gulf of Mexico: their distribution, seasonal status, and feeding ecology. Pp. III J/1-J/21 in J. I. Jones (ed.). A survey of the eastern Gulf of Mexico. State University System of Florida, Institute of Oceanography, St. Petersburg, FL.

Wotton, M. J. 1950. Notes on behaviour of Black Terns. Brit. Birds 43: 258-259.

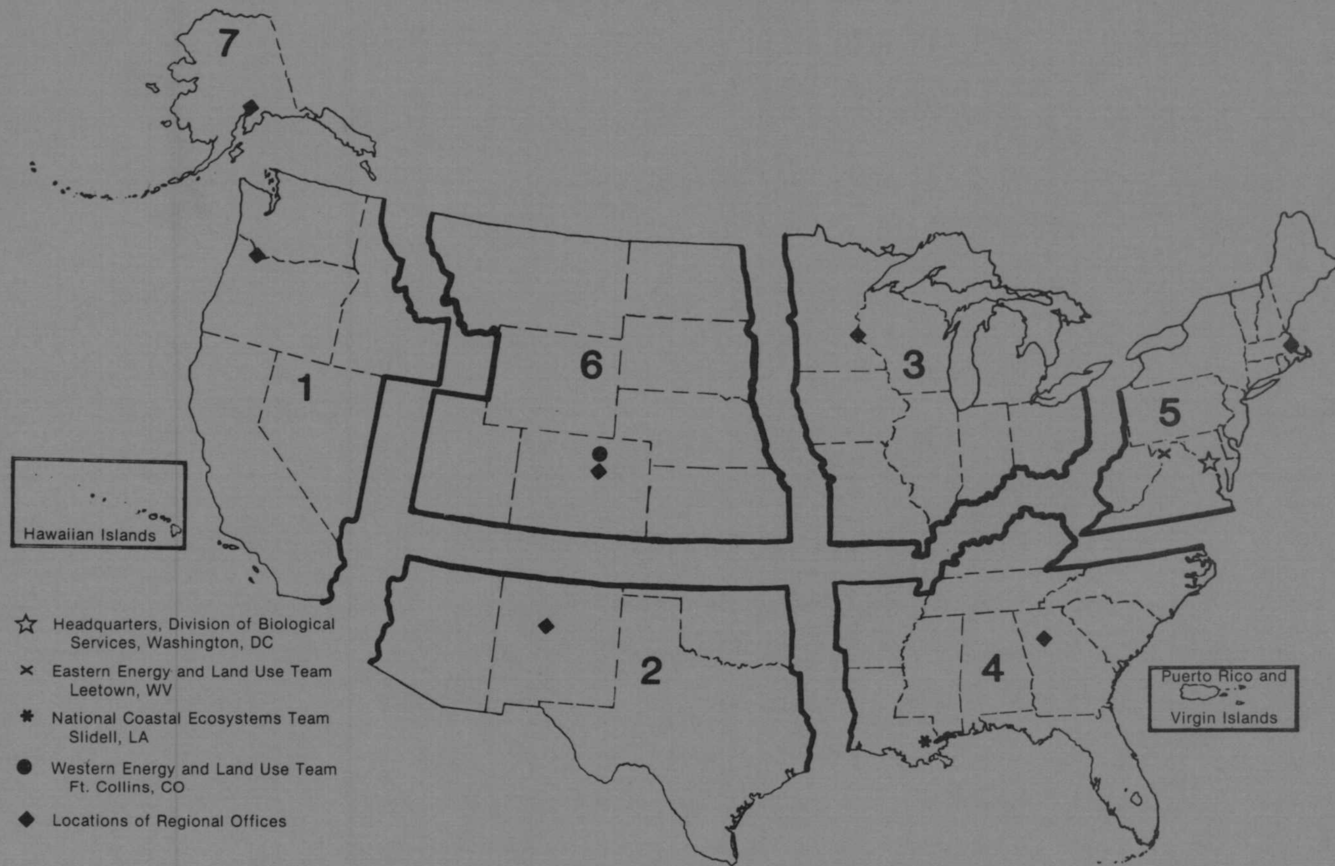
Wray, D. L. and H. T. Davis. 1959. Revised edition of birds of North Carolina (1942) by T. G. Pearson et al. N. C. Dep. Agric., Raleigh, NC. xxvii and 434 pp.

Zarudsky, J. 1981. Forster's Tern breeding on Long Island. Kingbird 31: 212-213.

Zusi, R. L. 1958. Laughing Gull takes fish from Black Skimmer. Condor 60: 67-68.

_____. 1959. Fishing rates in the Black Skimmer. Condor 61: 298.

_____. 1962. Structural adaptations of the head and neck in the Black Skimmer, *Rynchops nigra* Linnaeus. Publ. Nuttall Ornithol. Club 3. viii and 101 pp.



REGION 1
Regional Director
U.S. Fish and Wildlife Service
Lloyd Five Hundred Building, Suite 1692
500 N.E. Multnomah Street
Portland, Oregon 97232

REGION 2
Regional Director
U.S. Fish and Wildlife Service
P.O. Box 1306
Albuquerque, New Mexico 87103

REGION 3
Regional Director
U.S. Fish and Wildlife Service
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

REGION 4
Regional Director
U.S. Fish and Wildlife Service
Richard B. Russell Building
75 Spring Street, S.W.
Atlanta, Georgia 30303

REGION 5
Regional Director
U.S. Fish and Wildlife Service
One Gateway Center
Newton Corner, Massachusetts 02158

REGION 6
Regional Director
U.S. Fish and Wildlife Service
P.O. Box 25486
Denver Federal Center
Denver, Colorado 80225

REGION 7
Regional Director
U.S. Fish and Wildlife Service
1011 E. Tudor Road
Anchorage, Alaska 99503

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