Distribution and density of cetaceans, marine turtles, and seabirds in the shelf waters of the northeastern United States, June 1980 - December 1983, based on shipboard observations

P. Michael Payne
Lawrence A. Selzer
Amy R. Knowlton

Manomet Bird Observatory
Box 936
Manomet, MA 02345

August 1984

to

National Marine Fisheries Service
Northeast Fisheries Center
Woods Hole, MA 02543

In fulfillment of

NOAA/NMFS Contract No. NA-81-FA-C-00023

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INTRODUCTION

Marine systems, like any other, are made up of a large number of species that interact with each other and with their physical environment. Recent research on marine fisheries has emphasized an integrated, multispecies-ecosystem approach to management of fisheries stocks (Grosslein et al. 1978; May et al. 1979; Sissenwine et al. 1982). Analyses of such a fisheries program requires knowledge of all major consumer populations within the system. The utility and importance of quantitative, spatial and temporal abundance data on cetaceans and seabirds as components of the ecosystem have been demonstrated elsewhere.

The interaction of the anchovy (family Engraulidae) and guano birds Phalacrocorax bougainvillii at the same trophic level in the Peruvian upwelling was exemplified in the early 1970's when overfishing of anchovy coupled with a temporary cessation of the coastal upwelling caused a severe population crash of nesting guano birds (Sowls and Bartonek 1974).

Lavigne (1980) suggested that ecosystem considerations be incorporated into routine stock assessments and the formulation of appropriate management strategies for all marine resources. He cited the decline in catches of traditinal single species fisheries in inshore Newfoundland waters which led to the development of an offshore capelin Mallotus villosus fishery. The expansion of that fishery from 6000 metric tons in 1971 to an excess of 360,000 metric tons between 1973 and 1976 severely depleted the offshore capelin stocks, and in 1978 the fishery was closed due to steadily decreasing catches and the predominance of immature fish in the catch. Lavigne (1980) also suggests that the reduction in capelin biomass might have a profound effect on the projected stock increases for seals, whales, and cod Gadus morhua, all of which consume capelin and appear density limited by food availability. The depletion of offshore capelin stocks was not only viewed as a threat to the harp seal Phoca groenlandica (FAO 1977), but was also seen as a major factor in the redistribution of large whales around the Newfoundland coast (Lien and McLeod 1980). Movement inshore for food has brought whales into areas of intense fishing effort (due to restrictions on the offshore capelin stocks) which has resulted in increased whale collisions with fishing gear at a substantial loss to fishermen (Lien and Merdsoy 1979; Perkins and Beamish 1979).

Gordon-Clark (1976) stated that it was clear that within a whale fishery, treatment of the whales as components of the ecosystem is important since each whale alters the energetics of the system. Horwood (1976) advocated that baleen whales and Antarctic krill Euphausia superba be considered together for management purposes. Removal of whales as predators from parts of the Antarctic has increased the availability of krill to other organisms such as seals and penguins, allowing their populations to increase. Conversely the presence of whales removes a significant amount of prey organisms, thereby reducing availabity to other species.

In Monterey Bay, Krasnow (1978) estimated that the total annual demand of the squid Loligo opalescens by sooty shearwater Puffinus griseus exceeds the yearly commercial landing by 1400 percent.

In the northwest Atlantic, Mercer (1975) suggested a correlation between the availability of longfinned pilot whales Globicephala melaena for the shore-based Newfoundland fishery and the abundance of the short-finned squid

Illex illecebrossus. Intensive hunting between 1951-61 severely depleted pilot whale stocks off Newfoundland thereby releasing a large surplus production of squid to other predators (Mercer 1975).

In the shelf waters of the northeastern United States, Atlantic herring *Clupea harengus* stocks declined sharply during the past decade (Anthony and Waring 1980; Grosslein et al. 1980), possibly the result of overfishing. Coincident with the depletion of herring, a population explosion of sand eel *Ammodytes americanus* occurred (Smith et al. 1978; Meyer et al. 1979; Sherman et al. 1981). In recent years, baleen whales and seabirds have been observed feeding on sand eel (Overholtz and Nicolas 1979; Hain et al. 1982; Mayo 1982; Powers and Backus, in press), indicating that sand eel have become an increasingly important prey item. The present distribution of humpback whales *Megaptera novaeangliae* in the Gulf of Maine may be directly related to the dense patches of sand eel in that region (Kenney et al. 1981; Payne et al., in review).

Scott et al. (1983) estimated total consumption of zooplankton, finfish and squid on Georges Bank by the cetacean biomass to be 1.87 x 10^6mT. The bulk of this came from finfish populations (1.38 x 10^6mT, 73.8%). Squid consumption accounted for 17.0% (3.17 x 10^5mT) and zooplankton another 9.2% (1.74 x 10^5mT, Scott et al. 1983). Cetacean gross biomass production was estimated to represent approximately 14.5% of the estimated annual rate of finfish production on Georges Bank (Scott et al. 1983) They further suggest that energy flux to cetaceans may average 3.9 Kcal/m^2/yr in the Gulf of Maine, 4.8 Kcal/m^2/yr on Georges Bank, and 3.7 Kcal/m^2/yr in the mid-Atlantic region. Powers and Backus (in press) estimated that total energy flux to seabirds on Georges Bank at 2.14 Kcal/m^2/yr. Fishes comprised approximately 50% (1.05 Kcal/m^2/yr) and squid over 25% (0.56 Kcal/m^2/yr) of the total food requirements for birds (Powers and Backus, in press). Sissenwine et al. (1983) calculated the combined fish consumption by cetaceans and seabirds on Georges Bank to be 7.4 Kcal/m^2/yr or approximately 10-15% of estimated total fish production on Georges Bank. The human component of the Georges Bank energy budget has been estimated at 6.1 Kcal/m^2/yr (Sissenwine et al. 1983); therefore, the consumer role of cetaceans/seabirds in the shelf waters of the northeastern United States is not small, as previously suggested (Cohen et al. 1982), but rather needs to be considered as a major factor in fisheries management.

The Manomet Bird Observatory, Manomet, Massachusetts, has collected standardized data on seabirds and marine mammals (from shipboard observations), through contract with the National Marine Fisheries Service, Woods Hole, Massachusetts since 1980. The study has thus provided: 1) seasonal and regional account of cetaceans/seabirds (Powers et al. 1982; Powers 1983), 2) site-specific evaluations of cetacean and seabird densities (Powers 1982a; Powers and Payne 1982, 1983; Powers and Brown, in press), 3) trophic implications from the distribution of seabirds (Powers and Backus 1981), and 4) factors affecting the distribution of cetaceans in relation to fish/fisheries as prey items and oceanographic features (Payne et al., in review).

The data suggest considerable potential for interaction between at least two apex consumer groups -- cetaceans/seabirds and commercial fisheries. Differences in spatial-temporal biomass distribution of cetaceans and seabirds are evident between regions and seasons. Each of the four major regions -- Gulf of Maine, Georges Bank, southern New England and the mid-Atlantic -- may be characterized by distinctive assemblages of cetaceans and seabirds. The data also suggest strong seasonal variation in the abundance of major cetacean/seabird consumers. Estimates of seasonal and annual variation need to be quantified in order to describe overlap in resource utilization, and to assess the trophic interaction of cetaceans with seabirds, and cetaceans/seabirds with fisheries. This report tabularizes the available data from the shipboard data-base between June 1980 and January 1983 providing 1) seasonal and spatial distributions of species and species groups; and 2) abundance and density estimates of cetaceans and seabirds by season and region.

METHODS

Shipboard Sampling

The Manomet Bird Observatory has conducted seabird observations since 1976 using platforms-of-opportunity vessels (Powers et al. 1980b; Powers 1983). Counts of seabirds have followed a standardized path using a strip census technique modified from the USFWS, Pelagic Seabird Studies, as described by Gould et al. (1978). Between 1976 and 1980, observations were recorded during 10-minute transects, and three separate counts were maintained (from Powers 1982b):

1) Fixed-area count -- a count of all seabirds seen within an area 300 m lateral on one side of vessel (centerline of transect) to the projected end of the transect. The length of the transect was determined by the maintained speed of the ship during the 10-minute counting period. "Fixed-area" counts are used in quantitative analysis of seabird distribution and relative densities (birds per-unit area).

2) Ship-following count -- a count of those birds were initially considered as a "fixed-area bird" but remained with the vessel two or more transects (thereby a recount); therefore considered as a ship-following bird in all sightings after the initial sighting. Ship following counts were maintained separately and not used in determining relative densities.

3) Outside-zone -- birds seen outside the "fixed-area" count and not deemed a ship-follower were also counted. A summation of all birds seen (total of three count categories) during any transect resulted in a total bird count (similar to Brown et al. 1975) and was used to determine indices of relative abundance (birds per-unit time).

Powers (1982b) examined the relationship between Total Bird Counts (birds per-unit time) and Fixed-Area Counts (birds per-unit area) using a non-parametric test for association. These tests resulted in significant correlations between relative density and abundance estimates of all species and species groups tested with the exception of large gulls on a single cruise. Considering the significant correlations between the two methods, the abundance indices (Total Bird Count) have not been maintained since 1980. Also, ship-following birds previously counted throughout the transect period are now only counted at the beginning of the transect and include birds seen behind mid-ship only at that time. Fixed-area birds are only those birds that are sighted within the 300 m strip forward of midship to the projected end of the transect. A bird that enters within 300 m of the ship from the rear or one side but never flys beyond mid-ship forward is not included in the Fixed-area estimate. The overall effect was a reduction in the total number of birds being counted due principally to the elimination of the outside-zone count i.e., the count of birds seen beyond 300 meters.

In addition, the data collection was re-designed during 1980 so that one observer could collect information on cetaceans and marine turtles simultaneously with seabirds (Powers et al. 1980). Previous to this, sightings of cetaceans were recorded by MBO observers but emphasis was placed only on the sighting, not on relative abundance or a measure of effort with the sighting. The present data collection was designed with four objectives:

1) To provide a data collecting format such that cetaceans, seabirds and turtles can be counted by a single observer on a single set of forms.

2) To provide a method of effort standardization between observations of different taxa. Relative abundances and numbers of all taxa are based on one single unit effort therefore results between taxa can also be compared in a quantitative analysis.

3) To provide a form that will result in easy data extraction from computer data sets on all three taxa such that analyses can occur on any taxa individually or any set or combination of taxa simultaneously.

4) To provide a standardization of environmental and species/behavior such that information gathered at MBO is comparable to studies elsewhere.

The core of the sampling procedure is a 15-min time period during which the vessel is underway (> 4 km) and visibility is at least 1 km. Ship's position, course and speed are noted at the start of each 15-min period along with available data on weather (e.g., wind, sea state) and environment (e.g. surface temperature, presence of other vessels in the immediate area). The collected data are recorded into two major record types: location/environmental and species/behavioral. Each record type is recorded for every 15-minute observation period and tied by a unique cruise and observation number (Powers et al. 1982).

1) Location/environmental data are collected by the observer and recorded on field forms and later transcribed onto computer forms while at sea. Location/environmental data include: latitude-longitude (deg-min), stratum (NMFS groundfish strata), time (yr-mo-day-hr-min), elapsed time (min), vessel speed (kt) and course (deg N), water depth (m) and temperature (deg C), barometric pressure trend, visibility, and wind direction (deg N) and speed (kt) (Miller et al. 1980).

2) Species/behavioral data are recorded on field forms and later transcribed onto computer forms while at sea. Species data include: sighting zone (seabirds only), species/species group, numbers, age, color phase (seabirds only), estimated distance and angle to each sighting (cetaceans only), animal heading, animal association, debris association, and behavior (Miller et al. 1980).

The observer scans to the horizon in a forward 180° arc of the ship, 90° either side of the bow. All sightings of marine mammals and turtles in this area are noted by time of initial sighting with estimated radial distance and angle to the sighting. Distances are measured with a hand-held rangefinder (Heinemann 1981) and angles with a ship's compass, which is mounted on the bridge wing. When bird observations were made they were sampled in the same 15-min periods. However, the observer only recorded those birds which passed through a strip, 300 m out to one side of the ship and forward of mid-ship. This technique is presented diagramatically in Fig. 1. Ship-following birds were tallied separately at the start of each 15-min period. Incidental sightings of all marine mammals and turtles and noteworthy birds were made at any time, regardless of weather or ship's speed.

Observers are responsible for collecting data, coding this information, and

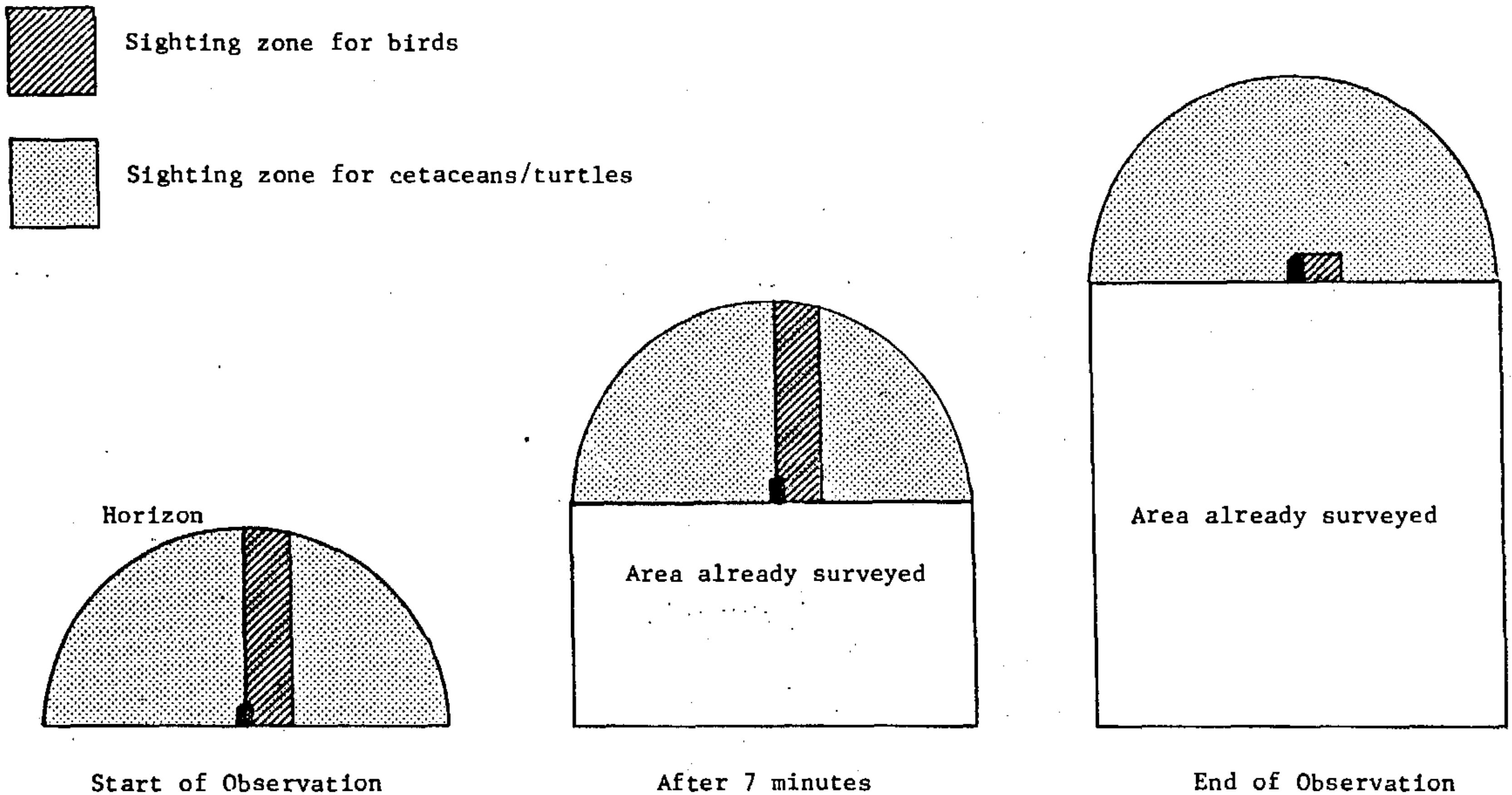

Figure 1 illustrates the area surveyed in a Type 1 Observation. Birds are counted in a rectangular Fixed Area while cetaceans/turtles are counted in a large semicircle which extends to the horizon. Although the sighting distances remain the same, the actual area surveyed changes as the ship moves.

A Type 2 Observation includes only the cetacean/turtle survey.

(from Powers et al. 1980 a)

writing a cruise report. Data are collected during daylight hours and coded in the evening at sea. Observers are expected to maximize daylight hours by conducting as many observations as possible. Daily operations of the vessel, meals, and inclement weather provide regular breaks from the routine. Data entry and validation occur at the Manomet Bird Observatory (MBO) on a WANG 2200 MVP computer.

In this report, observation data are presented on marine mammals, birds and turtles in shelf waters from Cape Hatteras to Nova Scotia between June 1980 and December 1983. We participated on 82 cruises during this period. This includes data collected on 30 cruises between May 1980 and December 1981 during NMFS Grant no. NA-80-FA-D-00004 (Powers et al. 1982), and data collected under the present contract on 52 cruises presented in Table 1.

Observations were temporally divided into four seasons: spring (March to May), summer (June to August), fall (September to November), and winter (December to February). The study area (Fig. 2) was spatially divided into four shelf regions: Gulf of Maine, Georges Bank, Southern New England, and Mid-Atlantic (Fig. 3). "Slope" refers to waters seaward of the shelf. The shelf regions were adapted from NMFS/NEFC assessment surveys (Fig. 4) of zooplankton and groundfish stocks (Grosslein et al. 1980; Sherman 1980). A breakdown of these strata into subregions was performed (Table 2), because mammal and bird distributions are patchy and often localized within a region. The use of subregions, which are based on features of hydrography and bathymetry, provided more specific locales to compare between regions, seasons and species. A seasonal breakdown of effort for cetaceans and sea turtles by region and subregion is given in Table 3 and for birds in Table 4. Seasonal sighting frequencies (individuals/linear km) and densities (individuals/km^2) by species of marine mammals and turtles (number of sightings per 15-min count) and densities of seabirds (birds/km^2) by species were calculated for each region and subregion sampled. Distribution plots of survey effort (number of 15-min periods per 10' x 10' blocks of latitude and longitude) for each season were compiled in Figures 5-8.

Table 1. List of cruise information used in this report, January 1982 through December 1983.

MBO Cruise No.	Vessel Cruise No.	Vessel	Dates
8201	AL82-01 (I)	RV ALBATROSS IV	25 Jan - 03 Feb
8202	AL82-01 (II)	RV ALBATROSS IV	05 - 12 Feb
8203	AL82-02 (I)	RV ALBATROSS IV	16 - 26 Feb
8204	AL82-02 (II)	RV ALBATROSS IV	02 - 11 Mar
8205	AL82-02 (III)	RV ALBATROSS IV	15 - 25 Mar
8206	AL82-04	RV ALBATROSS IV	19 Apr - 04 May
8207	DE82-03 (I)	RV DELAWARE II	17 - 28 May
8208	DE82-03 (II)	RV DELAWARE II	01 - 11 Jun
8209	AL82-06	RV ALBATROSS IV	01 - 10 Jun
8210	AL82-07	RV ALBATROSS IV	17 Jun - 02 Jul
8211	AL82-08 (I)	RV ALBATROSS IV	12 - 23 Jul
8212	AL82-08 (II)	RV ALBATROSS IV	26 Jul - 06 Aug
8213	GM82-10	RV GLORIA MICHELLE	05 - 06 Aug
8214	AL82-09	RV ALBATROSS IV	09 - 20 Aug
8215		CAPE HATTERAS	13 - 20 Aug
8216		FV YANKEE CAPTAIN	01 - 03 Sep
8217		CAPE HATTERAS	07 - 15 Sep
8218	AL82-11 (I)	RV ALBATROSS IV	13 Sep - 01 Oct
8219	DE82-06 (II)	RV DELAWARE II	21 - 28 Sep
8220	AL82-11 (II)	RV ALBATROSS IV	04 - 15 Oct
8221	AL82-11 (III)	RV ALBATROSS IV	18 - 29 Oct
8222	AL82-11 (IV)	RV ALBATROSS IV	01 - 12 Nov
8223	DE82-09 (I)	RV DELAWARE II	15 - 24 Nov
8224	AL82-12 (I)	RV ALBATROSS IV	15 - 24 Nov

Table (continued).

MBO Cruise No.	Vessel Cruise No.	Vessel	Dates
8225	AL82-12 (II)	RV ALBATROSS IV	29 Nov - 10 Dec
8226	DE82-09 (II)	RV DELAWARE II	29 Nov - 10 Dec
8227	DE82-09 (III)	RV DELAWARE II	13 - 22 Dec
8301	DE83-01 (I)	RV DELAWARE II	17 - 28 Jan
8302	DE83-01 (II)	RV DELAWARE II	31 Jan - 11 Feb
8303	DE83-01 (III)	RV DELAWARE II	14 - 25 Feb
8304	AL83-01	RV ALBATROSS IV	23 Feb - 03 Mar
8305	DE83-02	RV DELAWARE II	01 - 09 Mar
8306		RV DELAWARE II	14 - 22 Mar
8307	AL83-02 (I)	RV ALBATROSS IV	07 - 25 Mar
8308	AL83-02 (II)	RV ALBATROSS IV	28 Mar - 08 Apr
8309	AL83-02 (III)	RV ALBATROSS IV	11 - 22 Apr
8310	AL83-02 (IV)	RV ALBATROSS IV	25 Apr - 06 May
8311	AL83-03	RV ALBATROSS IV	09 - 20 May
8312	AL83-04 (I)	RV ALBATROSS IV	23 May - 03 Jun
8313	AL83-04 (II)	RV ALBATROSS IV	06 - 22 Jun
8314	AL83-06	RV ALBATROSS IV	01-15 Jul
8315	AL83-07 (I)	RV ALBATROSS IV	26 Jul - 05 Aug
8316	AL83-07 (II)	RV ALBATROSS IV	08 - 19 Aug
8317	AL83-07 (III)	RV ALBATROSS IV	22 Aug - 02 Sep
8318	AL83-08 (I)	RV ALBATROSS IV	12 - 30 Sep
8319	AL83-08 (II)	RV ALBATROSS IV	03 - 14 Oct
8320	AL83-08 (III)	RV ALBATROSS IV	17 - 28 Oct
8321	AL83-08 (IV)	RV ALBATROSS IV	31 Oct - 10 Nov

Table (continued).

MBO Cruise No.	Vessel Cruise No.	Vessel	Dates
8322		RV ALBATROSS IV	28 Nov - 09 Dec
8323	DE83-09 (I)	RV DELAWARE II	14 - 23 Nov
8324	DE83-09 (II)	RV DELAWARE II	28 Nov - 09 Dec
8325	DE83-09 (III)	RV DELAWARE II	12 - 21 Dec

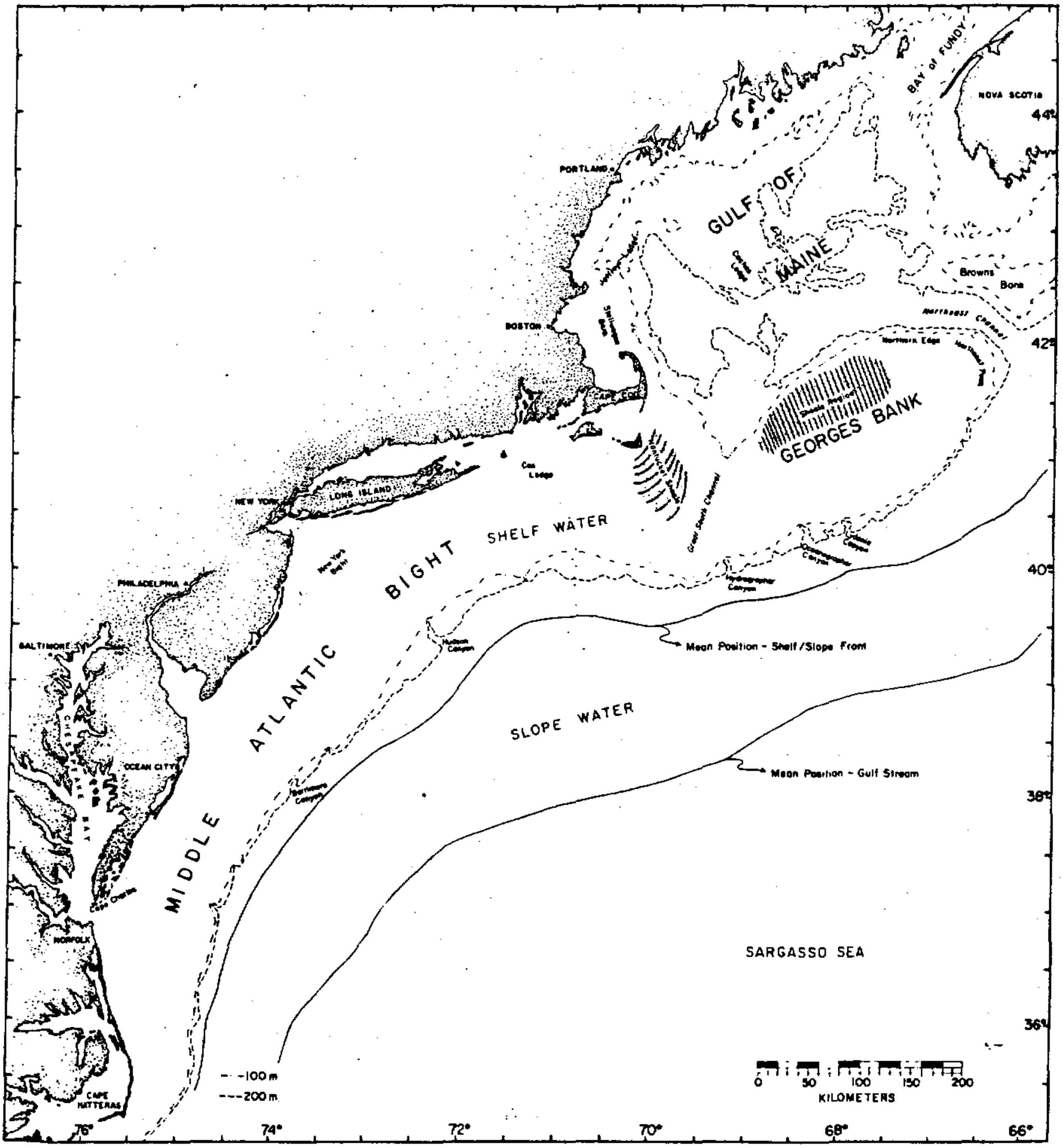

Fig. 2. Bathymetry and principal features of the continental shelf and slope off the northeastern United States.

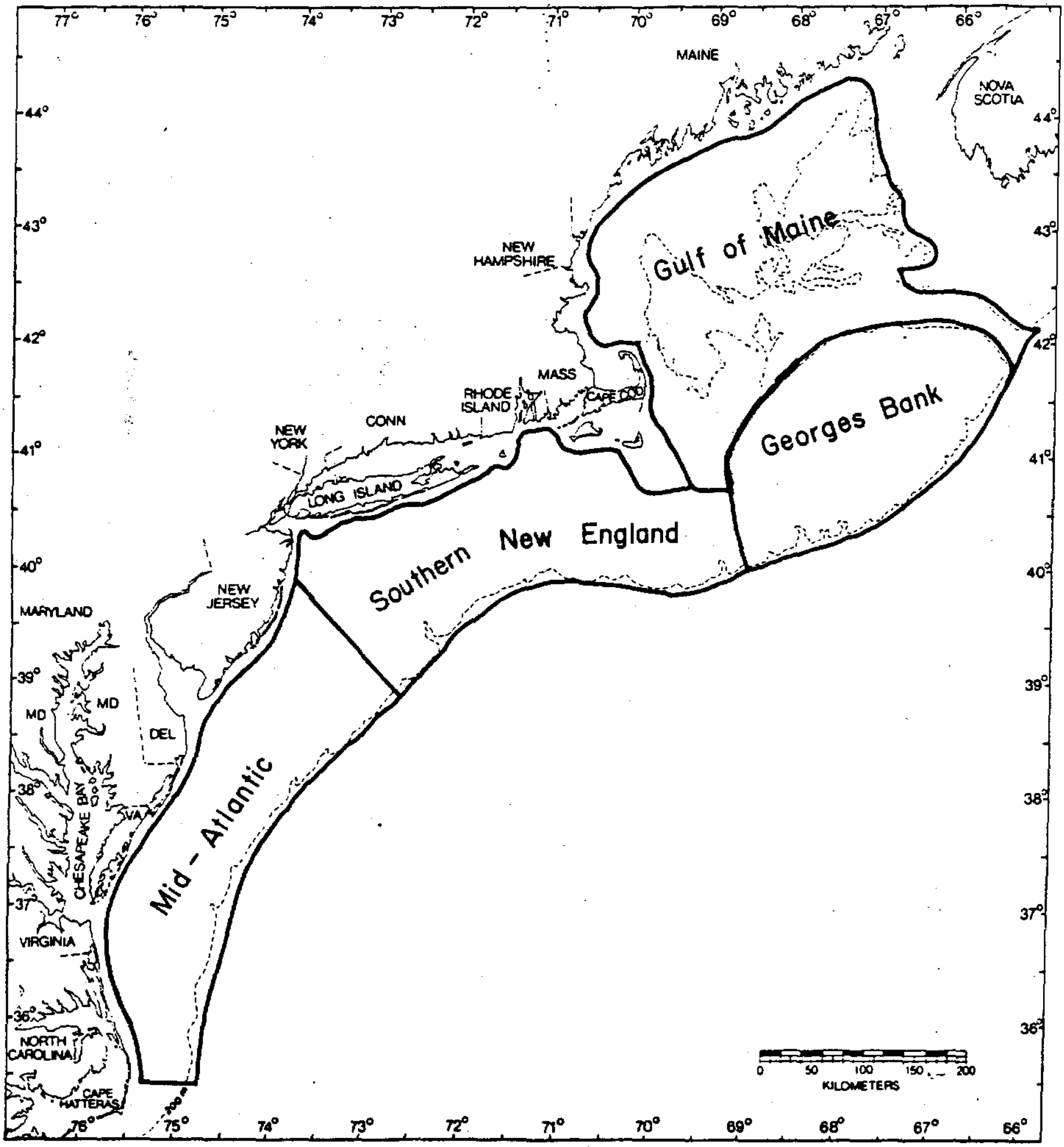

Figure 3. Outline of regions used in quantitative analyses.

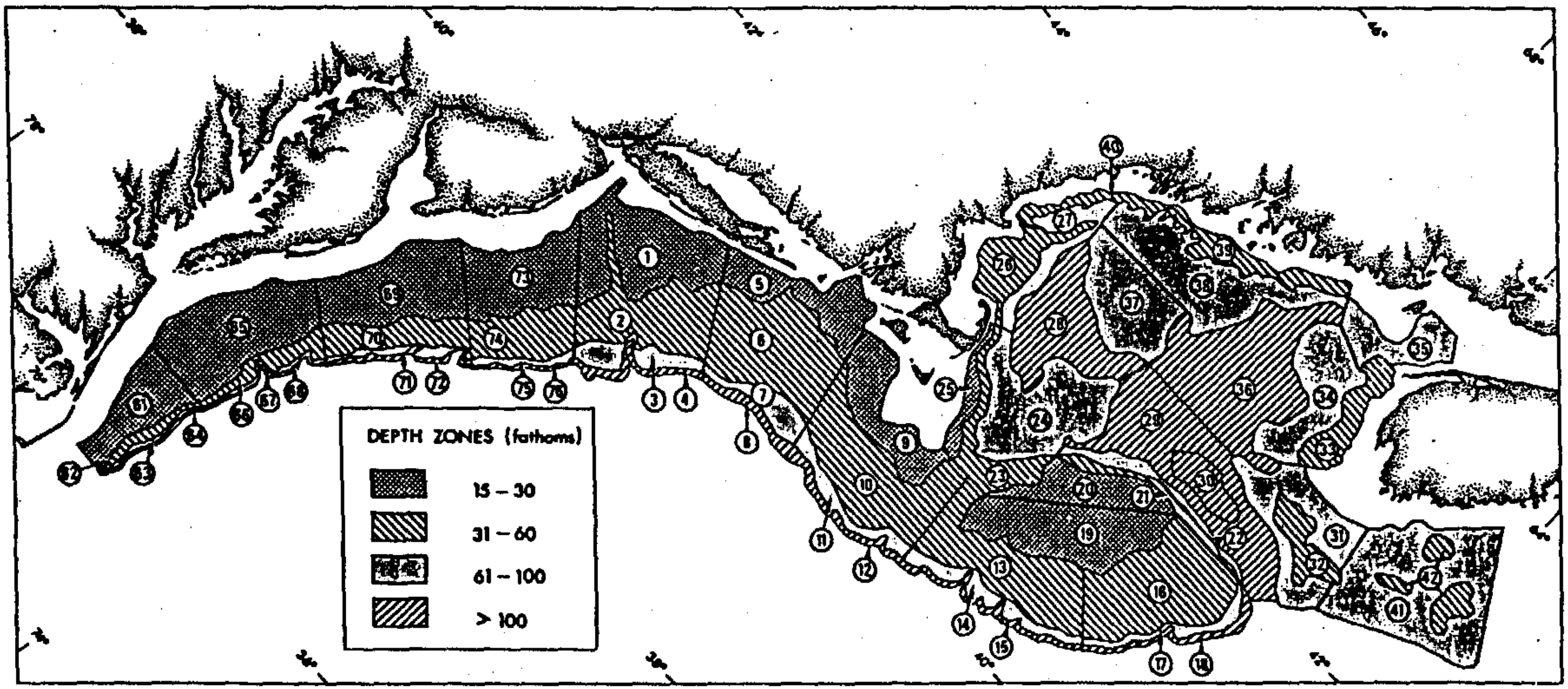

Figure 4. NMFS/NEFC bottom-trawl strate definition, based principally on depth, used in quantitative analyses.

Table 2. Breakdown of regions and subregions used in the quantitative analyses of cetaceans, bird and turtle distributions adapted from NMFS/NEFC groundfish strata.

Regions/subregions	NMFS Strata #	Total Area (km^2)
GULF OF MAINE		
Central (GM-c)	28-30, 34, 36-40	55,422
South (GM-s)	24	8,812
Southwest (GM-sw)	23, 25-27	7,957
GEORGES BANK		
Northern edge (GB-ne)	21, 22	3,012
Shelf edge (GB-sc)	14, 15, 17, 18	4,864
Shoals (GB-s)	19, 20	12,605
Central bank (GB-cb)	13, 16	18,364
SOUTHERN NEW ENGLAND		
Near shelf (SNE-ns)	1, 5, 9	18,910
Mid shelf (SNE-ms)	2, 6, 10	25,224
Outer shelf (SNE-os)	3, 4, 7, 8, 11, 12	7,875
MID ATLANTIC		
Near shelf (MA-ns)	61, 65, 69, 73	29,937
Mid shelf (MA-ms)	62, 66, 70, 79	10,616
Outer shelf (MA-os)	63, 64, 67, 68, 71, 72, 75, 76	2,981
SLOPE	0	50,000

Table 3. Breakdown of cetacean and sea turtle observation effort (number of 15-min counts) and area sampled (track km) by region/subregion and season, June 1980 through December 1983.

Region/subregion	Spring	Summer	Fall	Winter
GULF OF MAINE				
Central Gulf	221 (800.21)	467(1821.90)	342(1414.92)	516(2115.44)
South	82 (322.24)	123 (483.83)	108 (446.84)	117 (482.90)
Southwest	157 (544.17)	316(1252.56)	159 (593.47)	185 (782.47)
Total	460(1666.62)	906(3558.29)	609(2455.23)	818(3380.81)
GEORGES BANK				
Shoals	173 (665.79)	176 (685.24)	167 (651.44)	96 (412.53)
Northern Edge	40 (166.98)	46 (158.34)	78 (303.72)	23 (102.78)
Central Bank	300(1173.55)	307(1225.56)	192 (767.19)	198 (795.89)
Shelf Edge	81 (295.70)	121 (502.35)	109 (403.73)	27 (108.34)
Total	594(2302.02)	650(2371.49)	546(2126.08)	344(1419.54)
SOUTHERN NEW ENGLAND				
Near Shelf	176 (688.32)	513(2114.79)	238 (934.79)	165 (700.98)
Mid Shelf	211 (840.34)	650(2661.69)	332(1318.16)	212 (863.49)
Outer Shelf	165 (640.32)	159 (658.07)	184 (726.91)	24 (101.39)
Total	552(2168.98)	1322(5434.55)	754(2979.86)	401(1665.86)
MID ATLANTIC				
Near Shelf	286(1122.00)	475(1966.54)	214 (932.01	128 (547.72)
Mid Shelf	160 (634.92)	218 (883.86)	150 (655.14)	79 (352.80)
Outer Shelf	92 (381.82)	59 (264.83)	105 (417.93)	54 (243.07)
Carolina Shoals	88 (356.52)	9 (41.20)	96 (421.33)	24 (85.65)
Total	626(2495.26)	761(3156.43)	565(2426.41)	285(1229.24)

Table 3 (continued)

Region/subregion	Spring	Summer	Fall	Winter
SLOPE	118 (487.07)	270(1160.74)	94 (438.92)	2 (9.26)
NOVA SCOTIA				
West	23 (81.95)	27 (109.73)	87 (331.04)	86 (356.51)
Scotian Shelf	0	28 (58.33)	0	0
Total	23 (81.95)	55 (168.06)	87 (331.04)	86 (356.51)
BAY OF FUNDY	8 (29.63)	23 (95.37)	0	1 (4.63)
COASTAL				
Carolina	64 (265.29)	61 (272.24)	122 (519.02)	0
Mid Atlantic	110 (446.48)	175 (729.68)	237 (945.44)	33 (142.14)
Southern New England	37 (150.47)	87 (378.73)	74 (275.94)	109 (444.48)
Maine	0	7 (25.92)	7 (28.24)	32 (131.95)
Total	211 (862.24)	330(1406.57)	440(1768.64)	174 (718.57)

Table 4. Breakdown of seabird observation effort (number of 15-min counts) and area sampled (km^2) by region/subregion and season, June 1980 through December 1983.

	Spring		Summer		Fall		Winter	
	No. Transect	Area (km^2)	No. Transect	Area (km^2)	No. Transect	Area (km^2)	No. Transect	Area (km^2)
GULF OF MAINE								
Central Gulf	206	222.42	404	474.76	294	362.11	483	592.96
South	71	83.06	92	109.73	97	120.16	114	141.26
Southwest	139	144.78	236	281.27	134	152.06	163	207.09
Total	416	450.26	732	865.76	525	634.33	760	941.31
GEORGES BANK								
Shoals	164	189.87	159	188.07	156	183.48	95	122.64
Northern Edge	39	48.84	39	39.58	58	69.45	21	28.48
Central Bank	287	337.89	259	307.80	175	210.01	187	225.57
Shelf Edge	73	82.87	100	126.53	101	112.64	27	32.50
Total	563	659.47	557	661.98	490	575.58	330	409.19
SOUTHERN NEW ENGLAND								
Near Shelf	166	194.55	418	513.87	230	270.43	160	203.07
Mid Shelf	205	244.88	515	631.13	299	353.63	185	227.37
Outer Shelf	145	170.29	145	178.81	176	210.85	21	26.66
Total	516	609.72	1078	1323.81	705	834.91	366	457.10

Table 4 (continued)

	Spring		Summer		Fall		Winter	
	No. Transect	Area (km^2)	No. Transect	Area (km^2)	No. Transect	Area (km^2)	No. Transect	Area (km^2)
MID ATLANTIC								
Near Shelf	286	336.60	377	456.61	194	251.40	121	155.15
Mid Shelf	151	179.22	178	211.96	133	173.06	75	100.28
Outer Shelf	91	113.71	47	62.08	101	120.70	52	70.14
Carolina Shoals	87	106.52	5	6.94	91	119.73	24	25.69
Total	615	736.05	607	737.59	519	664.89	272	351.26
SLOPE	115	142.37	238	306.96	93	130.28	2	2.77
NOVA SCOTIA								
West	23	24.58	27	32.91	69	79.72	85	105.56
Scotian Shelf	---	---	28	17.50	---	---	---	---
Total	23	24.58	55	50.41	69	79.72	85	105.56
BAY OF FUNDY	8	8.88	18	21.94	---	---	1	1.38
COASTAL								
Carolina	64	79.58	44	58.06	115	146.53	---	---
Mid Atlantic	110	133.94	143	175.98	225	270.57	33	42.64
Southern New England	35	43.19	76	97.78	74	82.78	99	119.87
Maine	---	---	7	7.77	7	8.47	32	39.58
Total	209	256.71	270	339.59	421	590.92	164	202.09

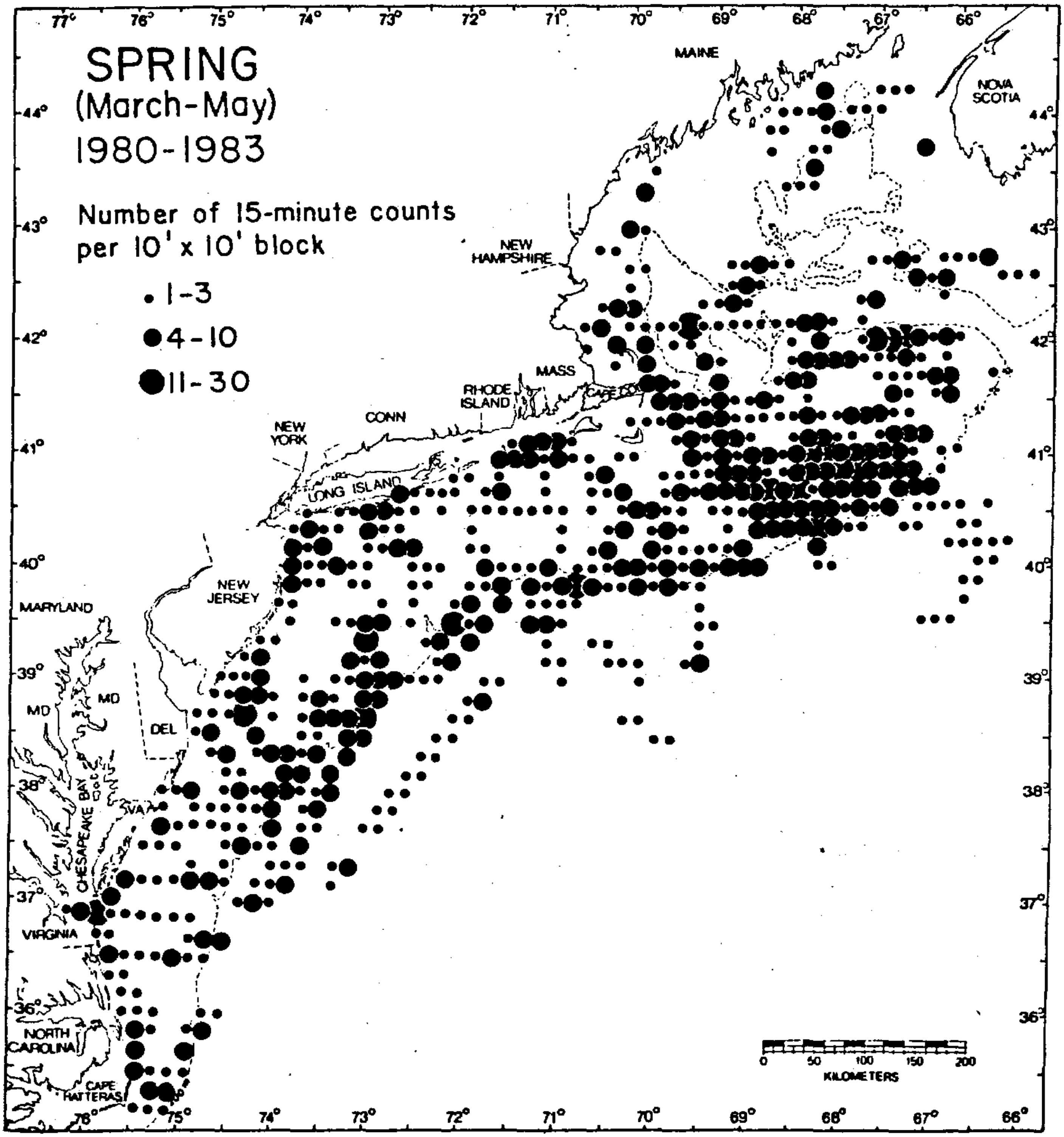

Figure 5. Distribution of sampling effort (number of 15 min counts and linear km surveyed) per 10' x 10' block for spring, June 1980 through December 1983.

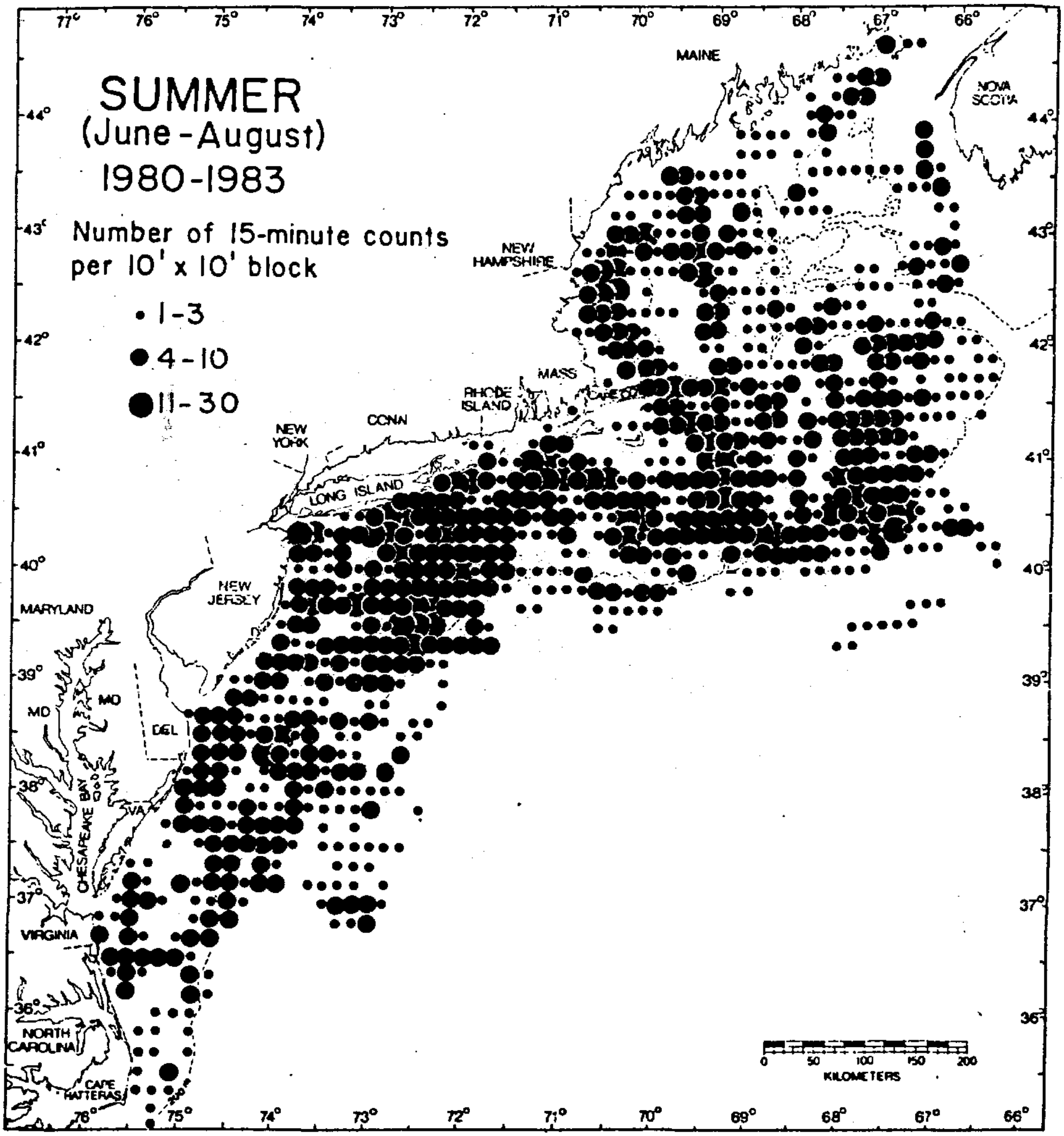

Figure 6. Distribution of sampling effort (number of 15 min counts and linear km surveyed) per 10' x 10' block for summer, June 1980 through December 1983.

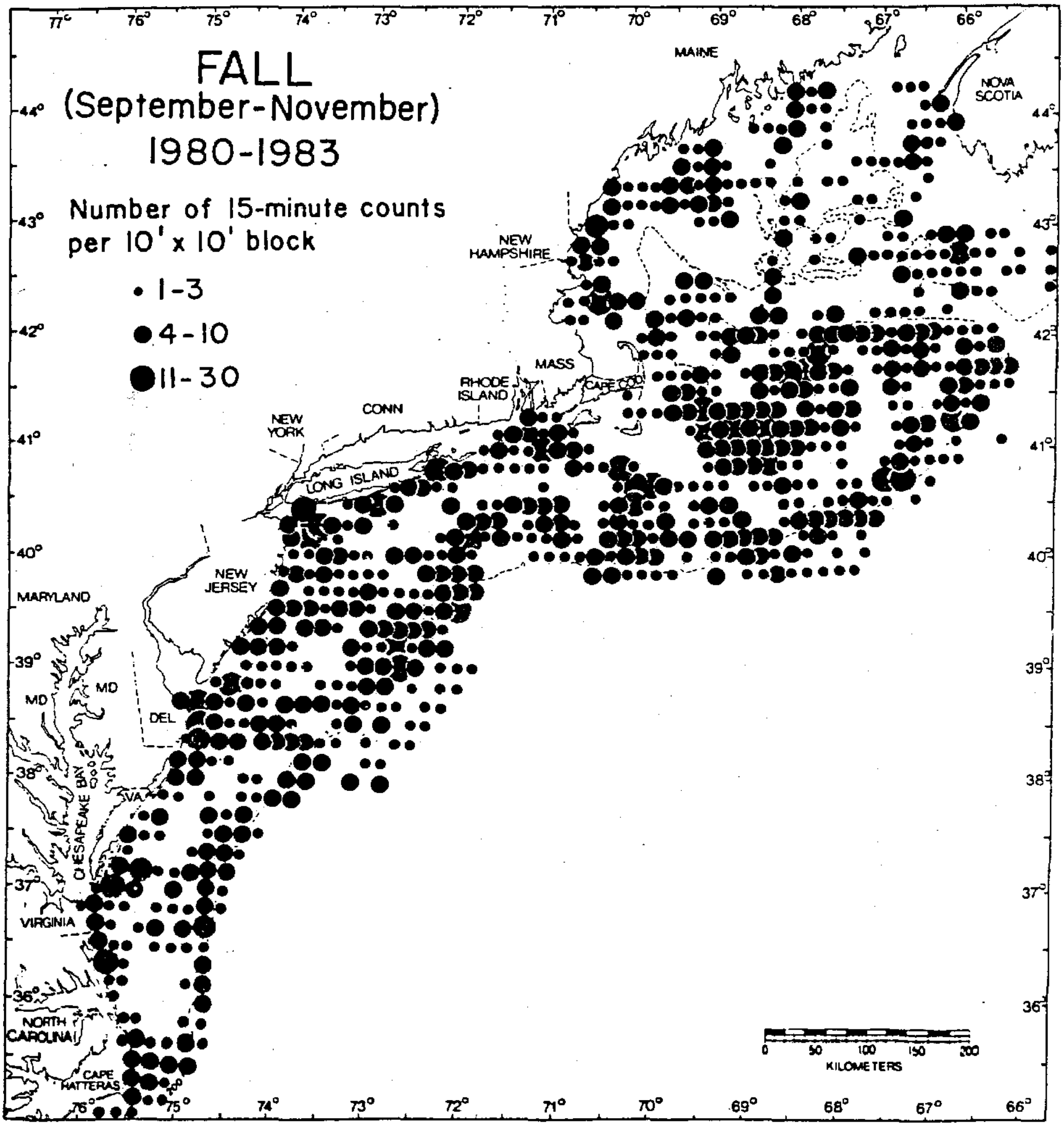

Figure 7. Distribution of sampling effort (number of 15 min counts and linear km surveyed) per 10' x 10' block for fall, June 1980 through December 1983.

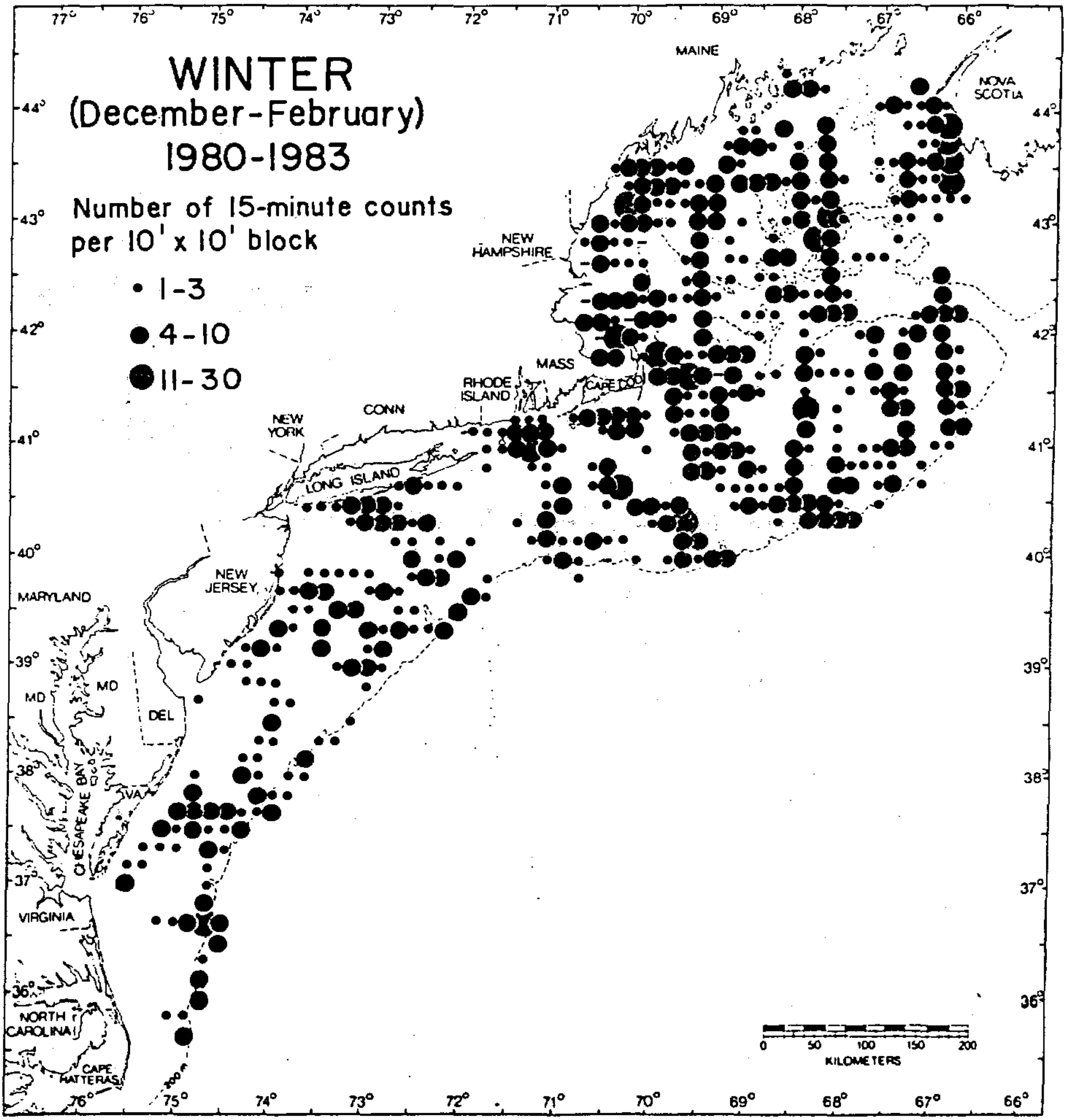

Figure 8. Distribution of sampling effort (number of 15 min counts and linear km surveyed) per 10' x 10' block for winter, June 1980 through December 1983.

Evaluation of Shipboard Sampling of Cetacean Abundance

Powers et al. (1982) provided a preliminary evaluation of the effectiveness of the cetacean sighting data as collected from ships-of-opportunity. The following is a further evaluation to determine: (1) if there are any significant biases in our sampling techniques and (2) if we can determine perpendicular sighting distances for cetaceans with confidence for density estimates. The principal biases that we have considered are observer variability, sighting distance as a function of distance from the observer, influences of sea state on sightability, and the effect of conducting seabird transects simultaneous with observation periods for cetaceans.

The sighting distance evaluation for all data June 1980 through 1983 is presented in Table 5. Mean right angle distances for dolphins varied from 206 m (Spotted Dolphins) to 446 m (Pilot Whales). The mean right angle sighting distance for all dolphins was 353 m (Table 5). This included those dolphins seen but not identified to species. Mean right angle sighting distances for whales ranged between 242 m (Minke Whale) to 940 m (Sperm Whale). The average sighting distance for all large whales (excluding Minke Whales) was 761 m (Table 5). Sightings unidentified to species generally were seen at a greater distance than the average for all dolphins and large whale sightings. The mean right angle sighting distance for all marine turtles was 107 m (Table 5). The frequency distribution of the total number of marine mammal sightings and individuals seen in relation to right angle distance from the transect line are presented in Tables 6 to 9 and Figures 9 to 11. The frequency distribution of the total number of turtle sightings and individuals seen in relation to right angle distances from the transect line are shown in Table 10 and Figure 12.

The use of different observers in any large-scale survey presents an unavoidable source of variability in distance and angle measurements at sea. To minimize this variability we selected only nine cruises (cruise nos. 8206-8207, 8210, 8213-8215, 8219, 8224-8225) for detailed analysis because each observer on these cruises had several years of experience in observing cetaceans and seabirds at sea. From these cruises which spanned from April to December 1982, a total of 453 15-min counting periods were conducted. No general observations were included in this analysis. Cetacean sightings were broken into two categories: dolphins and whales. Dolphins included all toothed whales except sperm whale, which was combined with baleen whales. The distinction between dolphins and whales is both taxonomic and behavioral. Dolphins are smaller and less conspicuous at the surface; whales are larger and are most conspicuous because of their blows.

There was considerable variability in sighting distances to whales and dolphins; although as expected, dolphins were seen at much shorter distances than whales. The mean radial distance was 858 m ($\pm$ 1815) to dolphins and 1312 m ($\pm$ 1073) to whales (Table 11). These means are similar to our 1980-81 data (Powers et al. 1982) except that we previously reported a mean radial distance to dolphins at 554 ($\pm$ 594). Both groups were seen as far as an estimated 5 km. Right angle or perpendicular sighting distances were computed from the following standard equation:

$$D = \sin \theta \cdot r$$

where D is the right angle distance,

Table 5. Sighting distance evaluation for all species and species groups of cetaceans and marine turtles.

	Linear Dis (m)			Sighting Angle			Right Angle Dis (m)				
Species	Mean Dis	S.D.	Range	Mean Angle	S.D.	Range	R.A. Dis	S.D.	Range	Sample Size	K
Dolphins											
Bottlenosed	521	867.4	0-5000	45	32.8	0-90	332	609.4	0-3300	68	
Saddleback	474	834.1	0-7000	38	31.8	0-90	259	521.7	0-3000	242	
White-sided	593	677.5	0-4000	38	28.2	0-90	338	434.6	0-1970	124	
Spotted	483	867.9	0-3000	26	21.3	0-70	206	388.9	0-1928	34	
Grampus	634	993.5	0-4000	48	29.7	0-90	272	295.3	0-1500	35	
Pilot Whale	819	830.5	0-5000	38	31.2	0-90	446	615.9	0-5000	124	
Striped	1327	1826.4	40-5000	15	13.3	0-40	353	624.3	0-1710	7	
Whales											
Fin	1190	1244.4	0-5000	40	29.8	0-90	652	766.4	0-4330	234	
Humpback	1098	1145.8	0-6000	42	33.1	0-90	605	798.3	0-4000	77	
Minke	324	407.2	0-1800	50	34.2	0-90	242	348.8	0-1773	38	0.0493
Right	833	913.6	0-2000	35	33.8	0-90	303	221.9	0- 684	6	
Sperm	1603	1285.4	50-5000	43	24.5	0-90	940	864.9	0-3447	50	
All large whales	1272	124.6	0-7400	42	29.4	0-90	761	876.1	0-5669	580	0.1858
All dolphins	623	881.3	0-7000	39	30.8	0-90	353	578.7	0-5000	709	0.0576
All marine turtles	125	325.0	0-2000	43	37.0	0-90	107	319.5	0-1970	40	0.0040

Table 6. Frequency distribution of observed right angle measurements by distance intervals for all dolphins (Delphinidae).

Right angle distance interval (m)	No. of sightings	% of total	No. of individuals	% of total
0 - 200	414	0.58	7667	0.50
200 - 400	116	0.16	1691	0.11
400 - 600	60	0.08	1293	0.09
600 - 800	31	0.04	2043	0.13
800 - 1000	31	0.04	412	0.03
1000 - 1200	6	<0.01	198	0.01
1200 - 1400	7	0.01	382	0.02
1400 - 1600	14	0.02	328	0.02
1600 - 1800	3	<0.01	165	0.01
1800 - 2000	6	<0.01	219	0.01
2000 - 2200	5	<0.01	618	0.04
2200 - 2400	2	<0.01	18	<0.01
2400 - 2600	2	<0.01	21	<0.01
2600 - 2800	---	---	---	---
2800 - 3000	9	0.01	239	0.01
> 3000	3	<0.01	66	<0.01

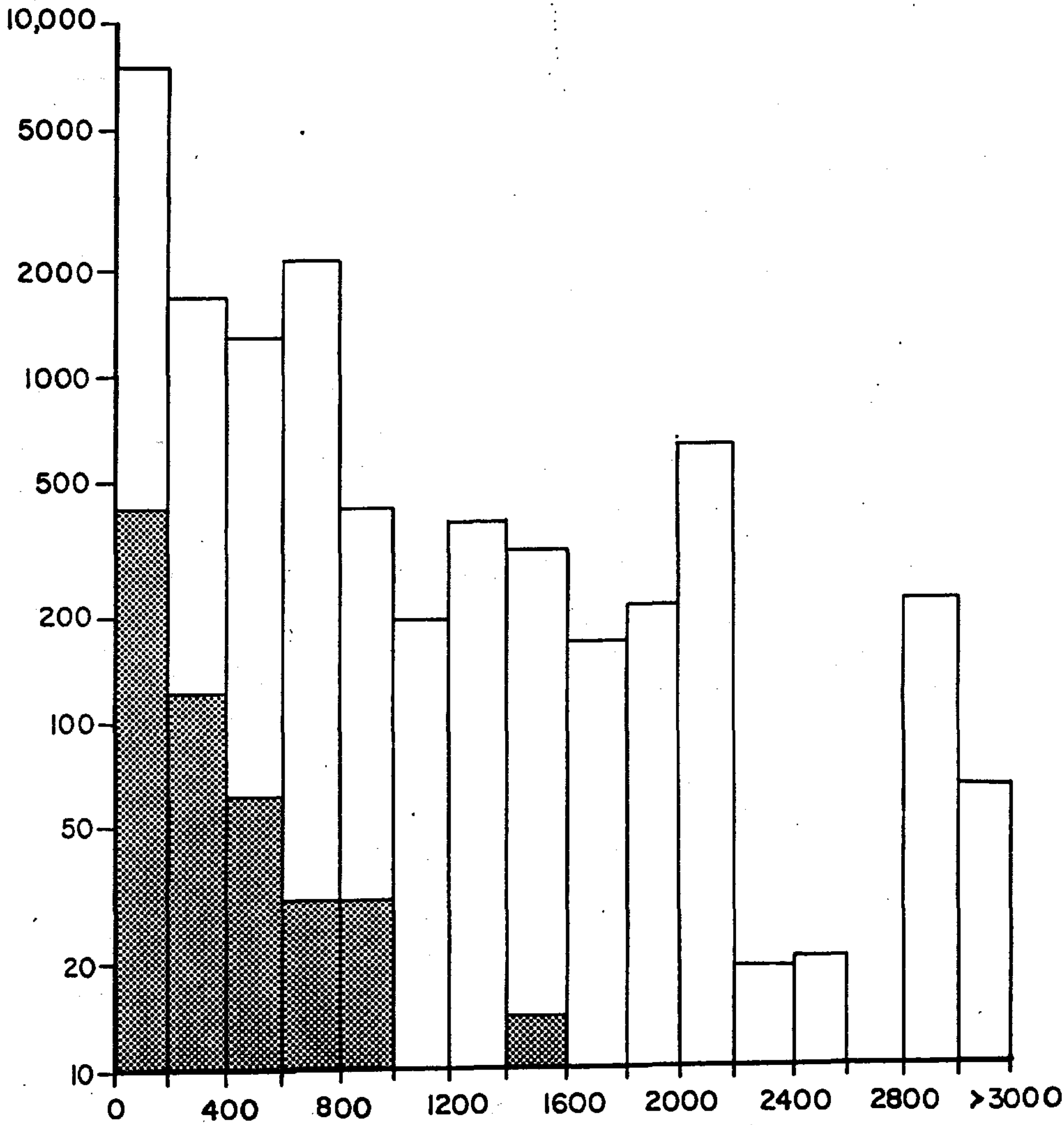

Figure 9. Frequency distribution of observed right-angle distance measurements by distance intervals for all dolphins (Delphinidae).

Table 7 . Frequency distribution of observed right angle measurement by distance intervals for Harbor Porpoise.

Right angle distance interval (m)	No. of sightings	% of total
0 - 100	10	0.36
100 - 200	8	0.29
200 - 300	6	0.21
300 - 400	2	0.07
400 - 500	2	0.07

Table 8. Frequency distribution of observed right angle distance measurements by distance intervals for all large whales (Balaenopteridae, except *B. acutorostrata* and Sperm Whale).

Right angle distance interval (m)	No. of sightings	% of total	No. of individuals	% of total
0 - 200	168	0.29	240	27
200 - 400	115	0.20	157	19
400 - 600	58	0.10	95	12
600 - 800	48	0.10	75	10
800 - 1000	42	0.07	62	07
1000 - 1200	21	0.04	30	03
1200 - 1400	17	0.03	29	03
1400 - 1600	34	0.06	61	07
1600 - 1800	11	0.01	20	02
1800 - 2000	17	0.03	26	03
2000 - 2200	9	0.01	17	02
2200 - 2400	1	<0.01	2	---
2400 - 2600	9	0.01	11	01
2600 - 2800	---	---	0	---
2800 - 3000	14	0.02	21	02
> 3000	16	0.03	24	02

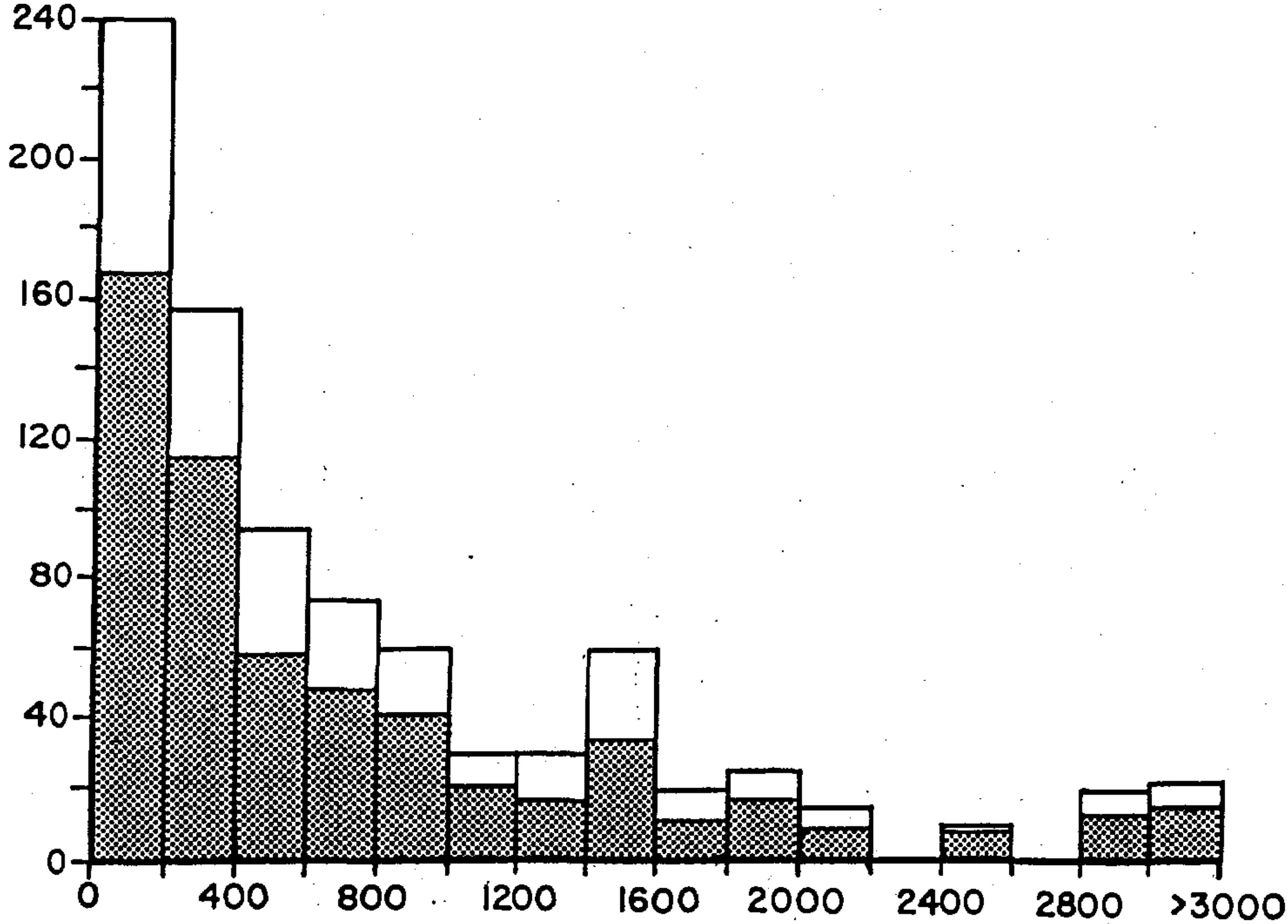

Figure 10. Frequency distribution of observed right-angle distance measurements by distance intervals for all large whales (Balaenopteridae) except B. acutorostrata.

Table 9 . Frequency distribution of observed right angle distance measurement by distance intervals for B. acutorostrata.

Right Angle Distance Inverval (m)	No. of Sightings	% of Sightings	No. of Individuals	% of Total
0 - 200	25	0.66	30	0.63
200 - 400	6	0.16	7	0.15
400 - 600	3	0.08	4	0.08
600 - 800	2	0.05	2	0.04
800 - 1000	---	---	---	---
1000 - 1200	1	0.025	2	0.04
1200 - 1400	---	---	---	---
1400 - 1600	---	---	---	---
1600 - 1800	1	0.025	3	0.06
> 1800	---	---	---	---

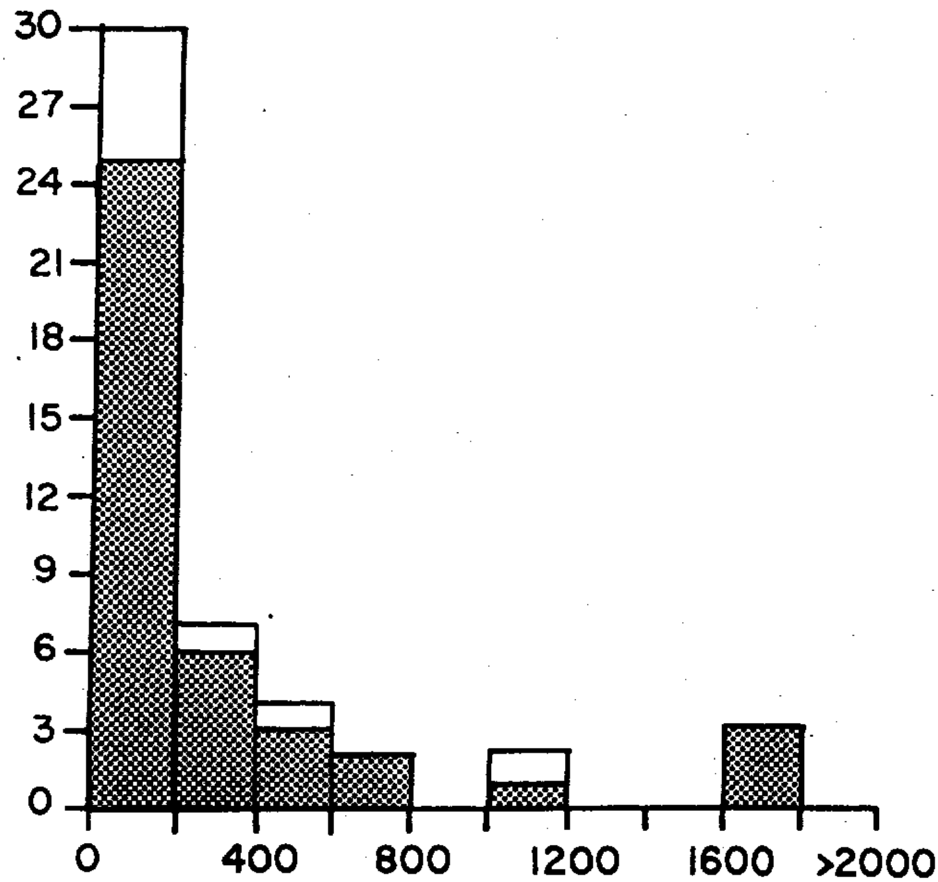

Figure 11 Frequency distribution of observed right-angle distance measurements by distance intervals for _B. acutorostrata_.

Table 10. Frequency distribution of observed right angle distance measurement by distance intervals for all marine turtles.

Right Angle Distance Inverval (m)	No. of Sightings	% of Sightings	No. of Individuals	% of Total
0 - 100	33	0.83	34	0.82
100 - 200	3	0.07	3	0.07
200 - 300	1	0.025	1	0.02
300 - 400	1	0.025	1	0.02
400 - 500	1	0.025	1	0.02
500 - 600	---	---	---	---
600 - 700	---	---	---	---
700 - 800	---	---	---	---
800 - 1000	---	---	---	---
> 1000	1	0.025	2	0.05

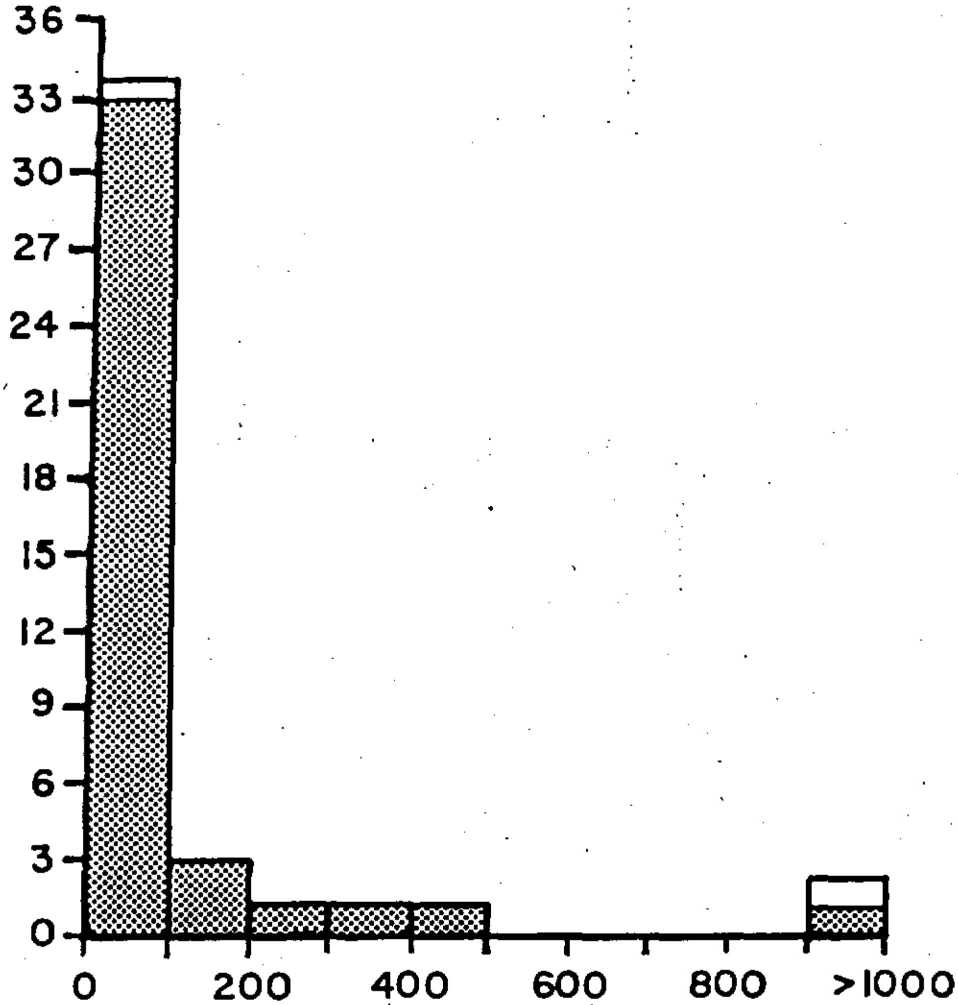

Figure 12. Frequency distribution of observed right-angle distance measurements by distance intervals for all marine turtles.

Table 11. Distance measurements for sightings of whales and dolphins by selected observers and cruises on ships during 1982.

Measurement	Dolphins	Whales
Number of sightings	144	120
Mean sighting (radial) distance (m)	858 ±(1815)	1312 ±(1073)
Range (m)	0 - 5000	0 - 5000
Mean sight angle distance (m)	434 ± (603)	830 ± (764)
Range (m)	0 - 3214	0 - 4000

r is the radial distance, and

θ is the sighting angle.

As expected, mean right angle sighting distances to whales were also greater than those to dolphins. The mean right angle distance was 830 m ($\pm$ 764) to whales and 434 m ($\pm$ 603) to dolphins. These means are greater than those shown in Table 5 for all data and all observers. This is to be expected as experienced observers generally sight marine mammals at a greater distance from the vessel and the transect line, than the less experienced observers (Powers et al. 1980a).

A frequency distribution of radial and right angle distances by fixed-intervals of distance gives a better perspective of the variability associated with their means. Sightability of dolphins decreases substantially beyond 500 m, as 62% of the radial and 78% of the right angle measurements were within that distance (Table 12). Powers et al. (1982) reported that 60% and 83% of the radial and right angle sighting distances were within 500 m for dolphins. Whales appeared to be equally sightable between the 0-500 m and 500-1000 m intervals but not beyond that distance (Table 12). Combined these two intervals accounted for 58% and 68% of the radial and right angle sighting distances for whales. Powers et al. (1982) found that 60% and 70% of the radial and right angle sighting measurements were within 1000 m for whales.

Sightability of cetaceans is dependent upon sea conditions. The frequency of whale and dolphin sightings by Beaufort sea conditions, as indicated by wind force, are given in Table 13. One may predict that sightability would be a function of sea state, but Table 13 suggests that dolphins are more visible in Beaufort 3 and whales in Beaufort 2 conditions; however, the relative frequency of whale and dolphin sightings are better explained when compared with the total level of effort (no. of 15-min counts) by sea conditions (Figure 13). The distribution of effort indicates that nearly 40% of the counting periods were made at Beaufort 3 and only 2% at Beaufort 1. Figure 13 indicates that the sightability of whales exceeds effort in Beaufort conditions 0-2 and drops considerably below it at Beaufort 3. Thus, whales are missed when winds exceed 12 knots. Conversely, the distribution of dolphin sightings is similar to that of effort, suggesting the sightability of dolphins is less affected by sea conditions. However, it should be noted that the sightability curve of dolphins exceeds the effort curve only in Beaufort 0-3 conditions.

Finally, in our previous report we found that whales and dolphins were not sighted at expected frequencies in sighting angle intervals. Given a sin function (with the sighting angle) in computing right angle distances, 50% of the sightings should be made 30° either side of the bow. Our previous results indicated that this was not the case with our data, which appeared to be biased towards greater sighting angles. Our explanation was two-fold: (1) error in angle measurements and (2) the observer's preoccupation with a search for birds on one side of the ship. In 1982, our observers recorded on what side of the ship bird transects were conducted and on which side cetacean observations were made. This allowed us to expand our sighting angle intervals to six (90°-60,...60-90°), and increase our chi-square test degrees of freedom to five, and examine what effect the bird search had on finding cetaceans within the 180° arc.

The results of expected and observed sighting angle interval frequencies are given in Table 14. A significant bias was found with more whales sighted on the side of the ship where the bird transect was made, particularly in the

Table 12. Frequency distribution of sighting measurements for cetaceans by distance intervals for selected cruises during 1982.

Distance interval (m)	Radial: No. of sightings	Radial: % total	Right Angle: No. of sightings	Right Angle: % total
Dolphins				
0 - 500	90	62	112	78
500 - 1000	30	21	16	11
1000 - 1500	7	5	9	6
1500 - 2000	8	5	2	1
2000 - 3000	7	5	4	3
3000 - 4000	1	1	1	1
4000 - 5000	1	1	---	---
Whales				
0 - 500	36	30	48	40
500 - 1000	34	28	34	28
1000 - 1500	10	8	17	10
1500 - 2000	21	15	12	10
2000 - 3000	14	12	7	6
3000 - 4000	3	2	2	2
4000 - 5000	2	2	---	---

Table 13. Sighting frequency of whales and dolphins in relation to sea conditions.[1]

Beaufort scale	Wind force (knots)	Dolphins		Whales	
		No. of sightings	Cumulative % total	No. of sightings	Cumulative % total
0	0	16	12	8	15
1	1 - 3	1	13	1	17
2	4 - 7	28	34	37	84
3	8 - 12	62	81	4	91
4	13 - 18	22	98	5	100
5	19 - 24	4	100		

[1] Wind speed was not available for all sightings.

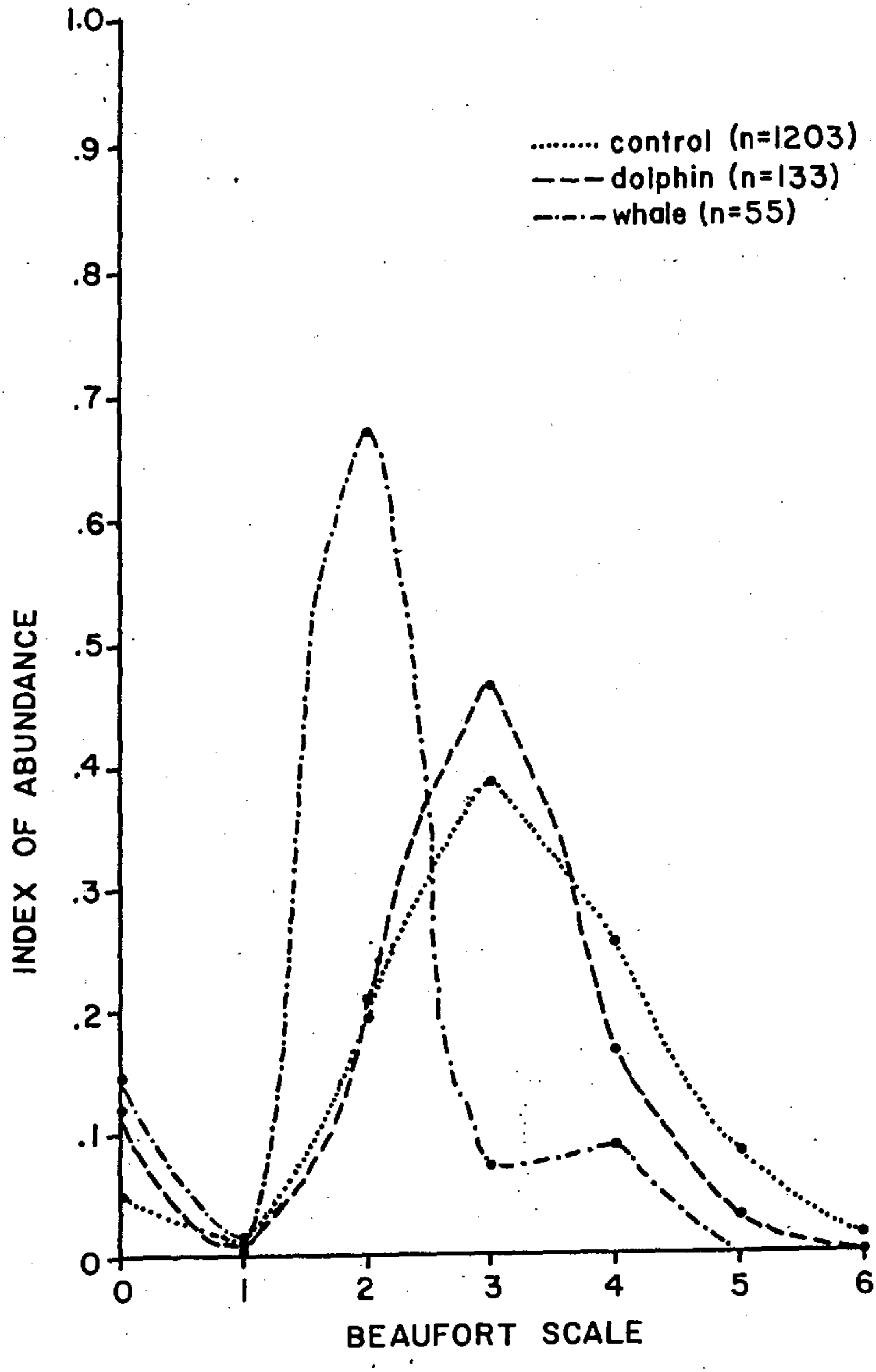

Figure 13. Sighting frequency of dolphins and whales in relation to sea conditions.

Table 14. Frequencies of observed and expected angle measurements for sightings of whales and dolphins within 90° either side of transect line relative to seabird transects, for selected cruises during 1982.

	Angular Field					
	90-60°	60-30°	30-0°	0-30°[2]	30-60°[2]	60-90°[2]
Whales						
Sighting frequency	5	10	6	12	12	12
% of total observed	.087	.175	.105[3]	.210	.210	.210[4]
% expected	.065	.185	.250	.250	.185	.065
Dolphins						
Sighting frequency	8	15	26	27	21	15
% of total observed	.071	.134	.232	.241	.187	.134
% expected	.065	.185	.250	.250	.185	.065

[1] Expected angle frequencies are based sin 0 x 0.5 because the total field of view was 180°. Significant differences between observed - expected frequencies are indicated. Bird transects, which were simultaneous with cetacean counting periods, were conducted on one side of the ship only (0-90°, not 90-0°).

[2] side of bird transect

[3] $P < 0.05$

[4] $P < 0.01$

60-90° interval (x^2 = 42.53). This bias may also affect the observed sighting distances of whales, since right angle distance will increase with sighting angle for the same radial distance. Although this bias is recognized, it was not factored into the preliminary density calculations for this report. Dolphin sightability was not significantly affected by searching for birds (x^2 = 8.95). Although like whales, nearly twice the expected number of dolphin sightings were made in the 60-90° interval on the side of the ship where birds were counted, this difference was not significant; therefore the sightability of dolphins is not substantially affected by sea conditions or the search for birds.

Density Estimates

Estimates of seabird density (birds/km^2) are derived from a strip transect procedure (Powers 1982). The observer counted all birds on one side of the ship out to 300 m and forward of mid-ship to the projected end of the transect. This strip-census method does not eliminate the problem of ship attraction (which varies according to cruise objective) or chronic ship-following (which varies by bird species), but it does minimize its inflationary effect on density estimates (Powers 1982b). Differences in the abilities of observers to count birds is a principal, but unavoidable, source of variability in any estimate of bird density at sea (Powers 1982).

Estimates of seabird density were calculated by dividing bird counts from the sampling strip by the area sampled for each transect (i.e., Powers 1983). Area sampled (A) per transect was calculated as follows:

$$A = \frac{\text{speed (nm/hr)}}{\text{60 min/hr}} \times 15\text{ min} \times \frac{1852\text{ m}}{1\text{ nm}} \times 300\text{ m} \times \frac{1\text{ km}^2}{1 \times 10^6\text{m}^2}$$

Densities were then calculated for each species/season, weighted by the total area sampled within each region.

Estimates of cetacean abundance have been derived based on the number of individuals/linear km. At the initial point of each mammal sighting a radial distance to the sighting and an angle measurement are made from the center transect line. Distance measurements up to 1 km are directly determined with a rangefinder. Sighting distances beyond 1 km are subjectively estimated. The use of the ship's radar may be useful in determining distances to objects near the sighting (e.g. ships, buoys) by adding greater confidence to the estimated distance. Angles are estimated from the ship's compass on the flying bridge or bridge wing. Right angle distances are calculated for all sightings from the sighting data.

Estimates of cetacean density were derived from sighting angles and distances using line transect methodology (Seber 1973; Eberhardt et al. 1979; Burham et al. 1980; Scott et al. 1983).

Densities were estimated using the Cox-Eberhardt (Eberhardt 1978) method where

$$D = \frac{nf(0)}{2L}$$

where n = the number of animals seen

L = length of transect line

f(0) = a constant describing the decreasing probability of sightings with the distance from the transect line.

This estimation was used by CeTAP (1982) and Kenney et al. (1983) to estimate cetacean densities from aerial surveys, and can be compared directly to the estimates (based on shipboard observations) obtained in this report for the same region/season.

The values of f(0) were obtained using data presented in Table 8, Fig. 8 (dolphins); Table 10, Fig. 9 (all large whales, except Minke Whale); Table 11, Fig. 10 (Minke Whale); Table 12, Fig. 11 (all marine turtles). The values of f(0) used in density calculations are found in Table 7.

RESULTS AND DISCUSSION

Cetaceans

A total of 1,756 sightings involving 21,201 individuals of 17 species of cetaceans were recorded from June 1980 to December 1983 (Table 15). Although sightings were nearly equally divided between dolphins (928) and large whales (828), dolphins were more abundant by a factor of 13 (Table 15). Common (Saddleback) Dolphin was the most frequently sighted delphinid and comprised 277 of the dolphin sightings and 55% of the total number of individuals. White-sided dolphins were also frequently sighted comprising 17% of the dolphin sightings, and 16% of the individuals. Another 14% of the dolphin sightings were unidentified. Fin Whales made up over half (Table 15) of the large whale sightings (54%) and number of individuals sighted (59%). Humpback Whales were recorded in 13% of the large whale sightings. Unidentified large whales accounted for 17% of the sightings (Table 15).

We recorded the greatest concentrations of dolphins from Georges Bank south to the Mid-Atlantic regions, principally from mid-shelf to slope waters (Tables 16-17, Figs. 14-18). This is characteristic of a Type III distribution (Hain et al. 1981) and is indicative of most toothed-whales or dolphins in our study area. The distribution of spotted, saddleback, grampus, striped, pilot whales and sperm whales, all conform to this distribution type. Bottlenosed dolphin are also found principally along the shelf edge north of the Chesapeake Bay, but are also found inshore south of this location to Cape Hatteras (CeTAP 1982). The center of abundance of all these species is the Mid-Atlantic Bight region with a tendency to move northward and onto the shelf in summer and fall. Only the southwest Gulf of Maine was ranked among the regions of greatest dolphin abundance (Tables 16-17). The species most often seen in this region was the White-sided dolphin. The GOM is the center of abundance for <u>L. acutus</u>. The importance of this region to large whales (Tables 20-21) is not shared by the other species of delphinids. Dolphin distribution is most widespread summer through fall, and most restricted in winter (Tables 16-17, Figs. 14-18). This may reflect seasonal movements onto the shelf during this period, as well as increased difficulty in detection during winter weather.

Gulf of Maine waters were especially important to large whales(Tables 18-19, Figs. 19-23). Large baleen whales were recorded throughout the shelf, but greatest concentrations occurred in the southwest-Gulf of Maine (NMFS strata 23,25-27) and the south-Gulf of Maine (NMFS strata 24), throughout the year (Tables 18-19). This shelf distribution is similar to that described by Hain et al. (1981) as a Type II distribution. Large whales were most frequently sighted spring through fall (Figs. 21-22). The importance of the southwest-Gulf of Maine (from Jeffreys Ledge south to Stellwagen Bank, and along the 100 m contour south to the Great South Channel) has been well documented (Hain et al. 1981; Kenney et al. 1981; Powers et al. 1982; CeTAP 1982; Payne et al. in review). This is the only predictable region where fin and humpback whales are known to overwinter north of 40°00'N latitude. The overall trend for large whales (Fig. 20) and dolphins (Fig. 14) to select areas of rapidly changing bathymetry is evident throughout the study area. The other areas of baleen whale concentrations were principally along the shelf edge from SNE north to Georges Bank.

The importance of the 100m contour is also evident when examining the mean depth at sighting (Table 20) for large whales, spring through summer (when most sightings occur). The range of all sightings (excluding sperm whales) is between 91.13 and 147.42 m (Table 20). Sightings of sperm whales occur in

Table 15. Total number and species composition of all cetacean sightings, January 1980 to December 1983.

Species	Number		% Composition	
	Individuals	Sightings	Individuals	Sightings
Dolphins				
Bottlenosed	1184	93	6	10
Spotted	763	40	4	4
Striped	450	11	2	1
Saddleback	10803	277	55	30
White-sided	3162	156	16	17
Pilot Whale	1176	151	6	16
Grampus	404	39	2	4
White-beaked	11	2	<1	<1
Killer	4	1	<1	<1
Harbor Porpoise	95	29	<1	3
Unid. dolphin	1649	129	8	14
Total	19701	928	100	100
Large Whales				
Sperm	91	54	6	7
Minke	80	63	5	8
Sei	10	8	<1	<1
Fin	885	444	59	54
Humpback	235	105	16	13
Right	15	11	1	1
Unid. large whale	179	141	12	17
Unid. beaked whale	4	2	<1	<1
Total	1500	828	100	100

Table 16. Seasonal estimates of members of Delphinidae and Harbor Porpoise abundance, animals/linear km ($\bar{X} \pm SD$), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter		Spring		Summer		Fall	
GULF OF MAINE								
Central gulf	0.004	(0.060)	0.038	(0.284)	0.186	(1.508)	0.176	(1.292)
South	0.396	(2.956)	0.299	(1.433)	0.210	(1.243)	0.238	(0.942)
Southwest	0.155	(1.109)	0.517	(3.656)	0.122	(0.739)	0.240	(1.444)
Total	0.094	(1.240)	0.248	(2.234)	0.167	(1.253)	0.204	(1.279)
GEORGES BANK								
Northern edge	0.137	(0.405)	0.354	(1.878)	0.083	(0.484)	0.557	(4.585)
Shelf edge	0.485	(1.897)	0.139	(0.723)	1.078	(4.910)	2.605	(19.715)
Shoals	0.013	(0.128)	0.006	(0.082)	0.061	(0.367)	0.061	(0.343)
Central bank	0.325	(1.327)	0.088	(0.519)	0.341	(1.984)	5.476	(66.823)
Total	0.238	(1.150)	0.089	(0.669)	0.384	(2.548)	2.544	(40.625)
S. NEW ENGLAND								
Inner shelf	0.032	(0.420)	0.002	(0.029)	0.002	(0.042)	---	
Mid shelf	0.243	(1.049)	0.146	(0.891)	0.125	(1.052)	0.316	(2.321)
Outer shelf	0.179	(0.521)	0.274	(1.917)	0.161	(1.211)	0.057	(0.503)
Total	0.153	(0.824)	0.138	(1.186)	0.082	(0.851)	0.153	(1.566)
MID-ATLANTIC								
Inner shelf	0.097	(0.728)	0.056	(0.510)	0.043	(0.341)	0.004	(0.059)
Mid shelf	0.790	(3.607)	0.254	(2.225)	0.068	(0.553)	0.079	(0.504)
Outer shelf	0.063	(0.326)	5.679	(41.193)	0.546	(1.626)	0.093	(0.620)
Total	0.300	(2.071)	1.076	(17.133)	0.090	(0.619)	0.048	(0.411)
SLOPE	---		1.181	(4.415)	0.670	(3.350)	0.106	(0.525)

Table 17. Seasonal estimates of all Dolphin and Harbor Porpoise densities, animals/km^2 ($\bar{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central Gulf	0.0052 (0.0793)	0.0604 (0.4291)	0.2584 (2.4926)	0.2337 (1.7080)
South	0.5237 (3.9063)	0.3957 (1.8942)	0.2775 (1.6430)	0.3005 (1.2398)
Southwest	0.2060 (1.6395)	0.6688 (4.8304)	0.1599 (0.9774)	0.3174 (1.9083)
Total	0.1248 (1.6395)	0.3278 (1.6954)	0.2266 (1.3478)	0.2674 (1.6895)
GEORGES BANK				
Northern edge	0.1817 (0.5364)	0.3387 (1.6790)	0.1107 (0.6399)	0.7363 (6.0586)
Shelf edge	0.6424 (2.5071)	0.1891 (0.9621)	1.4168 (6.4904)	3.4442(26.0519)
Shoals	0.0173 (0.1699)	0.0082 (0.1084)	0.0806 (0.4855)	0.0813 (0.4551)
Central bank	0.4296 (1.7538)	0.1165 (0.6870)	0.4486 (2.6211)	7.2466(88.3028)
Total	0.3146 (1.5203)	0.1098 (0.3891)	0.5053 (3.3669)	4.8090(31.5541)
S. NEW ENGLAND				
Inner shelf	0.0432 (0.5554)	0.0045 (0.0607)	0.0034 (0.0567)	---
Mid shelf	0.3219 (1.3873)	0.1935 (1.1784)	0.1543 (1.3765)	0.4187 (3.0681)
Outer shelf	0.2378 (0.6887)	0.3629 (2.5331)	0.2135 (1.6010)	0.0753 (0.6647)
Total	0.2022 (1.0895)	0.1824 (1.5683)	0.1029 (1.1160)	0.2027 (2.0695)
MID-ATLANTIC				
Inner shelf	0.1288 (0.9628)	0.0806 (0.6950)	0.0576 (0.4512)	0.0053 (0.0780)
Mid shelf	1.0444 (4.7669)	0.3381 (2.9408)	0.0902 (0.7316)	0.1057 (0.6660)
Outer shelf	0.0840 (0.4314)	7.5043(54.4336)	0.7223 (2.1486)	0.1235 (0.8194)
Total	0.3967 (2.7370)	1.4267 (9.3566)	0.1192 (0.8191)	0.0638 (0.5442)
SLOPE	---	1.5617 (5.8340)	0.8863 (4.4278)	0.1403 (0.6945)

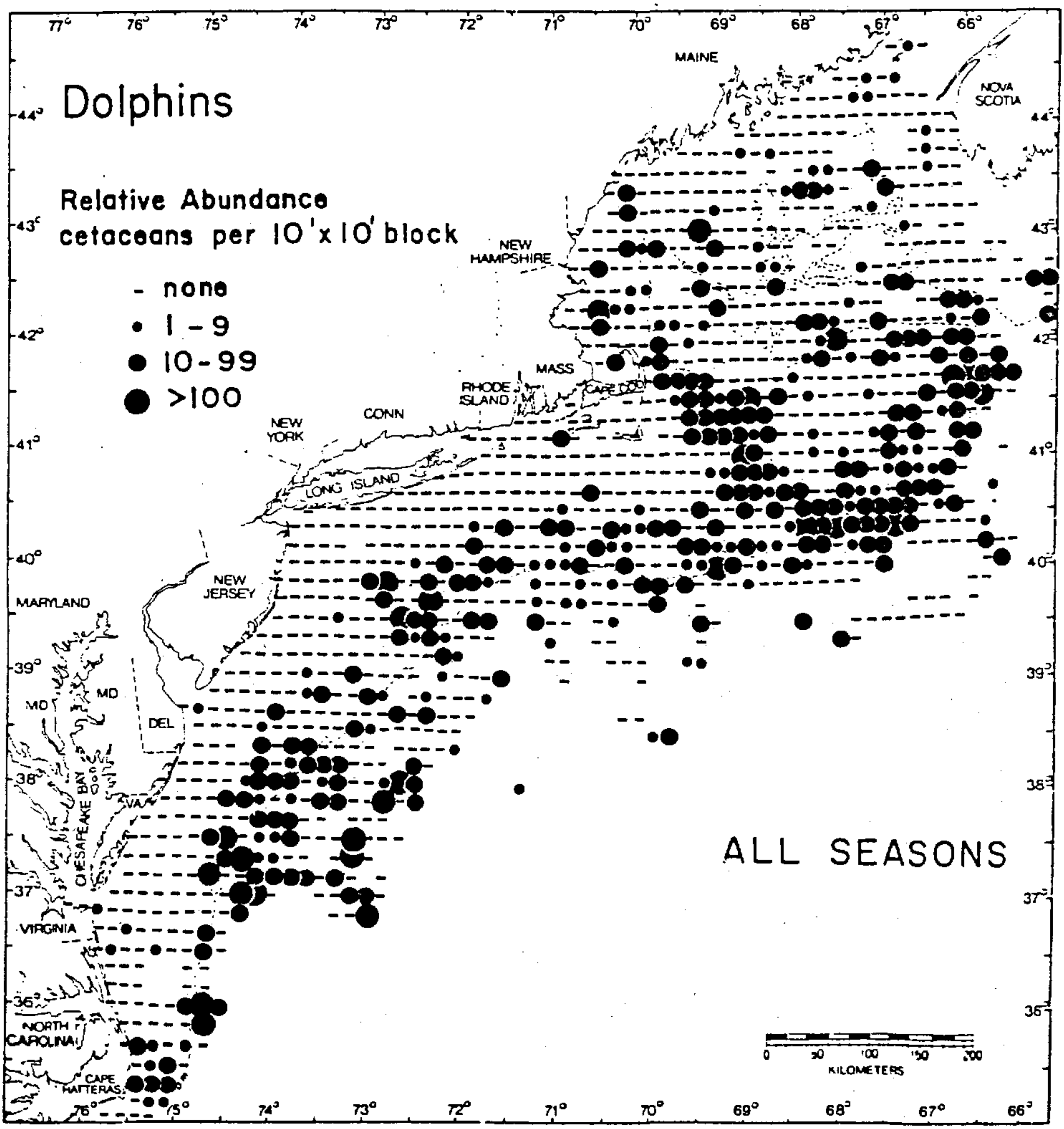

Figure 14. Relative distribution and abundance of all dolphins (Delphinidae) and Harbor Porpoise in all seasons.

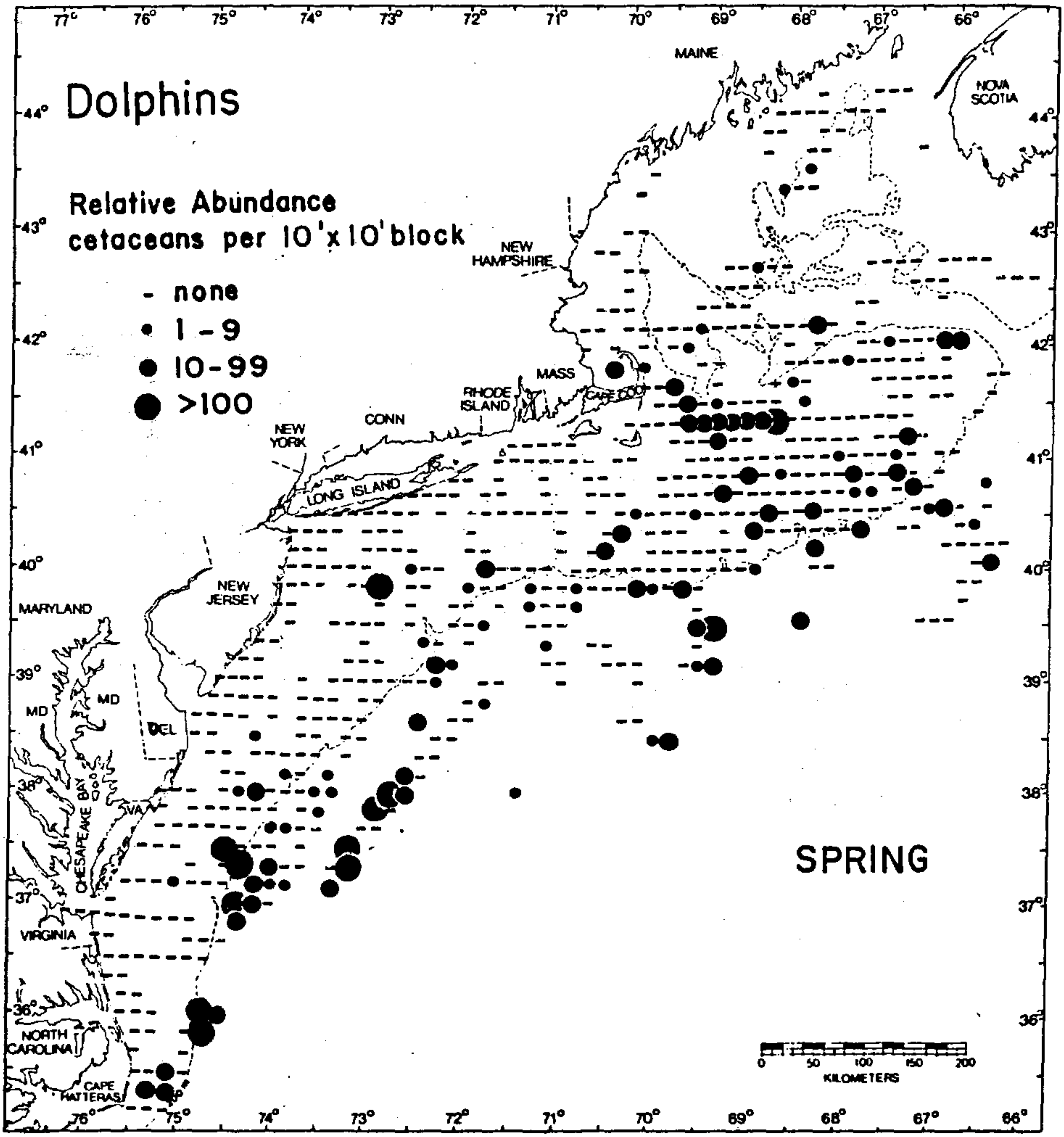

Figure 15. Relative distribution and abundance of all dolphins (Delphinidae) and Harbor Porpoise in spring.

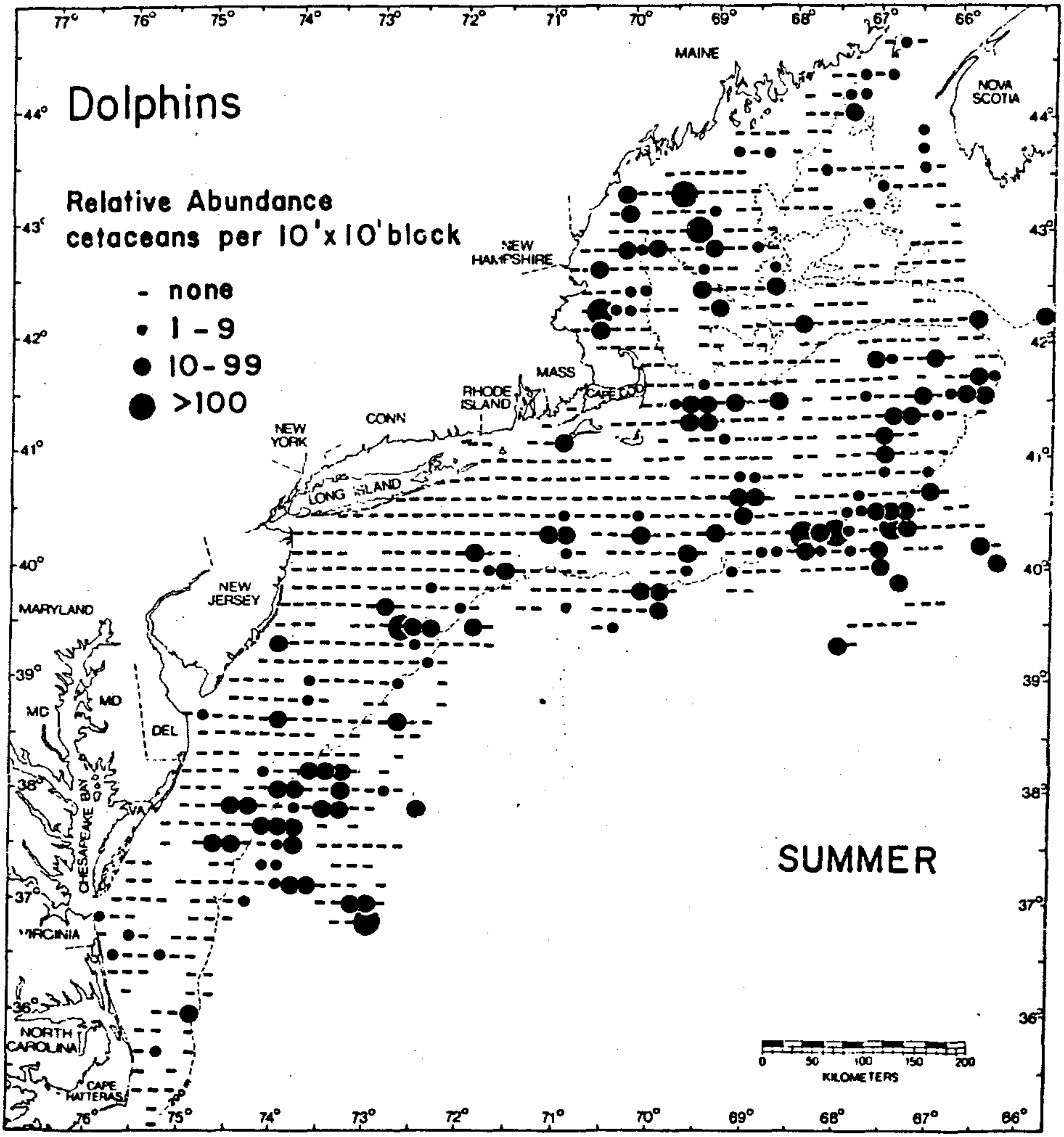

Figure 16. Relative distribution and abundance of all dolphins (Delphinidae) and Harbor Porpoise in summer.

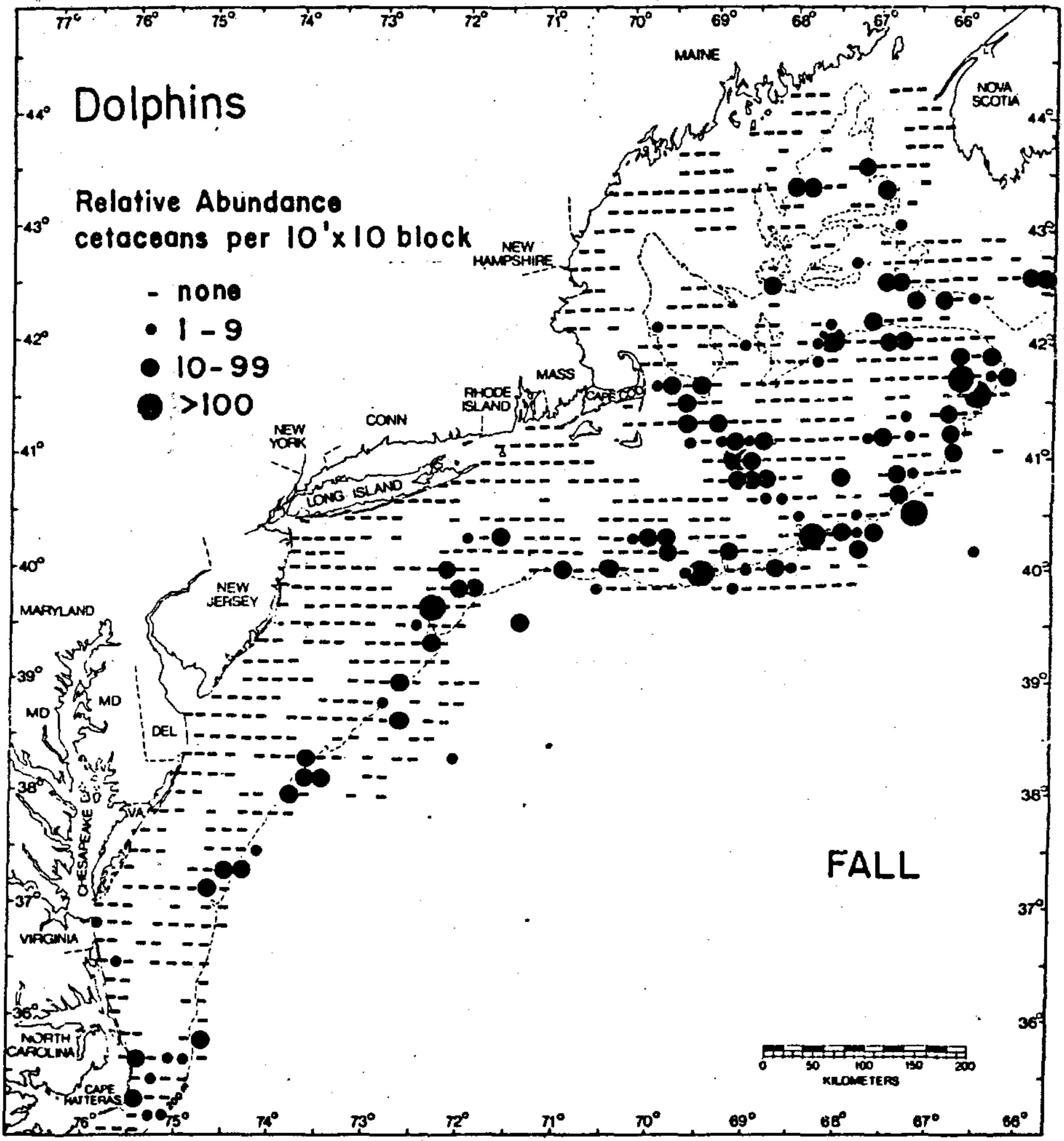

Figure 17. Relative distribution and abundance of all dolphins (Delphinidae) and Harbor Porpoise in fall.

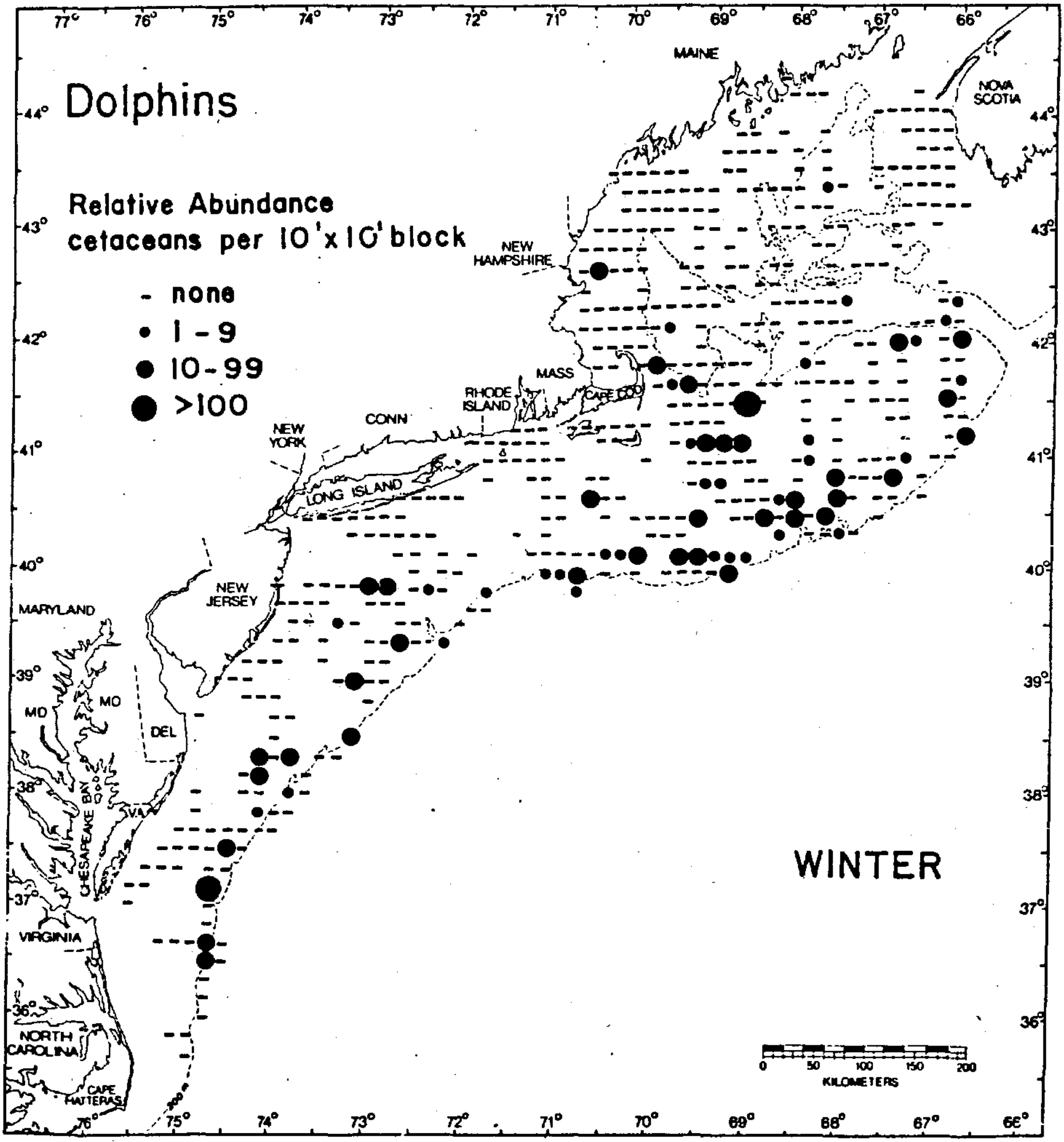

Figure 18. Relative distribution and abundance of all dolphins (Delphinidae) and Harbor Porpoise in winter.

Table 18. Seasonal estimates of Balaenopteridae and Sperm Whale abundance, animals/linear km ($\bar{x} \pm$ SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter		Spring		Summer		Fall	
GULF OF MAINE								
Central gulf	<0.001	(0.010)	0.002	(0.022)	0.016	(0.109)	0.015	(0.087)
South	0.002	(0.022)	0.040	(0.176)	0.087	(0.290)	0.024	(0.092)
Southwest	0.024	(0.108)	0.073	(0.252)	0.137	(0.393)	0.152	(0.607)
Total	0.006	(0.055)	0.033	(0.169)	0.068	(0.273)	0.052	(0.324)
GEORGES BANK								
Northern edge	0.011	(0.056)	0.017	(0.113)	0.014	(0.077)	0.066	(0.042)
Shelf edge	---		0.042	(0.134)	0.014	(0.080)	0.095	(0.230)
Shoals	---		0.001	(0.016)	0.002	(0.018)	0.002	(0.033)
Central bank	0.002	(0.027)	0.005	(0.065)	0.006	(0.051)	0.027	(0.168)
Total	0.002	(0.025)	0.010	(0.075)	0.007	(0.054)	0.029	(0.148)
S. NEW ENGLAND								
Inner shelf	0.012	(0.083)	0.001	(0.018)	0.021	(0.129)	0.004	(0.031)
Mid shelf	0.006	(0.098)	0.013	(0.097)	0.013	(0.094)	0.004	(0.034)
Outer shelf	---		0.056	(0.166)	0.025	(0.124)	0.007	(0.043)
Total	0.008	(0.089)	0.022	(0.111)	0.017	(0.112)	0.005	(0.038)
MID-ATLANTIC								
Inner shelf	0.001	(0.019)	0.005	(0.045)	0.014	(0.145)	<0.001	(0.013)
Mid shelf	0.005	(0.035)	0.007	(0.041)	0.022	(0.150)	0.016	(0.119)
Outer shelf	0.025	(0.108)	0.025	(0.091)	---		0.002	(0.023)
Total	0.007	(0.054)	0.209	(0.055)	0.015	(0.041)	0.005	(0.069)
SLOPE	---		0.028	(0.133)	0.026	(0.148)	---	

Table 19. Seasonal estimates of all Balaenopteridae and Sperm Whale densities, animals/km^2 ($\bar{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central Gulf	0.0015 (0.0254)	0.0012 (0.0129)	0.0147 (0.0925)	0.0104 (0.0555)
South	0.0011 (0.0125)	0.0227 (0.1003)	0.0571 (0.1964)	0.0136 (0.0523)
Southwest	0.0141 (0.0612)	0.0468 (0.1557)	0.0823 (0.2297)	0.0894 (0.3482)
Total	0.0042 (0.0361)	0.0205 (0.1021)	0.0441 (0.1702)	0.0316 (0.1866)
GEORGES BANK				
Northern edge	0.0066 (0.0319)	0.0102 (0.0645)	0.0165 (0.0826)	0.0038 (0.0240)
Shelf edge	---	0.0243 (0.0764)	0.0189 (0.1508)	0.0614 (0.1593)
Shoals	---	0.0007 (0.0093)	0.0037 (0.0422)	0.0014 (0.0190)
Central bank	0.0015 (0.0157)	0.0033 (0.0370)	0.0137 (0.1083)	0.0154 (0.0956)
Total	0.0013 (0.0144)	0.0059 (0.0428)	0.0122 (0.1035)	0.0186 (0.0938)
S. NEW ENGLAND				
Inner shelf	0.0070 (0.0476)	0.0007 (0.0102)	0.0143 (0.0868)	0.0023 (0.0181)
Mid shelf	0.0038 (0.0561)	0.0129 (0.0764)	0.0078 (0.0534)	0.0027 (0.0226)
Outer shelf	---	0.0350 (0.1055)	0.0147 (0.0703)	0.0066 (0.0459)
Total	0.0049 (0.0509)	0.0157 (0.0757)	0.0121 (0.0702)	0.0035 (0.0290)
MID-ATLANTIC				
Inner shelf	0.0038 (0.0433)	0.0028 (0.0257)	0.0080 (0.0828)	0.0005 (0.0076)
Mid shelf	0.0083 (0.0627)	0.0042 (0.0237)	0.0129 (0.0855)	0.0093 (0.0678)
Outer shelf	0.0142 (0.0613)	0.0146 (0.0520)	---	0.0051 (0.0531)
Total	0.0073 (0.0538)	0.0053 (0.0315)	0.0088 (0.0803)	0.0043 (0.0462)
SLOPE	---	0.0160 (0.0757)	0.0151 (0.0842)	---

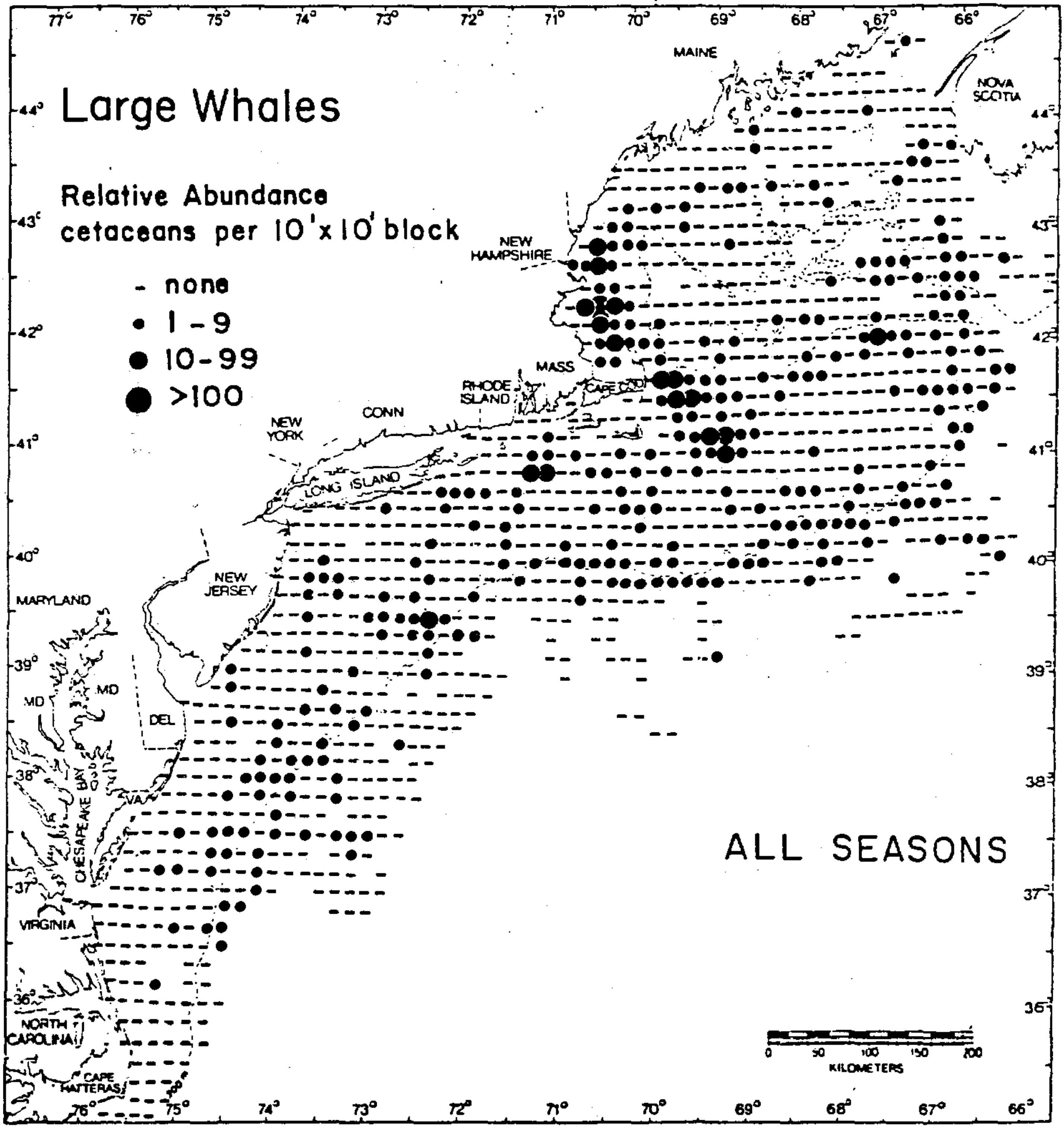

Figure 19. Relative distribution and abundance of all large whales (Balaenopteridae and Sperm Whale) for all seasons.

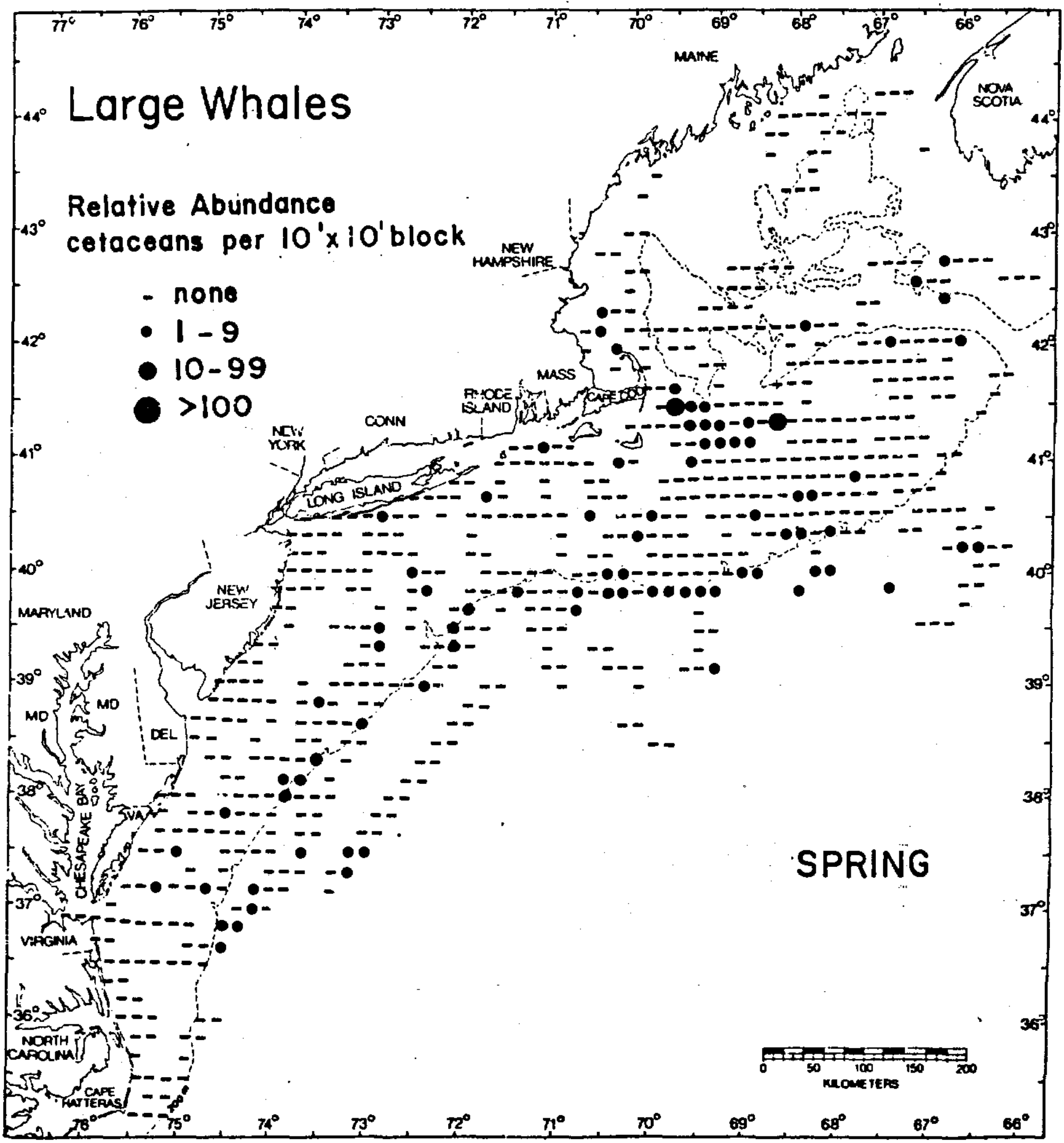

Figure 20. Relative distribution and abundance of all large whales (Balaenopteridae and Sperm Whale) in spring.

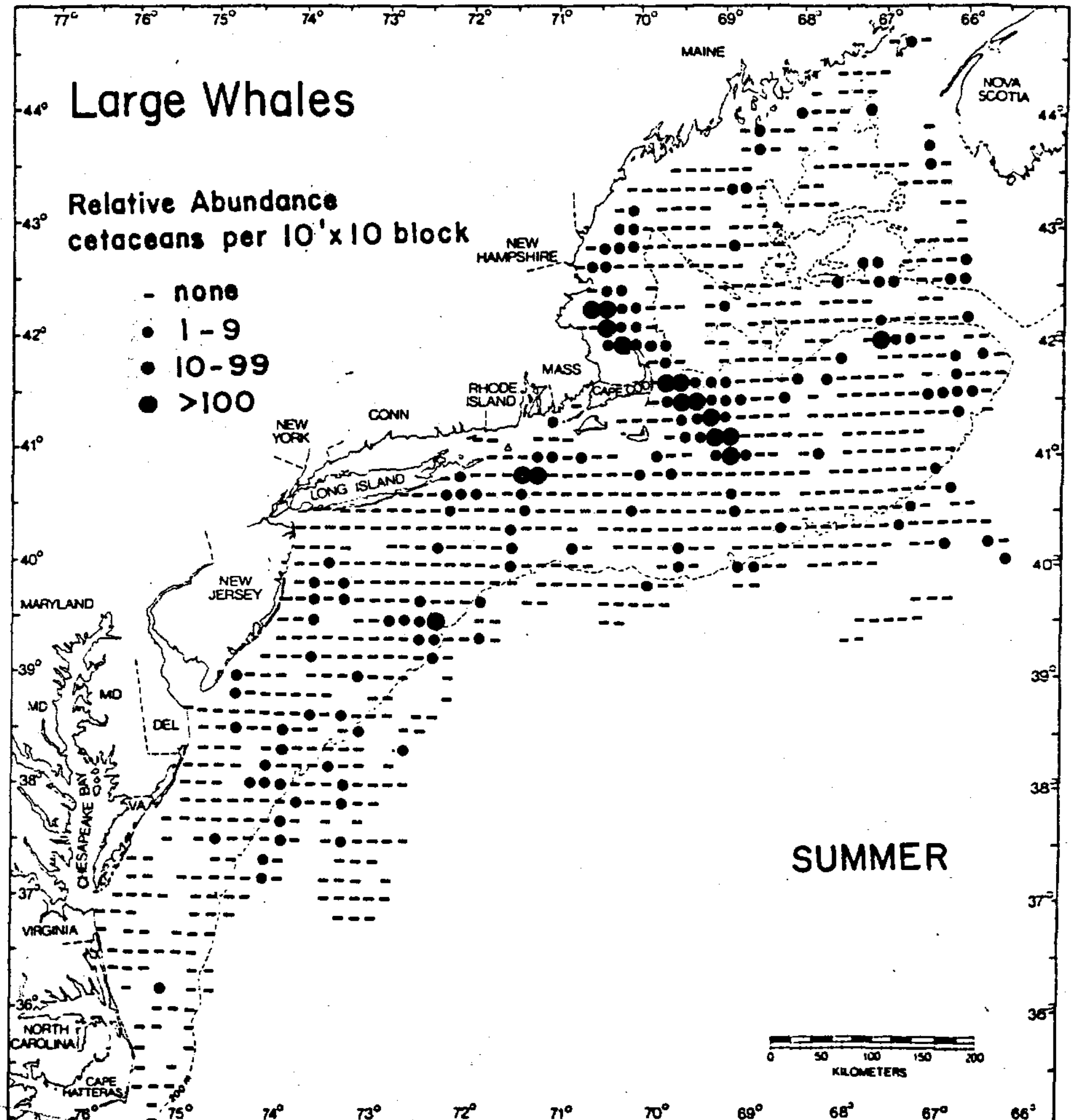

Figure 21. Relative distribution and abundance of all large whales (Balaenopteridae and Sperm Whale) in summer.

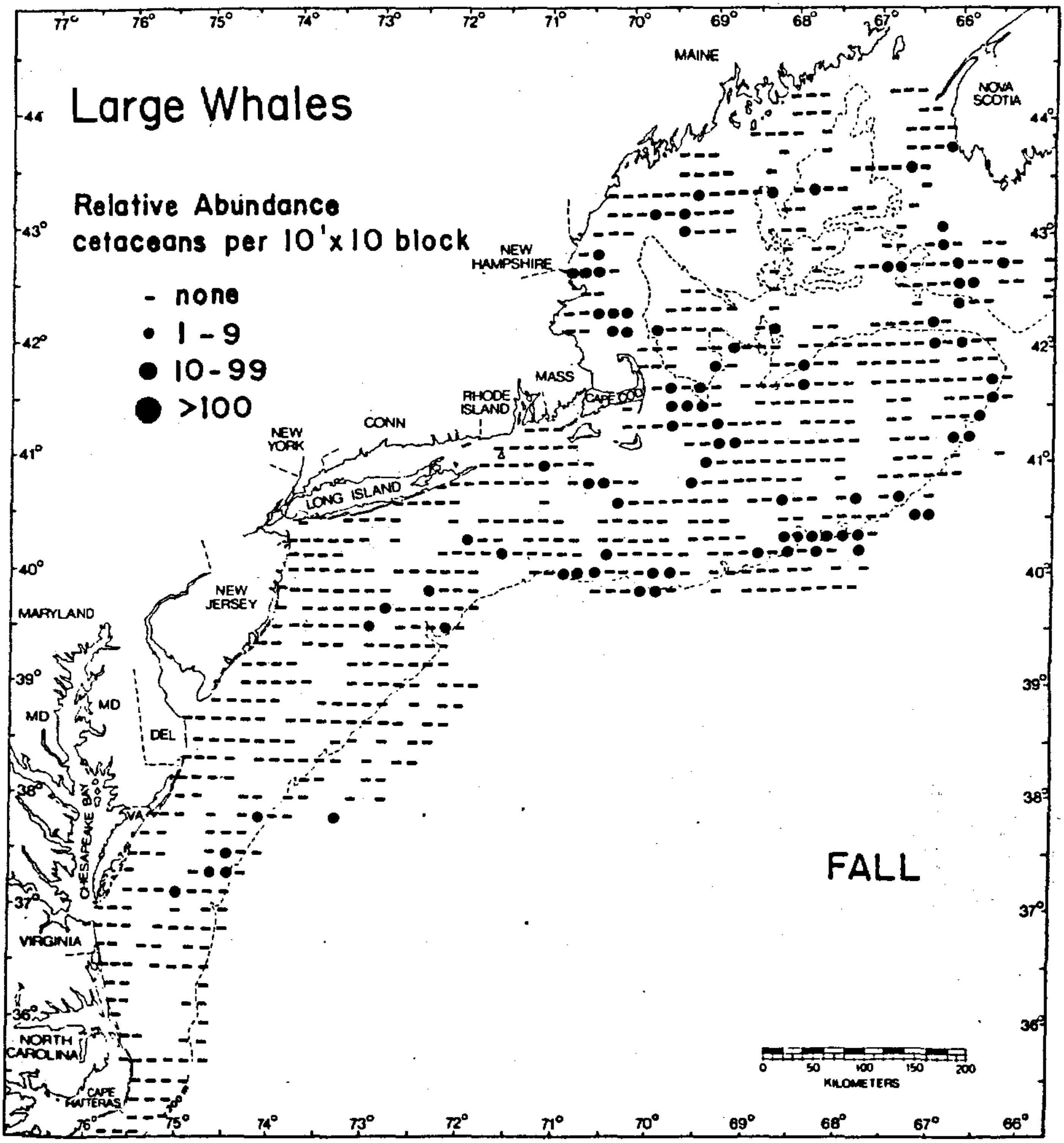

Figure 22. Relative distribution and abundance of all large whales (Balaenopteridae and Sperm Whale) in fall.

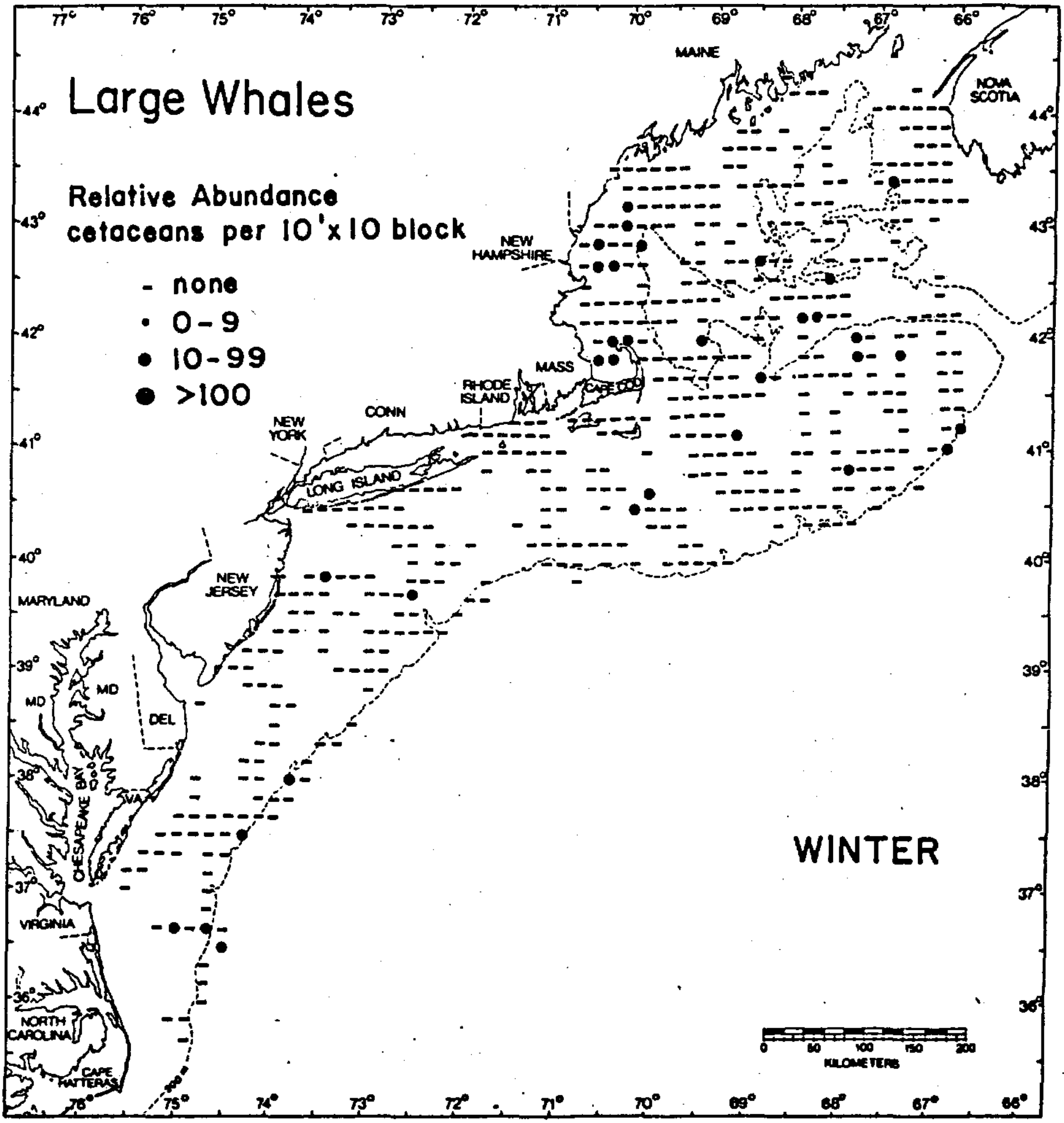

Figure 23. Relative distribution and abundance of all large whales (Balaenopteridae and Sperm Whale) in winter.

deeper, slope waters (range 1325.0-1463.5 m, N=45, Table 20). The mean range of all dolphin sightings (excluding white-sided dolphins) is between 250.27 and 1989.00 m (Table 20), again indicating a general preference for shelf edge to slope waters. The mean temperatures at sightings (Table 21) are not so reflective of the spatial distribution of cetaceans.

Table 20. Mean depth m (±SD) at sighting for cetaceans commonly seen in the study area. Date are arranged by season. N = the number of sightings.

Species	Winter	Spring	Summer	Fall
Dolphins				
Bottlenosed	183.50 (34.30) N=4	637.44(1085.25) N=16	495.80 (622.86) N=44	141.50(134.87) N=32
Spotted	---	718.33(1188.46) N=15	571.58(1181.67) N=12	74.47(144.43) N=15
Striped	---	1650.00 (369.68) N=4	1989.00(1105.33) N=6	2195.00 (---) N=1
Saddleback	91.41 (48.62) N=104	1157.72(1078.90) N=94	250.27 (695.10) N=53	103.73 (44.56) N=66
White-sided	137.47 (63.05) N=17	143.60 (99.13) N=55	117.32 (57.34) N=60	217.12(104.34) N=26
Grampus	---	1167.85 (912.66) N=13	436.07 (603.03) N=15	655.62(787.70) N=13
Pilot Whale	90.00 (58.74) N=14	558.05 (730.18) N=21	365.07 (601.53) N=42	137.79(212.10) N=78
Harbor Porpoise	---	134.71 (88.59) N=7	104.15 (38.52) N=20	103.00 (4.24) N=2
Whales				
Sperm	259.50(335.73) N=8	1463.48 (891.62) N=25	1325.05(1006.31) N=21	309.11(607.75) N=9
Minke	71.40 (59.61) N=5	131.13 (151.88) N=16	91.13 (93.68) N=39	74.00 (55.59) N=6
Fin	125.82 (47.20) N=17	139.77 (136.90) N=82	95.84 (80.22) N=259	123.13 (59.61) N=95
Humpback	55.87 (24.66) N=15	147.42 (181.45) N=24	95.06 (134.92) N=53	66.67 (57.30) N=21
Right	---	94.00 (39.30) N=9	171.50 (20.51) N=2	---
All Turtles	---	347.00 (896.25) N=8	152.59 (324.07) N=37	81.34 (70.97) N=15

Table 21. Mean temperature ^{o}C ($\underline{+}$SD) at sighting for cetaceans commonly seen in the study area. Date are arranged by season. N = the number of sightings.

Species	Winter	Spring	Summer	Fall
Dolphins				
Bottlenosed	10.33 (2.85) N=4	11.90 (5.69) N=16	13.55(10.11) N=44	18.36 (9.01) N=32
Spotted	---	17.31 (1.86) N=15	10.73(11.29) N=12	22.32 (9.27) N=15
Striped	---	4.48 (5.27) N=4	17.95 (3.01) N=6	22.60 (---) N=1
Saddleback	5.71 (4.91) N=104	6.66 (5.78) N=94	11.00 (7.34) N=53	13.03 (2.90) N=66
White-sided	4.39 (4.82) N=17	4.48 (3.72) N=55	10.46 (8.41) N=60	10.57 (3.86) N=26
Grampus	---	4.66 (5.51) N=13	8.86(11.33) N=15	18.84 (6.10) N=13
Pilot Whale	2.89 (4.90) N=14	6.26 (4.27) N=21	10.33 (8.57) N=42	13.18 (5.02) N=78
Harbor Porpoise	---	2.56 (4.82) N=7	---	17.50 (2.12) N=2
Whales				
Sperm	11.21 (5.44) N=8	5.03 (6.10) N=25	10.45(10.50) N=21	13.93 (4.37) N=9
Minke	4.96 (6.79) N=5	5.77 (3.59) N=16	8.02 (8.63) N=39	15.62 (8.50) N=6
Fin	4.35 (2.85) N=17	7.22 (3.20) N=82	12.87 (6.34) N=259	14.12 (4.78) N=95
Humpback	5.59 (4.45) N=15	5.35 (4.60) N=24	13.38 (7.91) N=53	8.15 (6.65) N=21
Right	---	3.84 (3.68) N=9	14.85 (6.29) N=2	---
All Turtles	---	14.79 (6.04) N=8	7.75 (5.98) N=37	20.92 (2.17) N=15

Species Accounts

The following species accounts involve only sightings identified to species or appropriate species group. They include tables of seasonal and regional/subregional sighting frequencies, densities and plots of seasonal relative abundance.

Bottlenosed Dolphin (Tursiops truncatus)

T. truncatus is a secondary or tertiary carnivore which opportunistically feeds on a wide variety of species including fish, squid and invertebrates (Godin 1977; Leatherwood 1975; Leatherwood et al. 1976). They may feed on squid and crustaceans (Katona et al. 1977) or scavenge behind shrimp boats, feeding off fish stirred up by the trawls or on discarded fish (Leatherwood 1975; Leatherwood et al. 1976). They have also been seen to cooperatively feed on schools of fish (Hoese 1971).

Tursiops is distributed worldwide in warm and temperate waters (Katona et al. 1977). The bottlenosed dolphin is common along the east coast of the United States from Nova Scotia to Florida, westward into the Gulf of Mexico and south to Venezuela (Hain et al. 1981; Katona et al. 1977; Leatherwood et al. 1976; Fritts and Reynolds 1981, Marcuzzi and Pilleri 1971; Powers et al. 1982; Powers and Payne 1983; Sergeant et al. 1970).

Between Cape Hatteras and Nova Scotia, Tursiops has a distinct J-shaped distribution consisting of an elongate offshore portion along the shelf-edge within the study area, and an abbreviated inshore portion between Cape Hatteras and approximately Delaware Bay (Hain et al. 1981; CeTAP 1982). Two forms of Tursiops are recognized. A smaller, inshore form is found in coastal waters of the MAB south of Delaware Bay (Hain et al. 1981). The larger form occurs offshore along the shelf edge from Cape Hatteras to at least northeastern Georges Bank (35°00'n to 42°00'N), (Rowlett 1980; Hain et al. 1981; CeTAP 1982; Powers et al. 1982; Powers and Payne 1983). Tursiops' occurrence in the outer shelf waters between GB and the MAB is year around (CeTAP 1982; Powers and Payne 1983). The shelf edge-slope water population of Tursiops remains similar in distributional range and abundance levels from May to October (Hain et al. 1981; Powers et al. 1981; CeTAP 1982; Powers and Payne 1983). The nearshore component of the Tursiops population, generally limited to the MAB, also has a relatively constant distribution and abundance during spring and summer, but is reduced southward in fall, and in winter is absent from the study area (CeTAP 1982).

Sightings of Tursiops within the GOM occur but appear extralimital. This species is generally considered absent from the GOM.

Sightings from our data base occurred principally from spring through fall, in the SNE and MA regions (Figs. 24-28). The midshelf to shelf-break distribution of the offshore form is apparent within our data base. The J-shaped distribution of the inshore form (as discussed by CeTAP 1982) is not so apparent. Bottlenosed dolphin sightings in the GOM occur in late summer to fall, but are considered extralimital. Densities were greatest along the shelf edge between GB and the MA region (Tables 22-23), summer and fall.

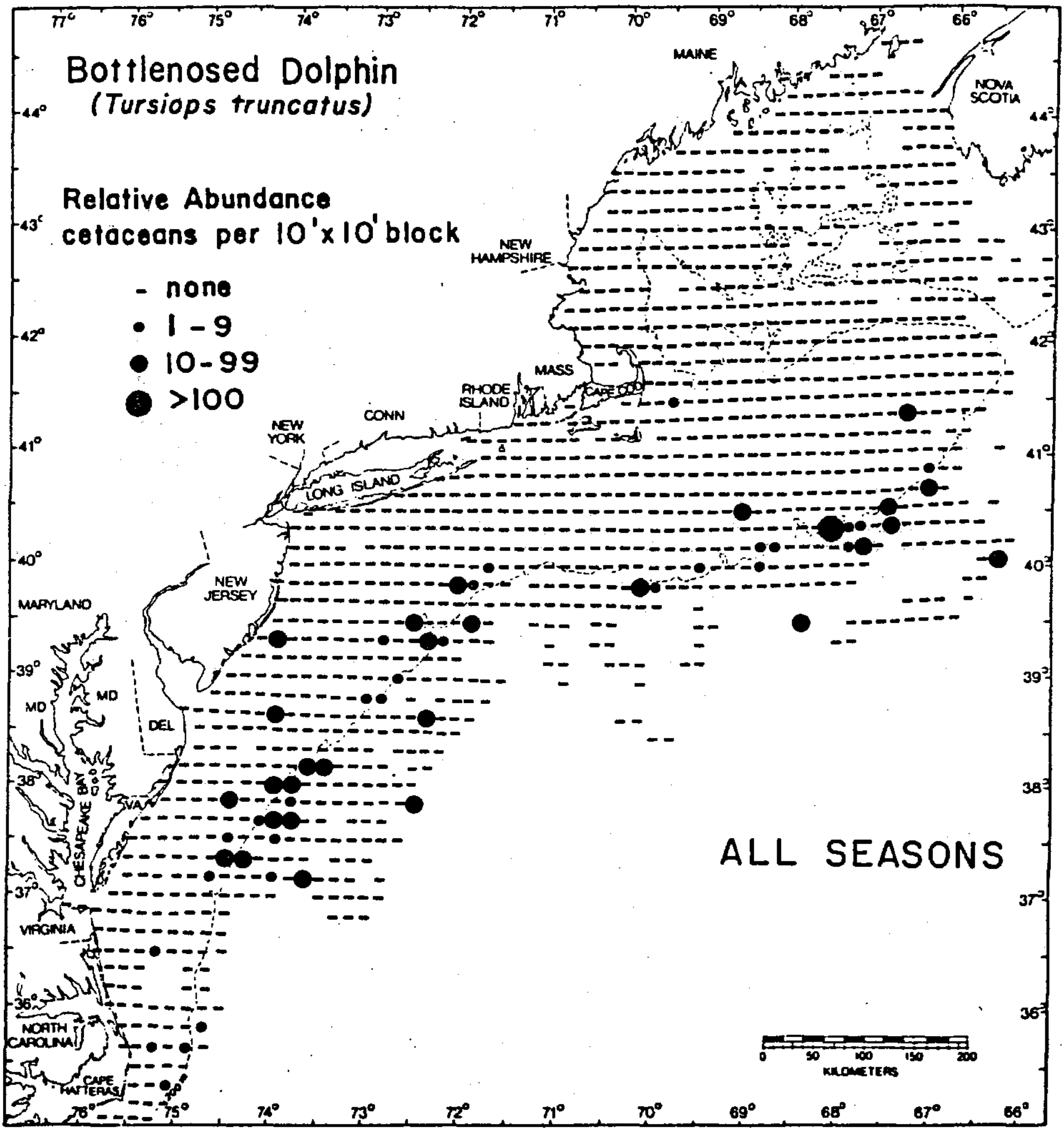

Figure 24. Relative distribution and abundance of Bottlenosed Dolphins for all seasons.

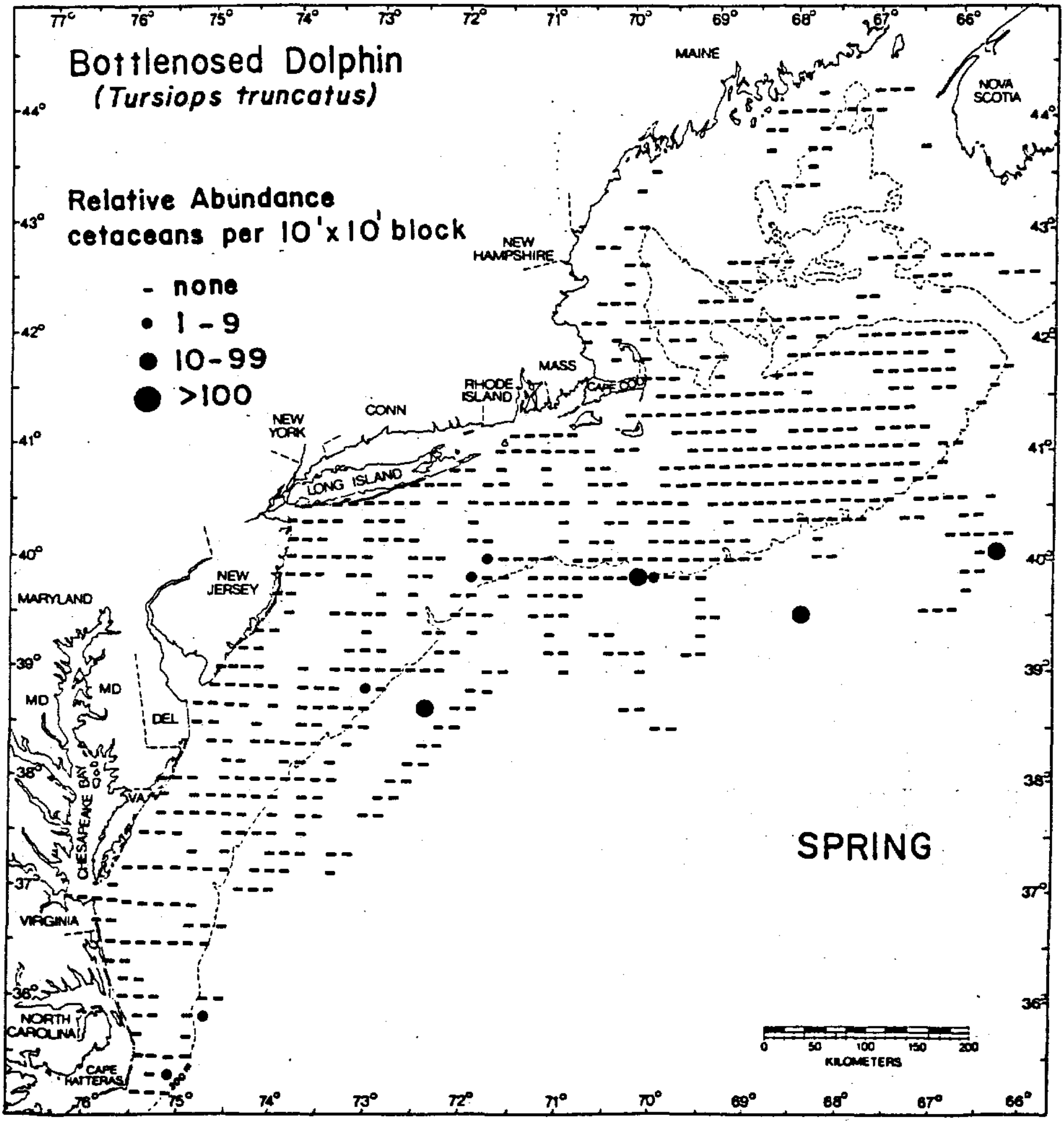

Figure 25. Relative distribution and abundance of Bottlenosed Dolphins in spring.

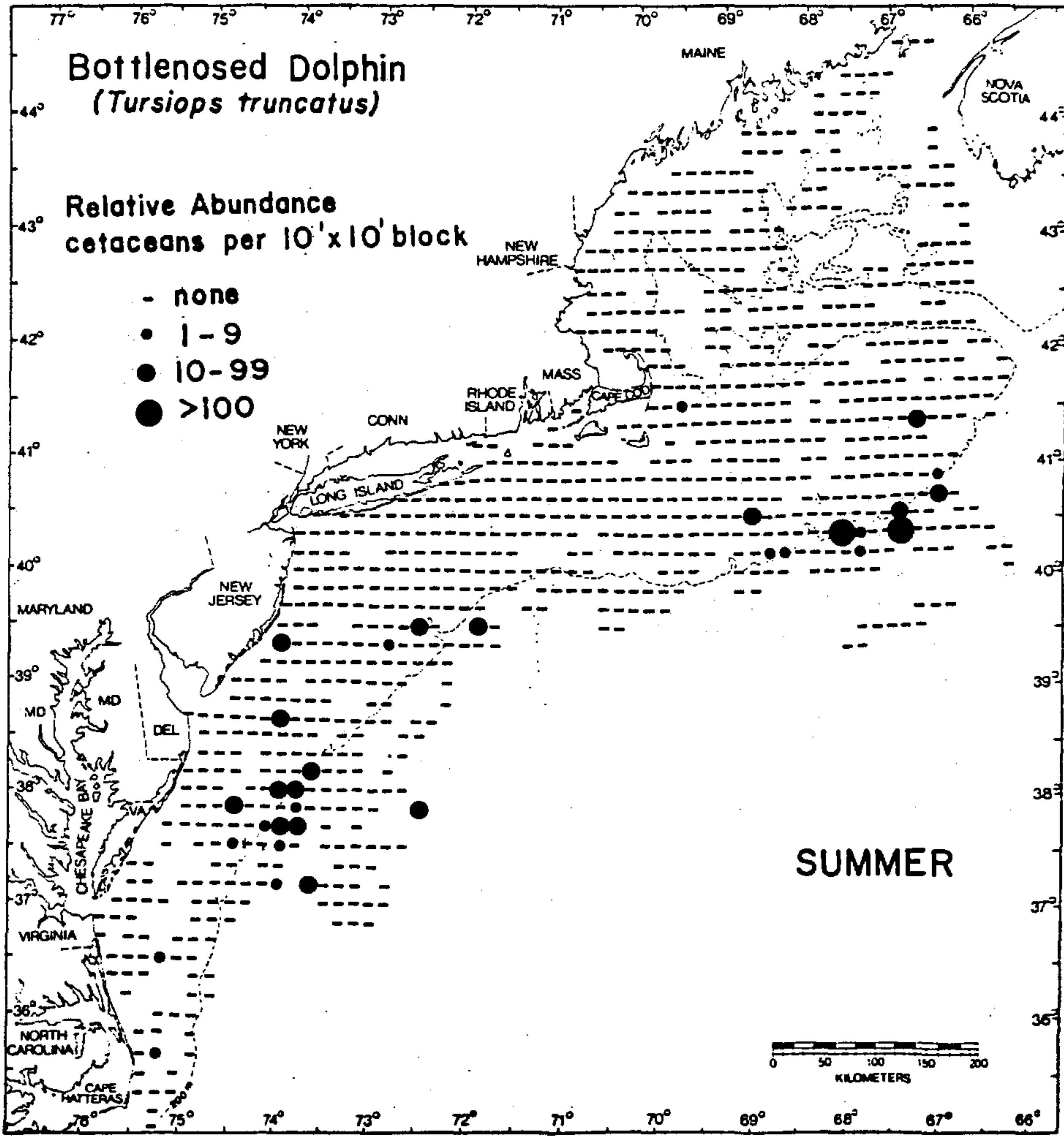

Figure 26. Relative distribution and abundance of Bottlenosed Dolphins in summer.

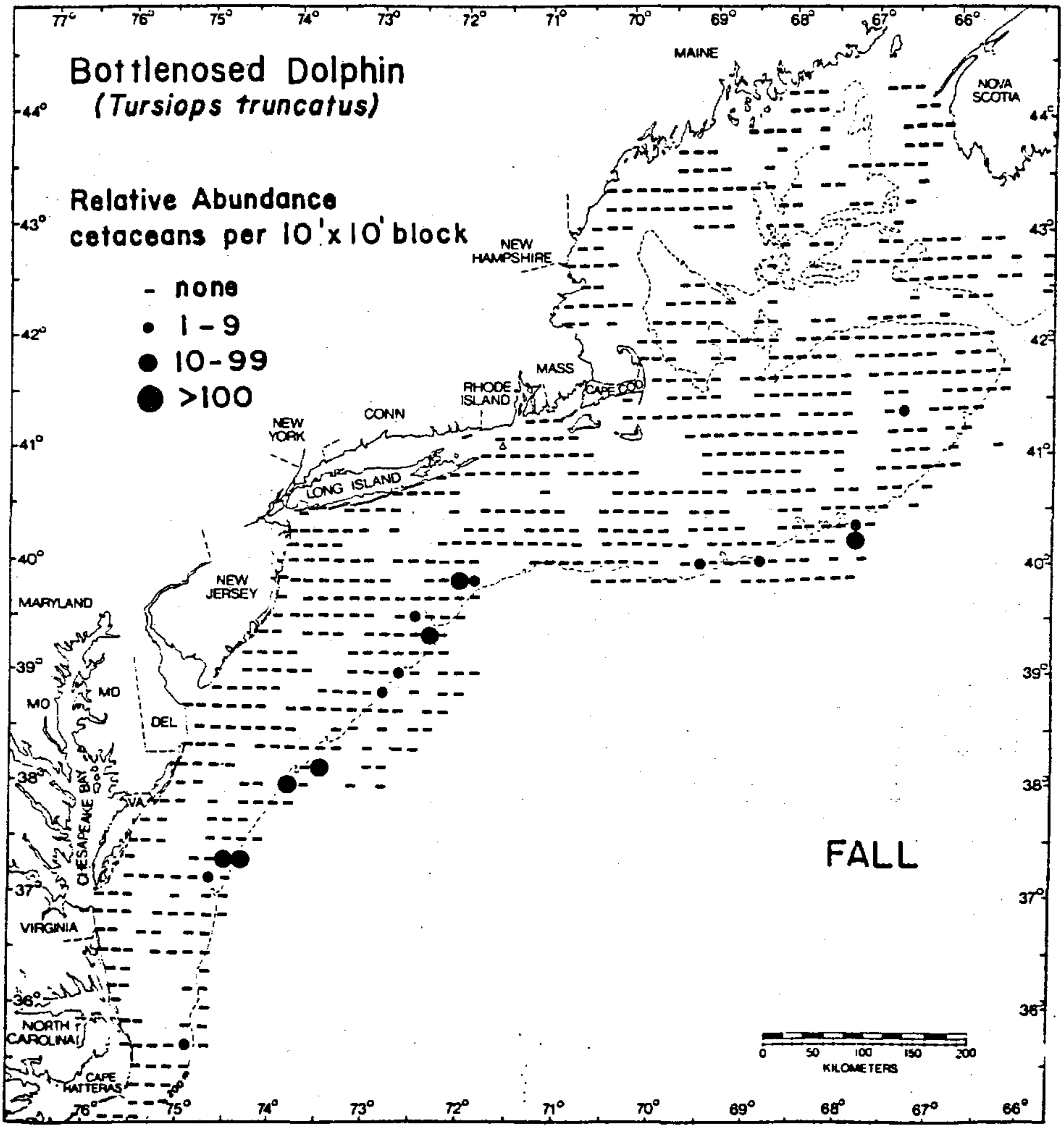

Figure 27. Relative distribution and abundance of Bottlenosed Dolphins in fall.

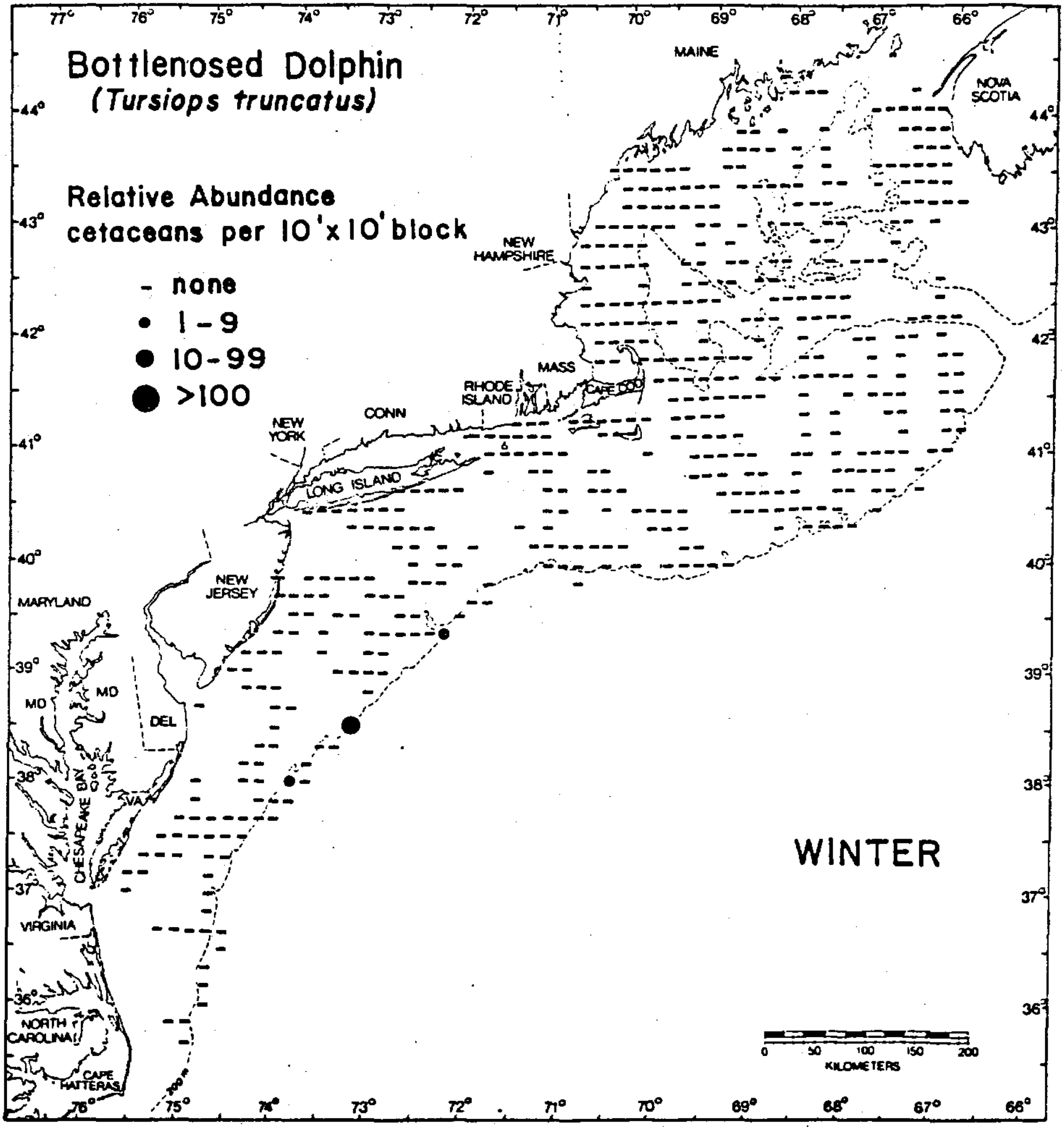

Figure 28. Relative distribution and abundance of Bottlenosed Dolphins in winter.

Table 22. Seasonal estimates of Bottlenosed Dolphin abundance, animals/linear km ($\bar{X}$+SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter		Spring		Summer		Fall	
GULF OF MAINE								
Central gulf	---		---		---		---	
South	---		---		---		---	
Southwest	---		---		---		---	
Total	---		---		---		---	
GEORGES BANK								
Northern edge	---		---		---		---	
Shelf edge	---		---		0.215	(1.225)	0.015	(0.139)
Shoals	---		---		---		---	
Central bank	---		---		0.015	(0.148)	0.004	(0.069)
Total	---		---		0.047	(0.542)	0.004	(0.074)
S. NEW ENGLAND								
Inner shelf	---		---		---		---	
Mid shelf	---		0.013	(0.156)	0.004	(0.094)	0.019	(0.277)
Outer shelf	---		0.002	(0.037)	0.090	(1.141)	---	
Total	---		0.006	(0.098)	0.012	(0.401)	0.008	(0.184)
MID-ATLANTIC								
Inner shelf	---		0.003	(0.047)	0.008	(0.169)	0.004	(0.059)
Mid shelf	---		0.022	(0.284)	0.018	(0.177)	0.057	(0.429)
Outer shelf	0.063	(0.326)	0.007	(0.067)	0.268	(1.143)	0.026	(0.188)
Total	0.013	(0.149)	0.009	(0.161)	0.027	(0.346)	0.026	(0.262)
SLOPE	---		0.050	(0.385)	0.214	(1.762)	0.038	(0.371)

Table 23. Seasonal estimates of Bottle-nosed Dolphin densities, animals/km^2 ($\overline{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central Gulf	---	---	---	---
South	---	---	---	---
Southwest	---	---	---	---
Total	---	---	---	---
GEORGES BANK				
Northern edge	---	---	---	---
Shelf edge	---	---	0.2849 (1.6187)	0.0200 (0.1840)
Shoals	---	---	---	---
Central bank	---	---	0.0202 (0.1966)	0.0066 (0.0915)
Total	---	---	0.0625 (0.7170)	0.0063 (0.0985)
S. NEW ENGLAND				
Inner shelf	---	---	---	---
Mid shelf	---	0.0180 (0.2068)	0.0053 (0.1249)	0.0255 (0.3670)
Outer shelf	---	0.0038 (0.0493)	0.1196 (1.5089)	---
Total	---	0.0080 (0.1307)	0.0170 (0.5305)	0.0112 (0.2436)
MID-ATLANTIC				
Inner shelf	---	0.0052 (0.0628)	0.0114 (0.2240)	0.0053 (0.0780)
Mid shelf	---	0.0297 (0.3760)	0.0248 (0.2344)	0.0761 (0.5675)
Outer shelf	0.0840 (0.4314)	0.0093 (0.0892)	0.3550 (1.5108)	0.0344 (0.2486)
Total	0.0173 (0.1977)	0.0132 (0.2131)	0.0422 (0.4819)	0.0344 (0.3464)
SLOPE	---	0.0669 (0.5090)	0.2838 (2.3288)	0.0506 (0.4906)

Spotted Dolphin (Stenella spp.)

Spotted dolphins are tertiary carnivores that feed primarily on fishes. In the Atlantic, spotted dolphins feed on herring, anchovies, carangids, and squid (Caldwell and Caldwell 1966); whereas in the Pacific they feed on epipelagic and mesopelagic fishes, e.g. flying fishes (Fitch and Brownell 1968; Perrin et al. 1973).

Spotted dolphin (Stenella spp.) taxonomy is not clear but S. attenuata/frontinalis and S. plagiodon occur in the western North Atlantic (Katona et al. 1977; Hain et al. 1981; Schmidly 1981; CeTAP 1982). S. plagiodon is found in warm and temperate waters throughout the western Atlantic, Gulf of Mexico, and Caribbean and considered to be the more northern of the species (Gunter 1954; Fritts and Reynolds 1981). The distribution of S. plagiodon overlaps with another spotted dolphin species, and then is replaced by S. attenuata/frontinalis in the Caribbean (Katona et al. 1977; CeTAP 1982; thus we refer to all spotted dolphins as Stenella spp.

Spotted dolphins are broadly distributed on the shelf, along the shelf edge, and offshore (> 1000 m) south of 40°00'N, with evidence of a seasonal shift in the distribution pattern especially in winter when no spotted dolphins have been sighted in our study area (CeTAP 1982). Spotted dolphins regularly occur in the inshore waters of the MAB south of Chesapeake Bay; otherwise their distribution is generally near the shelf edge and in slope waters (Hain et al. 1981; CeTAP 1982; Powers and Payne 1983). In the Chesapeake Bight, Rowlett (1980) reported Stenella sightings during summer and early fall. The majority of sightings occur from April to October along the shelf-break and south of 38°00'N (Rowlett 1980; Hain et al. 1981; Powers et al. 1982). Sightings occur to the slope waters of GB (41°00'N) during this period, suggesting the northernmost extension of their range within our study area.

Within our data base, most spotted dolphin are seen within the MA spring through fall, south of 38°00'N latitude (Figs. 29-32; Tables 24-25). Spotted dolphins are also seen in slope waters south and east of GB in summer to fall (Figs. 31-32). There have been no winter sightings, or sightings on GB or in the GOM.

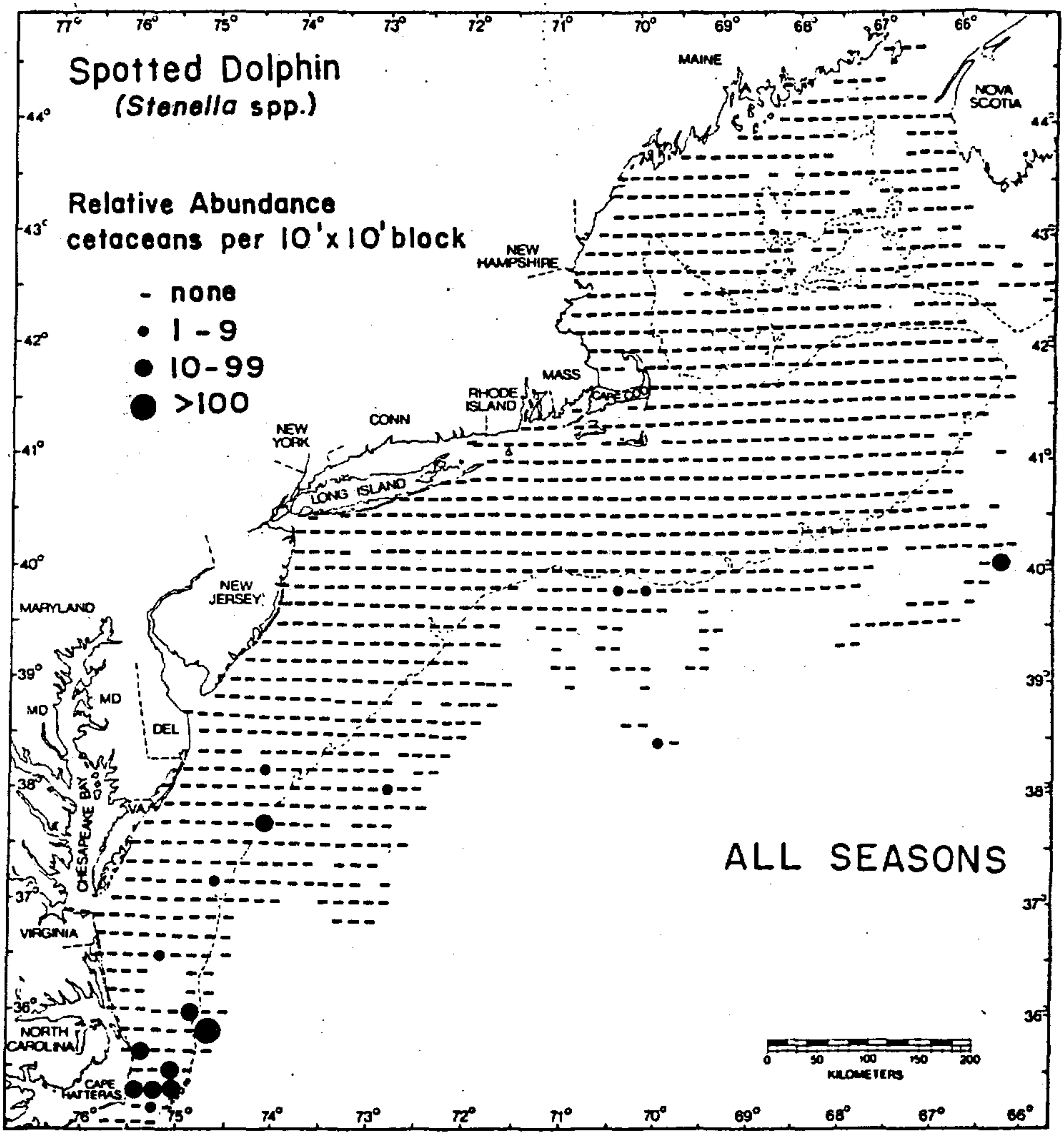

Figure 29. Relative distribution and abundance of Spotted Dolphins (Stenella spp.) for all seasons.

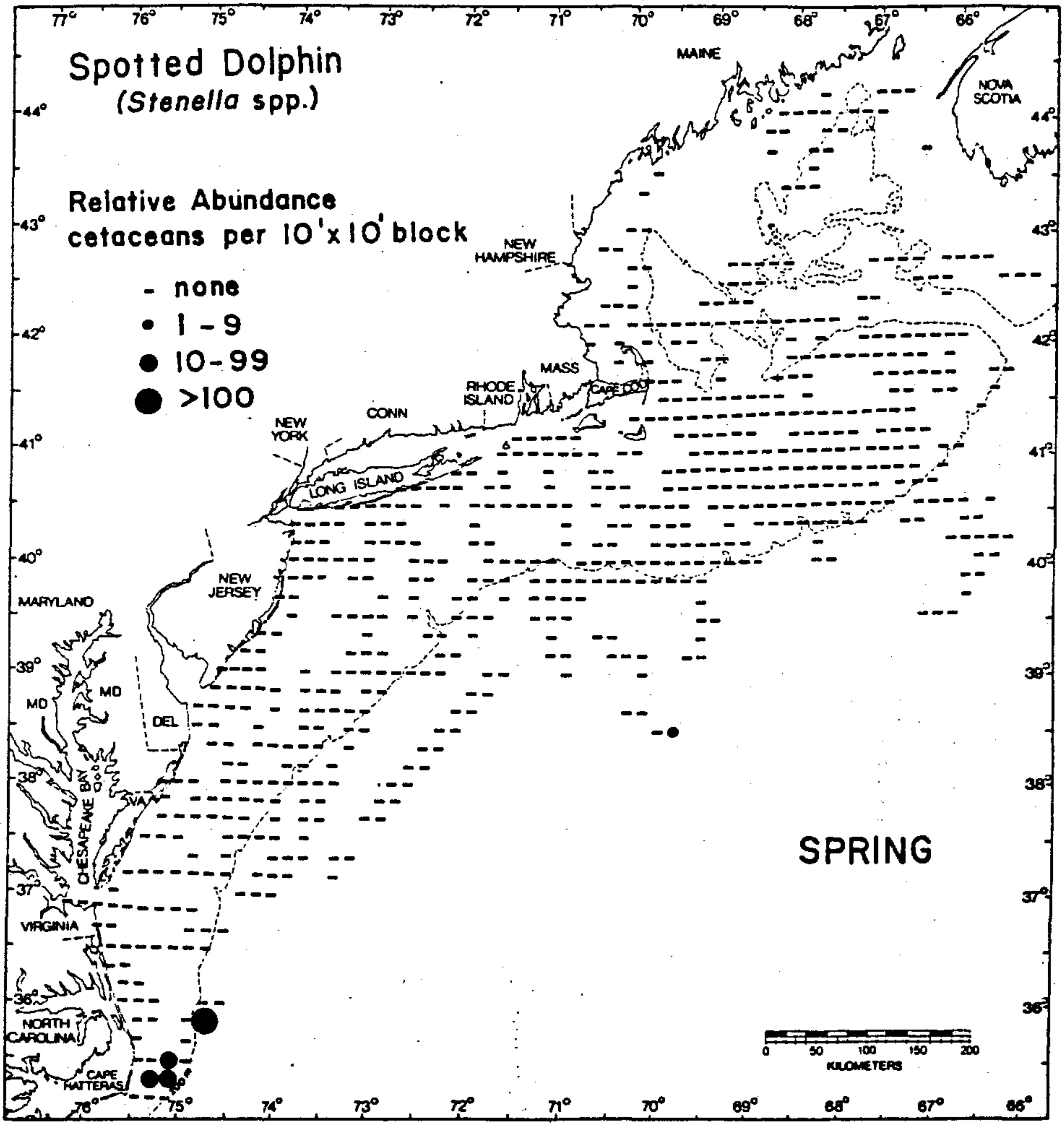

Figure 30. Relative distribution and abundance of Spotted Dolphins (Stenella spp.) in spring.

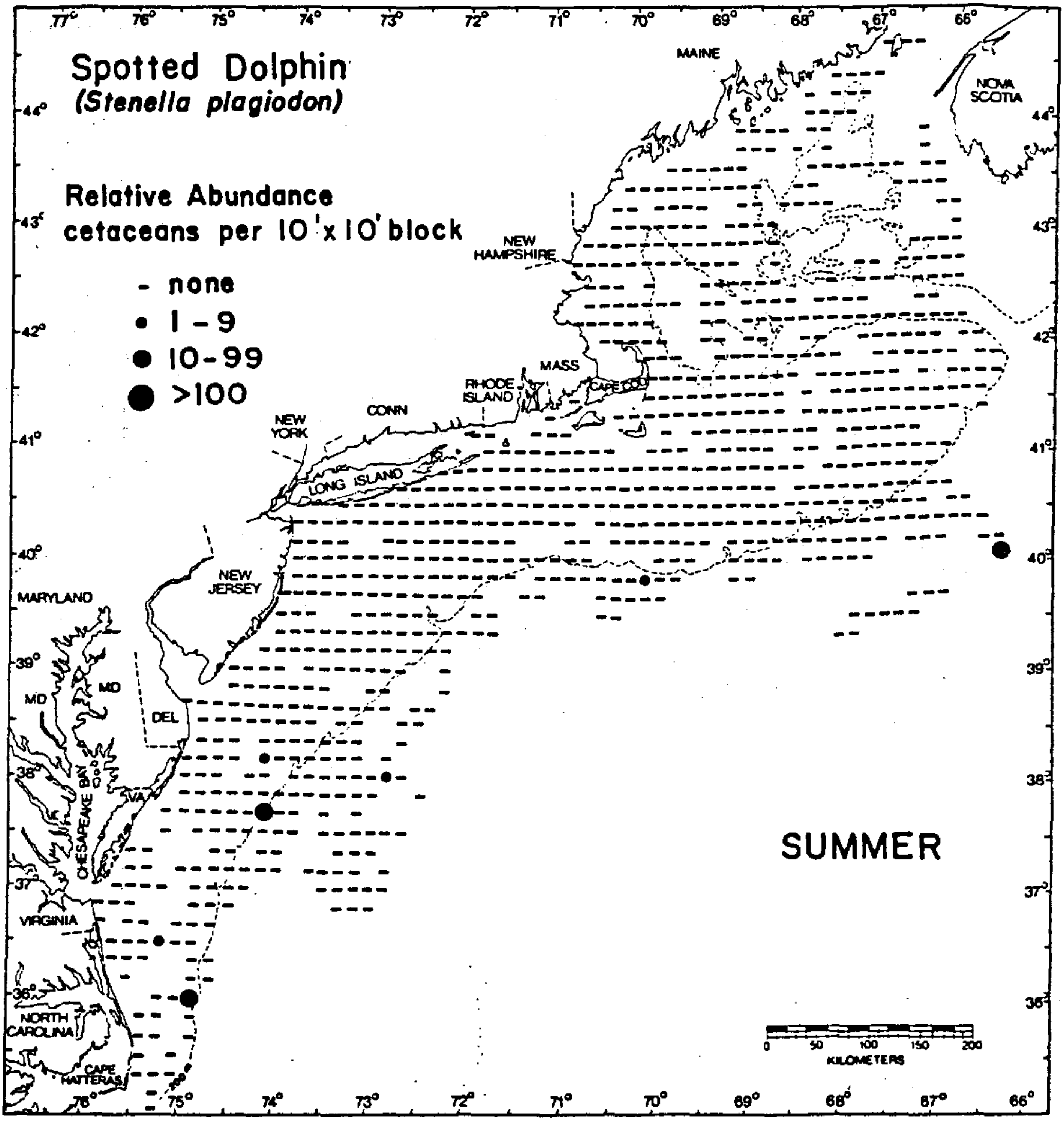

Figure 31. Relative distribution and abundance of Spotted Dolphins (Stenella spp.) in summer.

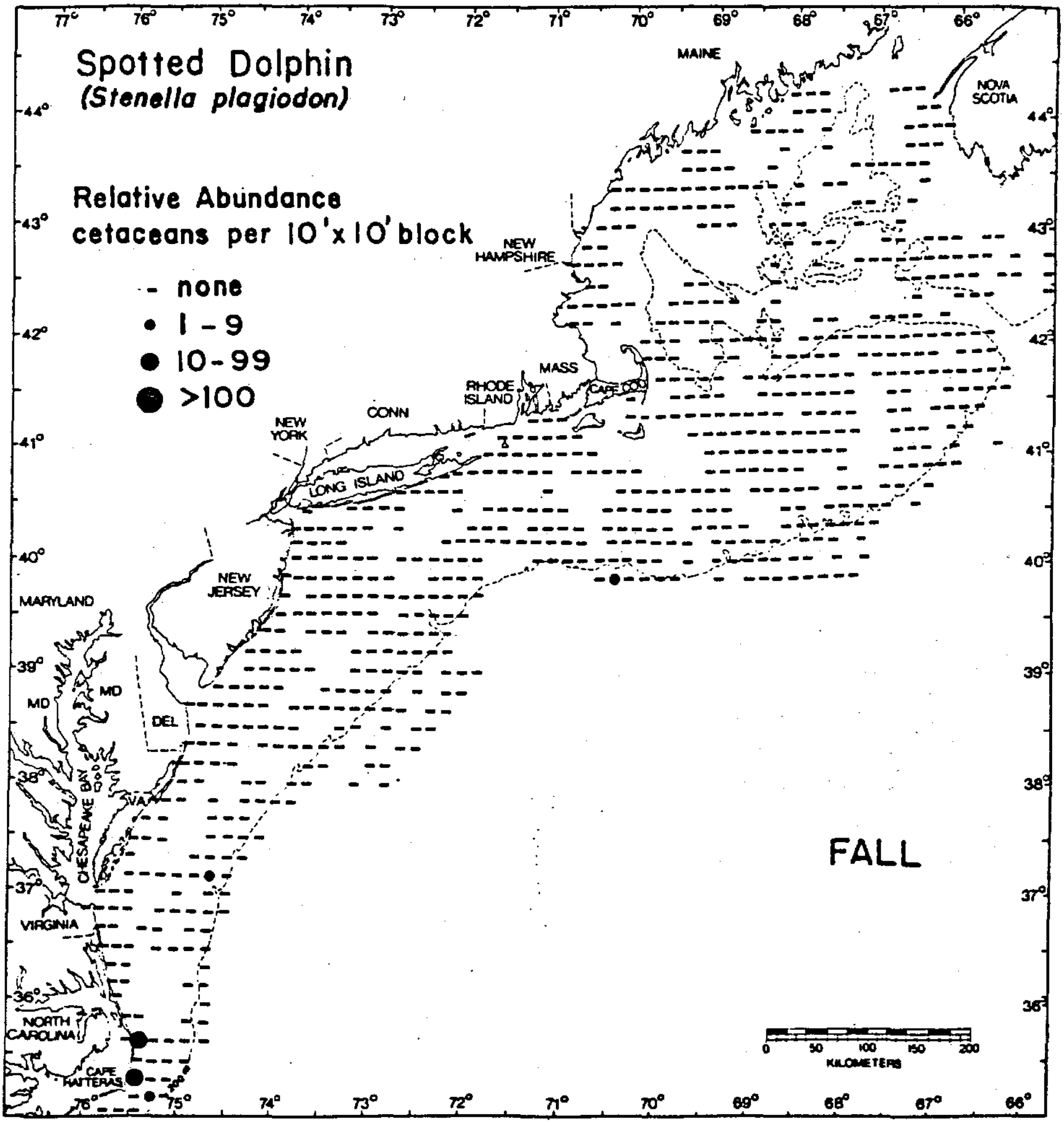

Figure 32. Relative distribution and abundance of Spotted Dolphins (Stenella spp.) in fall.

Table 24. Seasonal estimates of Spotted Dolphin abundance, animals/linear km ($\bar{X}\underline{+}SD$), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	---	---	---	---
South	---	---	---	---
Southwest	---	---	---	---
Total	---	---	---	---
GEORGES BANK				
Northern edge	---	---	---	---
Shelf edge	---	---	---	---
Shoals	---	---	---	---
Central bank	---	---	---	---
Total	---	---	---	---
S. NEW ENGLAND				
Inner shelf	---	---	---	---
Mid shelf	---	---	---	---
Outer shelf	---	---	0.009 (0.114)	0.008 (0.119)
Total	---	---	0.001 (0.039)	0.002 (0.058)
MID-ATLANTIC				
Inner shelf	---	0.007 (0.077)	0.023 (0.254)	---
Mid shelf	---	---	---	0.001 (0.019)
Outer shelf	---	0.293 (2.814)	0.073 (0.562)	---
Total	---	0.054 (1.165)	0.020 (0.255)	<0.001 (0.011)
SLOPE	---	0.009 (0.099)	0.031 (0.446)	---

Table 25. Seasonal estimates of Spotted Dolphin densities, animals/km^2 ($\bar{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central Gulf	---	---	---	---
South	---	---	---	---
Southwest	---	---	---	---
Total	---	---	---	---
GEORGES BANK				
Northern edge	---	---	---	---
Shelf edge	---	---	---	---
Shoals	---	---	---	---
Central bank	---	---	---	---
Total	---	---	---	---
S. NEW ENGLAND				
Inner shelf	---	---	---	---
Mid shelf	---	---	---	---
Outer shelf	---	---	0.0119 (0.1508)	0.0116 (0.1577)
Total	---	---	0.0014 (0.0523)	0.0028 (0.0779)
MID-ATLANTIC				
Inner shelf	---	0.0097 (0.1028)	0.0305 (0.3357)	---
Mid shelf	---	---	---	0.0021 (0.0258)
Outer shelf	---	0.3877 (3.7193)	0.0967 (0.7431)	---
Total	---	0.0714 (1.5396)	0.0269 (0.3382)	0.0006 (0.0146)
SLOPE	---	0.0120 (0.1313)	0.0422 (0.5900)	---

Striped Dolphin (Stenella coeruleoalba)

S. coeruleoalba feed mainly on small pelagic fishes, squid and shrimp (Nishiwaki 1975; Watson 1981).

Striped dolphins are known mainly from tropical and temperate waters of the Atlantic and Pacific, preferring offshore waters (rather than coastal or shelf waters), with seasonal movements poleward in spring-summer, and toward the equator in autumn-winter (Watson 1981). In our study area, S. coeruleoalba is distributed along the shelf-edge from Cape Hatteras to the southern margin of Georges Bank, and offshore, generally seaward of the 1000m isobath (Hain et al. 1981; CeTAP 1982; Powers and Payne 1983). CeTAP (1982) showed that in spring there is a concentration along the shelf-edge in the MAB and southeast of Nantucket along the southwest edge of Georges Bank. This area is occupied throughout the year (CeTAP 1982).

S. coeruleoalba were recorded infrequently from our shipboard observers. This is likely due to the limited effort seaward of the shelf-edge (> 1000 m) where Hain et al. (1981) and CeTAP (1982) found the greatest concentration and general center of their abundance.

Our sightings have occurred principally in slope waters of the mid-Atlantic, spring through fall (Figs. 33-36; Tables 26 and 27).

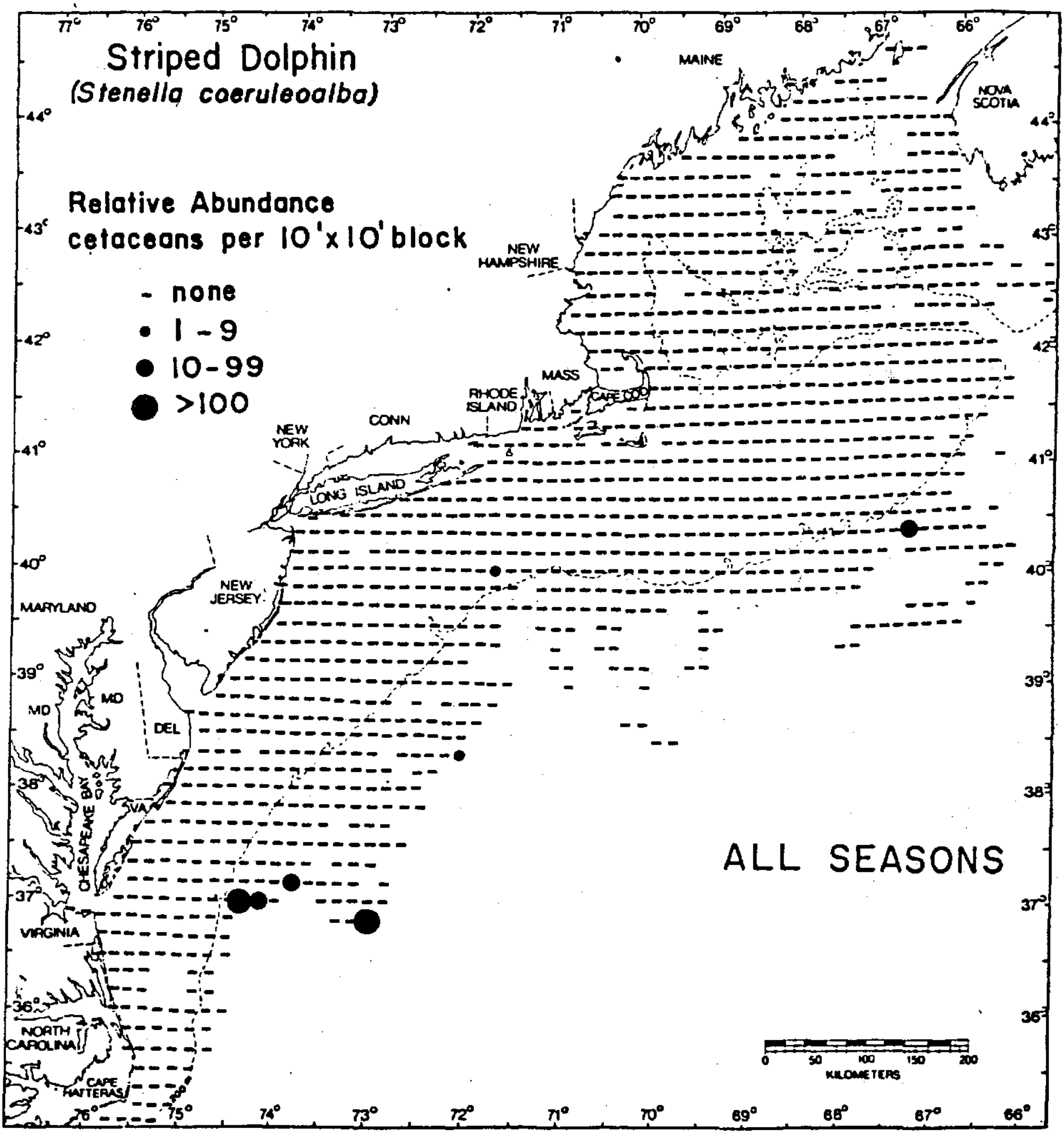

Figure 33. Relative distribution and abundance of Striped Dolphins for all seasons.

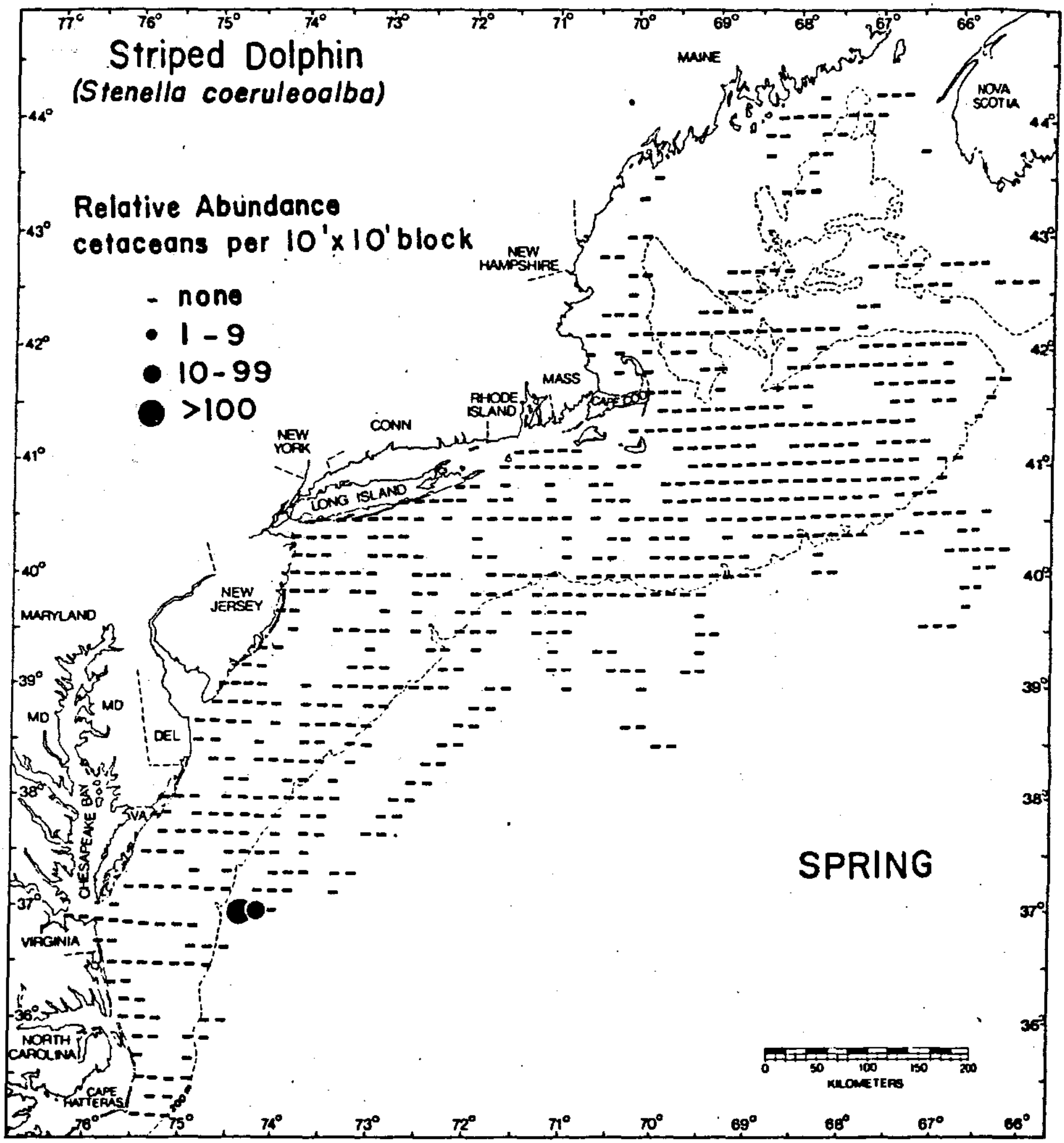

Figure 34. Relative distribution and abundance of Striped Dolphins in spring.

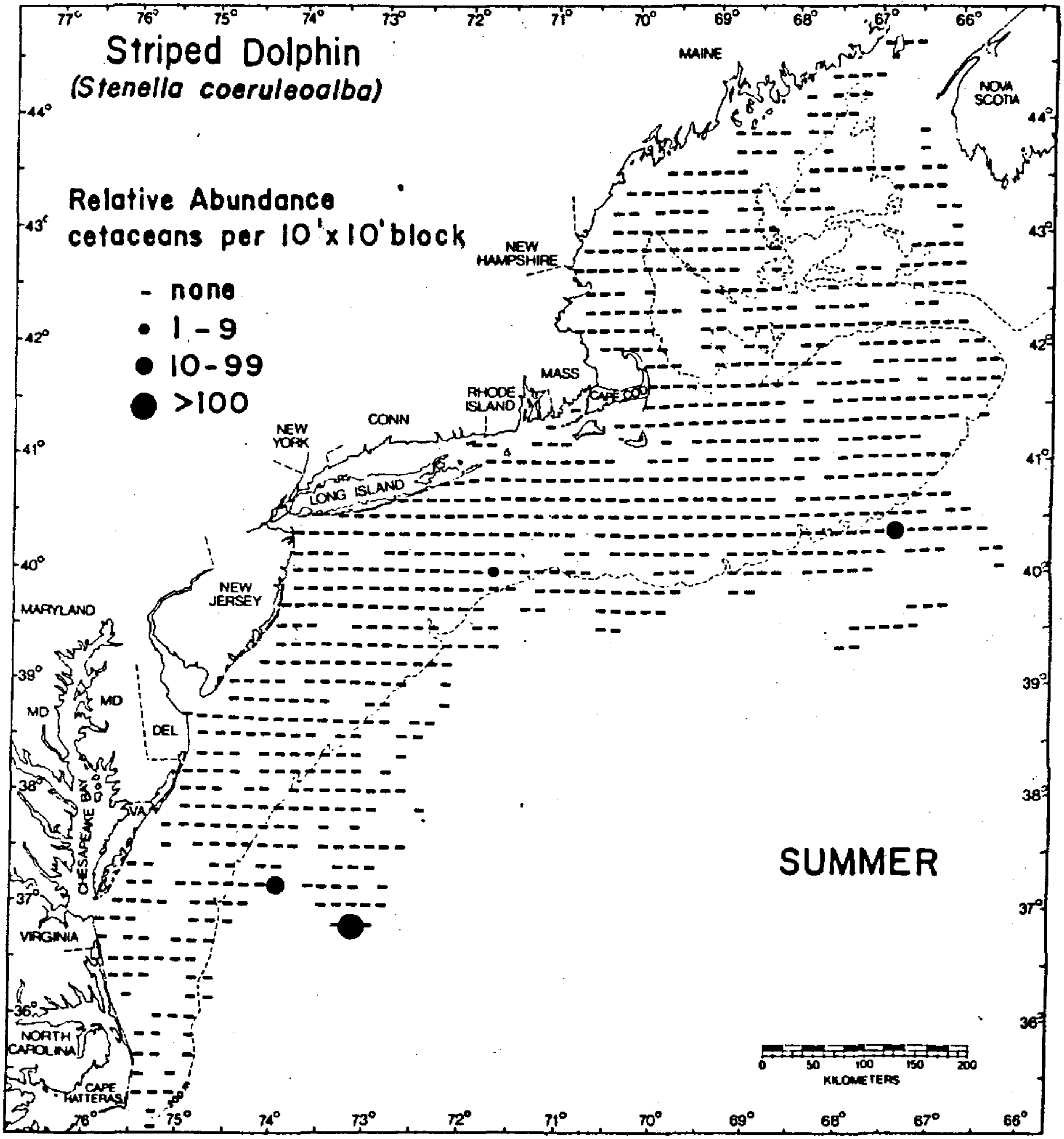

Figure 35. Relative distribution and abundance of Striped Dolphins in summer.

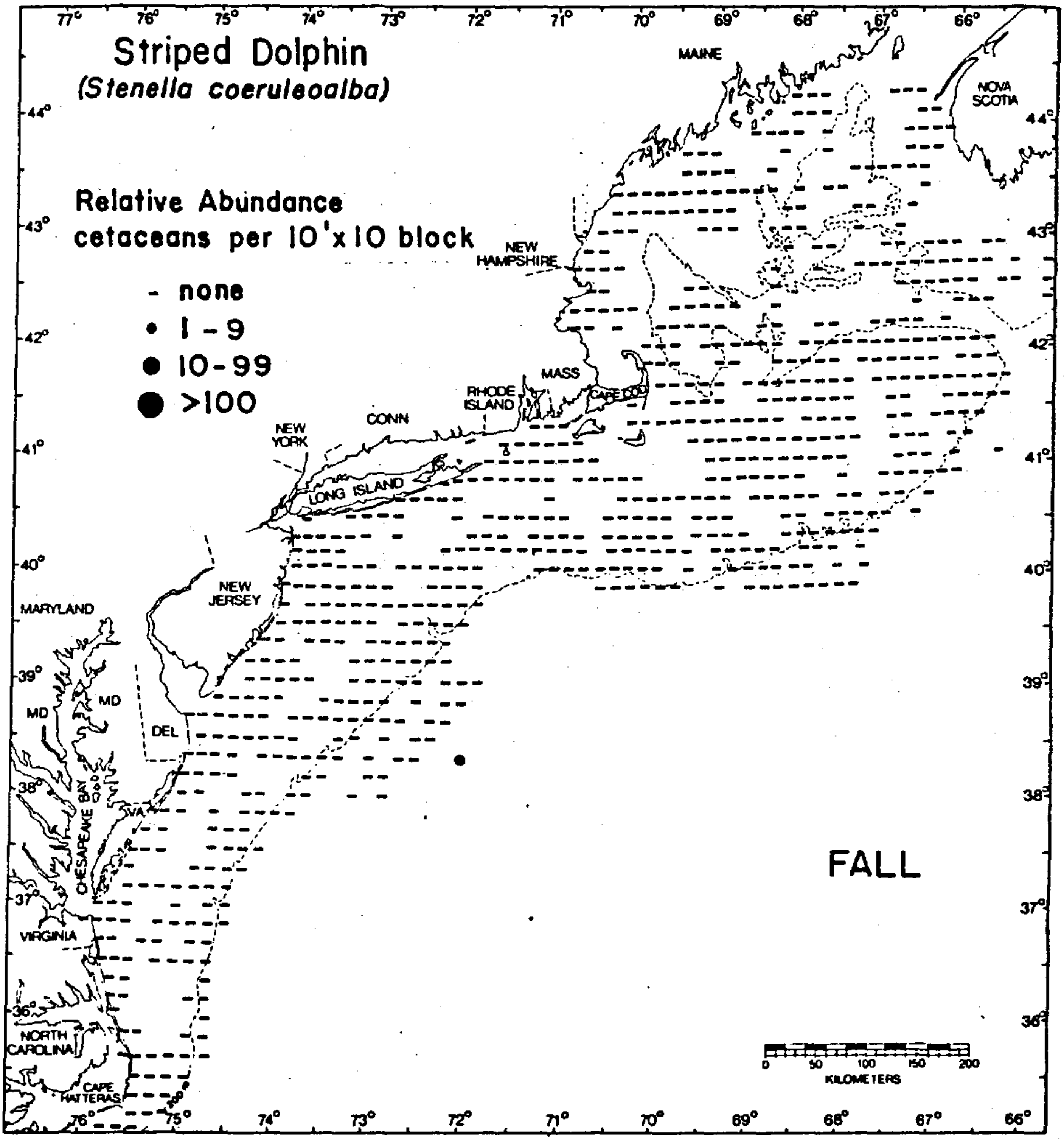

Figure 36. Relative distribution and abundance of Striped Dolphins in fall.

Table 26. Seasonal estimates of Striped Dolphin abundance, animals/linear km ($\bar{X} \pm SD$), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	---	---	---	---
South	---	---	---	---
Southwest	---	---	---	---
Total	---	---	---	---
GEORGES BANK				
Northern edge	---	---	---	---
Shelf edge	---	---	---	---
Shoals	---	---	---	---
Central bank	---	---	---	---
Total	---	---	---	---
S. NEW ENGLAND				
Inner shelf	---	---	---	---
Mid shelf	---	---	0.002 (0.056)	---
Outer shelf	---	---	---	---
Total	---	---	0.001 (0.039)	---
MID-ATLANTIC				
Inner shelf	---	---	---	---
Mid shelf	---	---	---	---
Outer shelf	---	---	---	---
Total	---	---	---	---
SLOPE	---	0.231 (2.222)	0.155 (2.219)	0.010 (0.101)

Table 27. Seasonal estimates of Striped Dolphin densities, animals/km^2 ($\overline{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central Gulf	---	---	---	---
South	---	---	---	---
Southwest	---	---	---	---
Total	---	---	---	---
GEORGES BANK				
Northern edge	---	---	---	---
Shelf edge	---	---	---	---
Shoals	---	---	---	---
Central bank	---	---	---	---
Total	---	---	---	---
S. NEW ENGLAND				
Inner shelf	---	---	---	---
Mid shelf	---	---	0.0029 (0.0746)	---
Outer shelf	---	---	---	---
Total	---	---	0.0014 (0.0523)	---
MID-ATLANTIC				
Inner shelf	---	---	---	---
Mid shelf	---	---	---	---
Outer Shelf	---	---	---	---
Total	---	---	---	---
SLOPE	---	0.3063 (2.9372)	0.2055 (2.9329)	0.0138 (0.1338)

Saddleback dolphin (Delphinus delphis)

D. delphis are tertiary carnivores that feed on a wide variety of schooling fishes, which include anchovies, myctophids and hake (Leatherwood et al. 1976), and squid (Sergeant 1958; Katona et al. 1977). They have also been observed feeding on saury (MBO, unpubl. data). Most sightings of feeding Delphinus are on Georges Bank south to the Mid-Atlantic Bight, between mid-shelf and slope waters (Hain et al. 1981; CeTAP 1982; MBO, unpubl. data).

Delphinus have been reported throughout the temperate and tropical waters of the Atlantic (Leatherwood et al. 1976) and Pacific oceans (Evans 1974). In the western North Atlantic, they have been reported off Nova Scotia (Sergeant and Fisher 1957, Leatherwood et al. 1976), throughout the shelf waters off the eastern United States into the Gulf of Mexico (Fritts and Reynolds 1981), south to Venezuela (Leatherwood et al. 1976).

Within our study area, D. delphis is widespread from Cape Hatteras northeastward to the eastern tip of Georges Bank (35°00'N to 42°00'N) in mid-to-outer shelf waters (Hain et al. 1981; CeTAP 1982; Powers et al. 1982; Powers and Payne 1983), on a year-around basis. Sightings in the Gulf of Maine are limited to fall and winter, generally on the northern edge of northeastern Georges Bank. The mid-shelf distribution is especially evident from Georges Bank southward. Greatest sighting frequencies occurred on central Georges Bank (NMFS Strata No. 13, 16) in fall; however, Delphinus are abundant on Georges Bank May to June and again from October to December (Hain et al. 1981; Powers et al. 1982). There is a decrease in sightings during mid-to late summer when D. delphis apparently moves north of the study area. Greatest sighting frequencies in the Mid-Atlantic Bight occur from February to May (Hain et al. 1981; CeTAP 1982; Powers and Payne 1983). Hain et al. (1981) suggested that summer and fall sightings are greatest north of 37°30'N and winter and spring sightings south of this latitude; however our relative abundance data suggest that D. delphis has common occurrence on Georges Bank throughout winter. Powers et al. (1982) reported a summer sighting in the Mid-Atlantic Bight, south of the 37° 30'N latitutde also indicated by Hain et al. (1981) as a possible seasonal limit.

Saddleback dolphins are the most frequently sighted dolphin, comprising 55% of the total number of individuals seen (Table 15). They are year-round south of the Gulf of Maine (Figs. 37-41; Tables 28-29), and considered an uncommon straggler into the Gulf of Maine. Regionally they were most abundant on GB from mid-bank to the shelf-break (Tables 28-29) in fall, when densities reached 7.09/km^2 on the central bank (NMFS/NEFC strata 13,16).

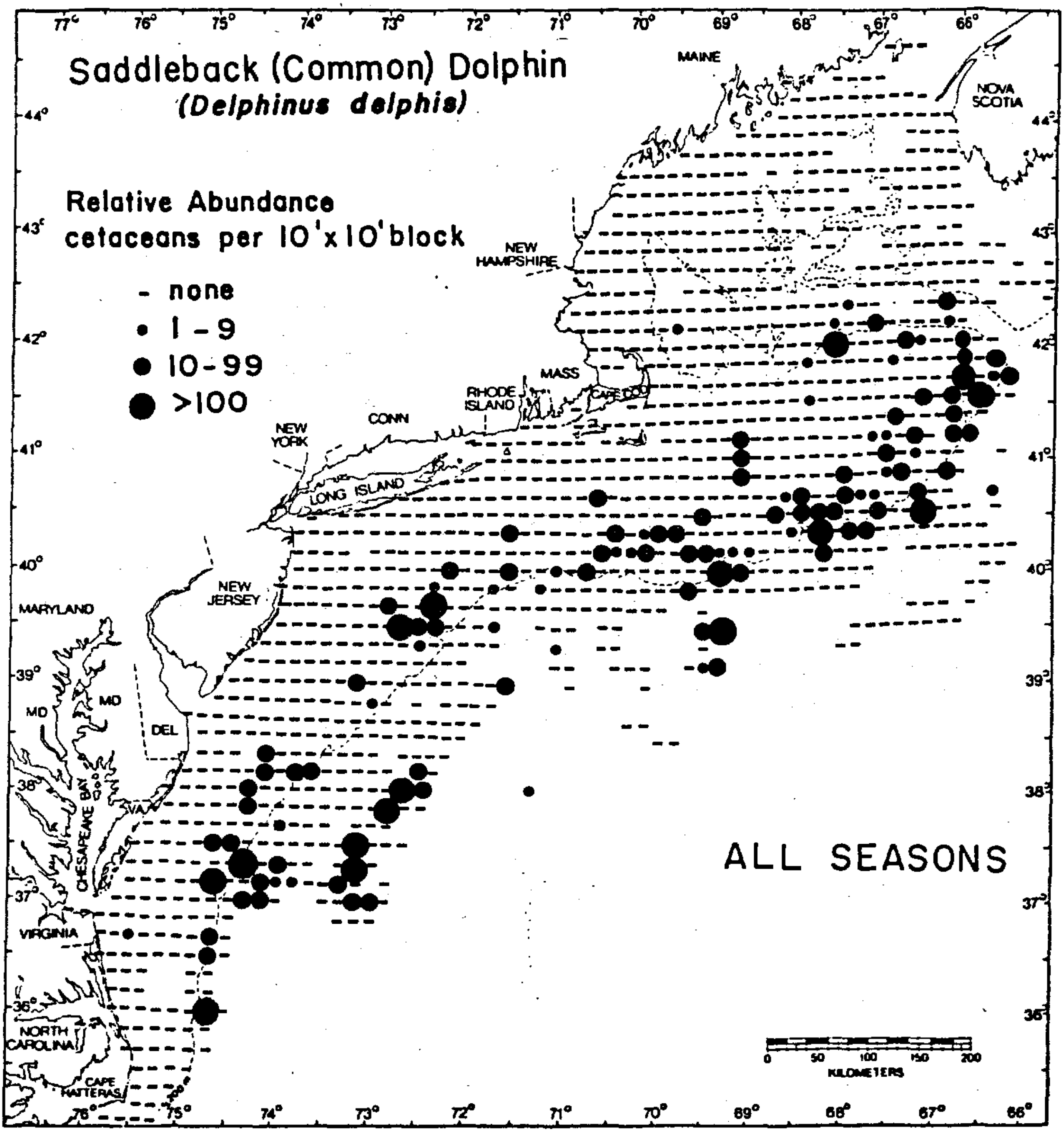

Figure 37. Relative distribution and abundance of Saddleback Dolphins for all seasons.

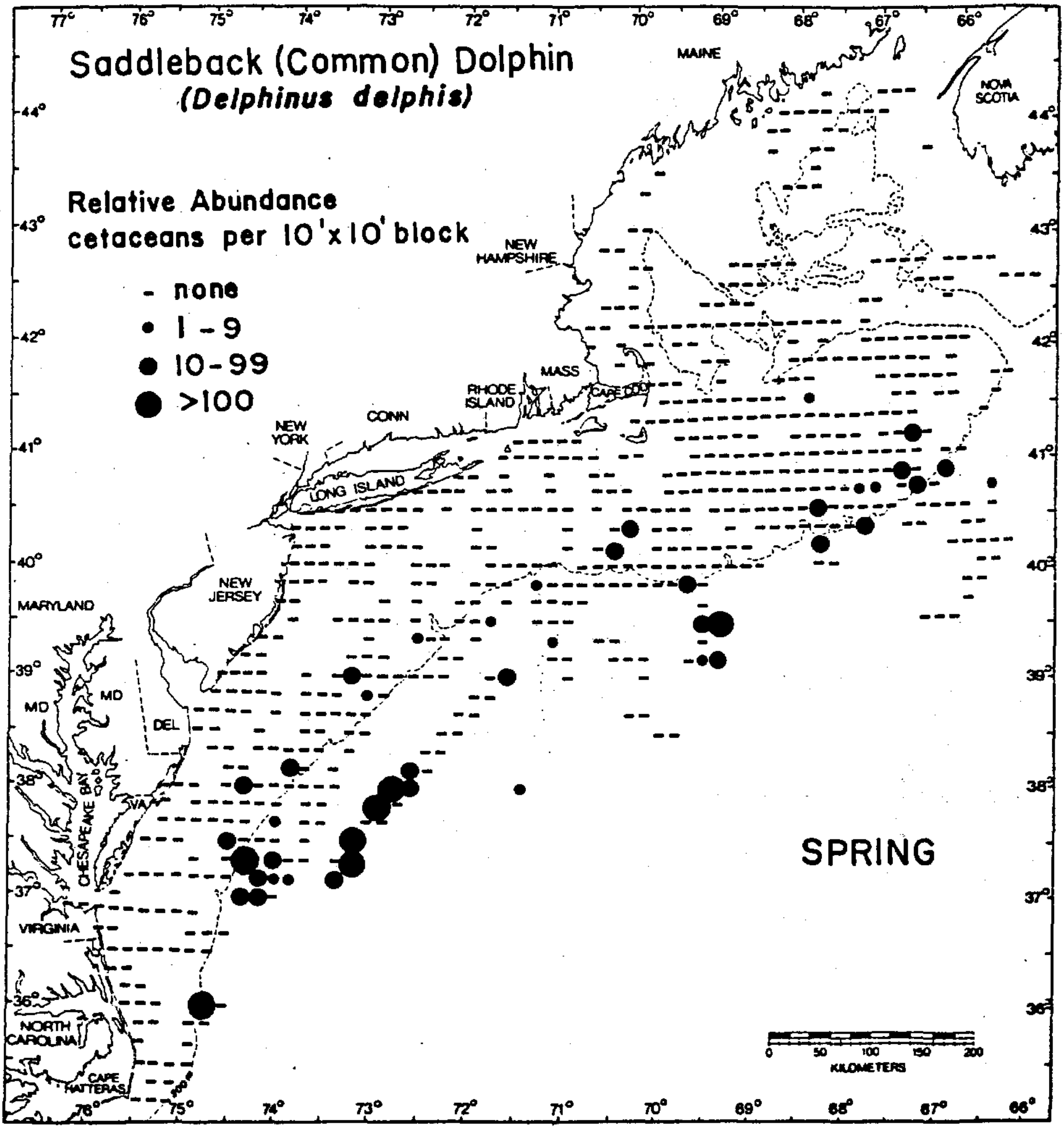

Figure 38. Relative distribution and abundance of Saddleback Dolphins in spring.

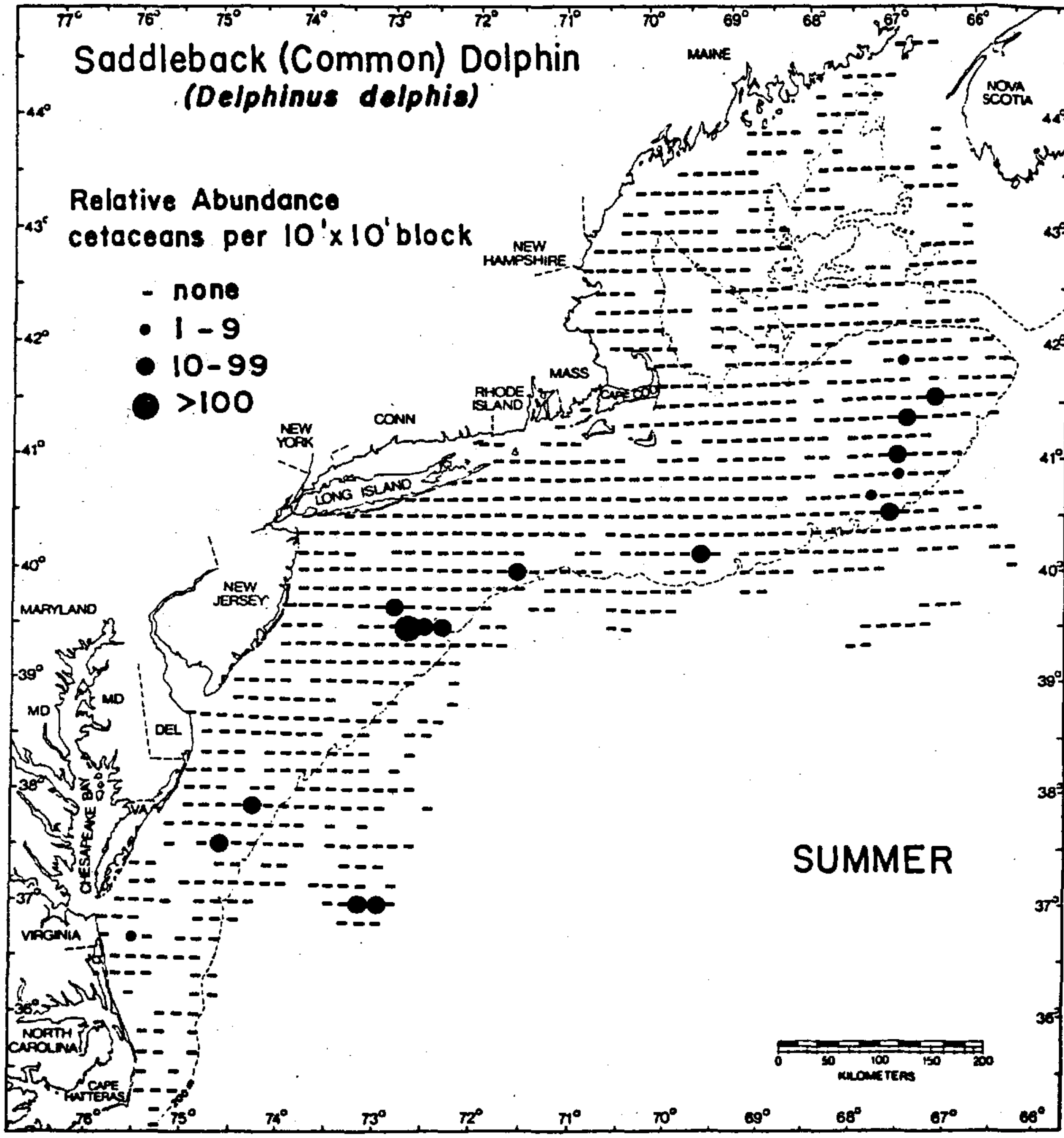

Figure 39. Relative distribution and abundance of Saddleback Dolphins in summer.

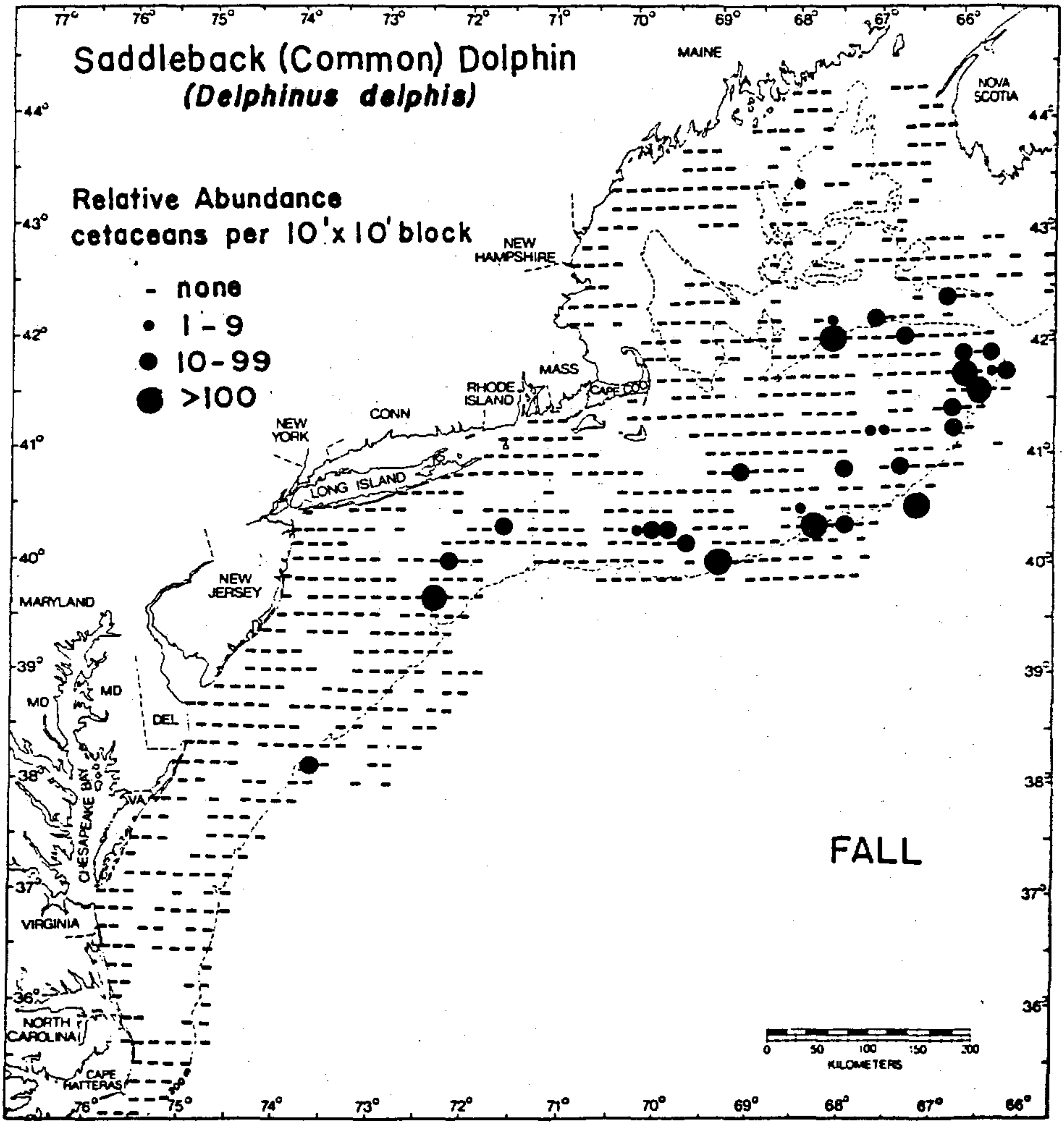

Figure 40. Relative distribution and abundance of Saddleback Dolphins in fall.

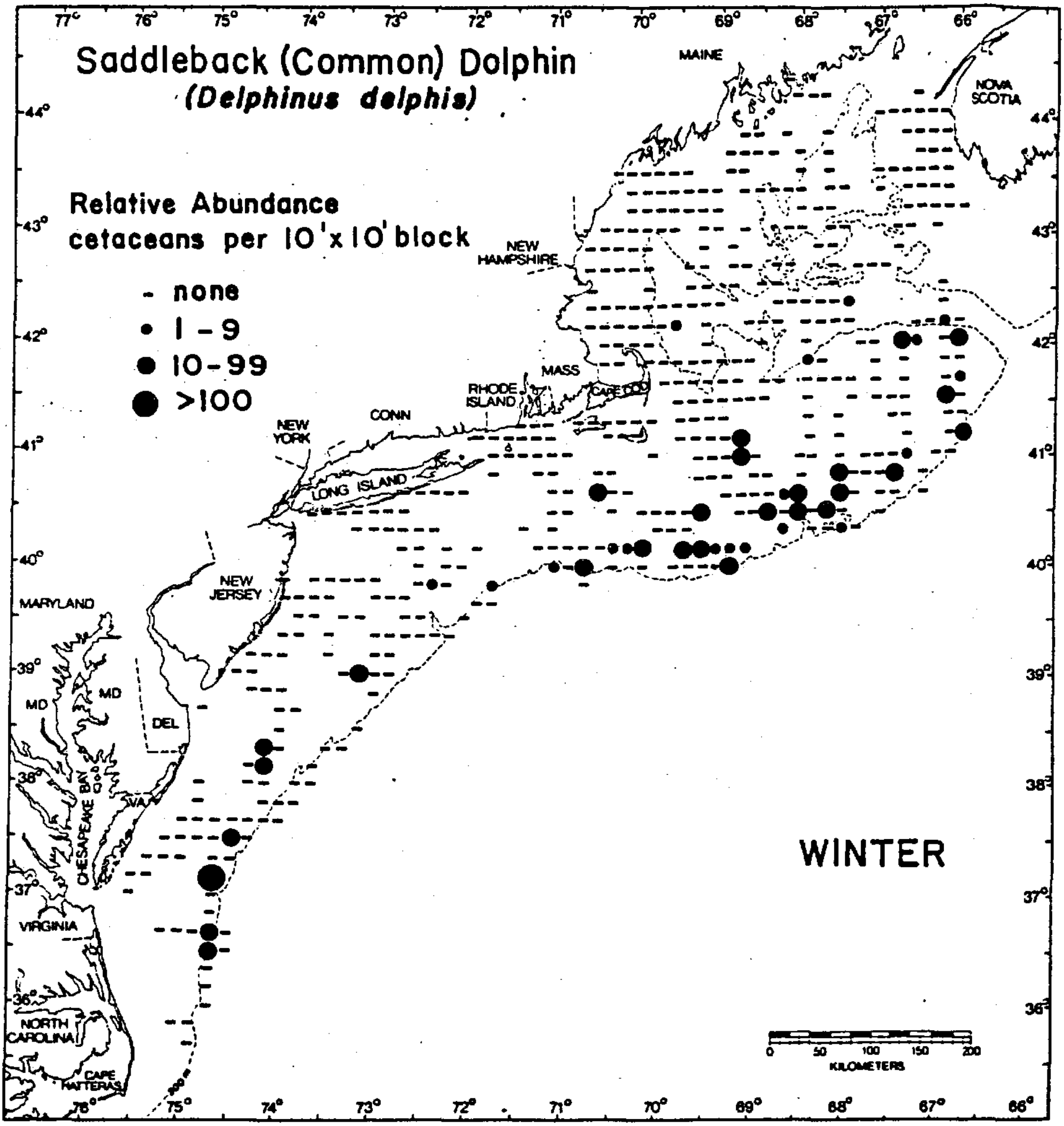

Figure 41. Relative distribution and abundance of Saddleback Dolphins in winter.

Table 28. Seasonal estimates of Saddleback dolphin abundance, animals/linear km ($\overline{X} \pm SD$), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	0.001 (0.030)	---	---	---
South	---	---	---	---
Southwest	0.095 (1.024)	---	---	---
Total	0.002 (0.488)	---	---	---
GEORGES BANK				
Northern edge	0.137 (0.405)	---	---	0.529 (4.585)
Shelf edge	0.485 (1.897)	0.132 (0.722)	0.013 (0.147)	2.126 (19.616)
Shoals	0.013 (0.128)	---	---	0.016 (0.208)
Central bank	0.325 (1.327)	0.033 (0.317)	0.108 (1.003)	5.372 (66.827)
Total	0.238 (1.150)	0.035 (0.350)	0.053 (0.694)	2.394 (40.616)
S. NEW ENGLAND				
Inner shelf	0.032 (0.426)	---	---	---
Mid shelf	0.161 (0.751)	0.094 (0.838)	0.088 (1.000)	0.184 (2.076)
Outer shelf	0.049 (0.244)	0.027 (0.258)	0.020 (0.263)	---
Total	0.102 (0.614)	0.044 (0.537)	0.046 (0.708)	0.081 (1.380)
MID-ATLANTIC				
Inner shelf	0.086 (0.718)	---	0.005 (0.109)	---
Mid shelf	0.774 (3.608)	0.149 (1.794)	0.049 (0.526)	---
Outer shelf	---	5.229 (41.140)	---	0.057 (0.585)
Total	0.276 (2.065)	0.938 (17.075)	0.017 (0.296)	0.012 (0.277)
SLOPE	---	0.628 (2.591)	---	---

Table 29. Seasonal estimates of Saddleback Dolphin densities, animals/km^2 ($\overline{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central Gulf	0.0022 (0.0401)	---	---	---
South	---	---	---	---
Southwest	0.1256 (1.3533)	---	---	---
Total	0.0298 (0.6451)	---	---	---
GEORGES BANK				
Northern edge	0.1817 (0.5364)	---	---	0.6997 (6.0587)
Shelf edge	0.6421 (2.0571)	0.1755 (0.9542)	0.0176 (0.1945)	2.8099(25.9206)
Shoals	0.0173 (0.1699)	---	---	0.0214 (0.2768)
Central bank	0.4296 (1.7538)	0.0446 (0.4200)	0.1429 (1.3263)	7.0987(88.3060)
Total	0.3146 (1.5203)	0.0465 (0.4635)	0.0707 (0.9171)	3.1695(53.7202)
S. NEW ENGLAND				
Inner shelf	0.0432 (0.5554)	---	---	---
Mid shelf	0.2138 (0.9930)	0.1247 (1.1073)	0.1174 (1.3223)	0.2348 (2.7445)
Outer shelf	0.0660 (0.3236)	0.0365 (0.3420)	0.0276 (0.3482)	---
Total	0.1348 (0.8122)	0.0585 (0.7107)	0.0610 (0.9363)	0.1073 (1.8236)
MID-ATLANTIC				
Inner shelf	0.1139 (0.9498)	---	0.0066 (0.1440)	---
Mid shelf	1.0227 (4.7678)	0.1994 (2.3716)	0.0654 (0.6954)	---
Outer shelf	---	6.9099(54.3267)	---	0.0755 (0.7736)
Total	0.3654 (2.7295)	1.2409(22.5637)	0.0231 (0.3918)	0.0169 (0.3660)
SLOPE	---	0.8310 (3.4245)	---	---

White-sided Dolphin (*Lagenorhynchus acutus*)

L. acutus are tertiary carnivores which have been reported to feed on a variety of fishes (Atlantic herring *Clupea harengus*, Silver Hake *Merluccius bilinearis* and smelt *Osmerus mordax*) or squid (*Illex illecebrosus*) (Schevill 1956; Sergeant et al. 1980; Katona et al. 1977; 1978). In our study area *L. acutus* have been seen in close association to feeding humpback *M. novaeangliae* and fin *Balaenoptera physalus* whales in the Gulf of Maine and on Georges Bank (Katona et al. 1977; Hain et al. 1981; Mayo 1982) which are believed to be feeding on sand lance *Ammodytes americanus* in these regions (Overholtz and Nicolas 1979; Hain et al. 1982; Mayo 1982; Payne et al. in review). Thus, it seems likely that *L. acutus* also feeds on sand lance. Most feeding sightings in this study occurred over shelf edges, or above shelf bottoms with rugged relief, often in the presence of whales. Feeding sightings were common in the southwest Gulf of Maine (NMFS strata 23, 25-27), between the 70-100 m contours. The apparent prey during surface-feeding activity was sand lance (Mayo 1982).

In the western North Atlantic, Leatherwood et al. (1976) reported white-sided dolphins from Davis Strait south to Hudson Canyon. The first confirmed report of *L. acutus* from Cape Cod was by Schevill (1956). The southernmost extent of their range was redefined to the Mid-Atlantic Bight near Chesapeake Bay by Testaverde and Mead (1980). This southern range limit was supported by Hain et al. (1981), CeTAP (1982), and Powers and Payne (1983). *L. acutus* is widespread throughout the Gulf of Maine and Georges Bank throughout the year south to approximately 40°00'N (Hain et al. 1981; CeTAP 1982). Within these regions they are most abundant in the southwestern Gulf of Maine. Hain et al. (1981) suggested that its distribution is most widespread October to November, with spring to fall sightings along the shelf edge from south of Nantucket to Virginia, but not in winter. *L. acutus* was the most abundant (total numbers) cetacean observed in the study area by Scott et al. (1981) and CeTAP (1982).

Sightings from our data base are most widespread spring and summer (Figs. 42-46). We have sightings reported to the Mid-Atlantic Bight in winter (Fig. 46), in reduced numbers (Tables 30-31). The identification of these sightings are considered reliable. *L. acutus* was most widespread winter and spring, and most abundant in summer. This species was found year-round only in the Gulf of Maine (Tables 30-31) where it is the dominant delphinid. The areas of greatest concentrations were in the southwest (NMFS/NEFC strata No. 23, 25-27) and south NMFS/NEFC strata No. 24) regions of the GOM (Tables 30-31).

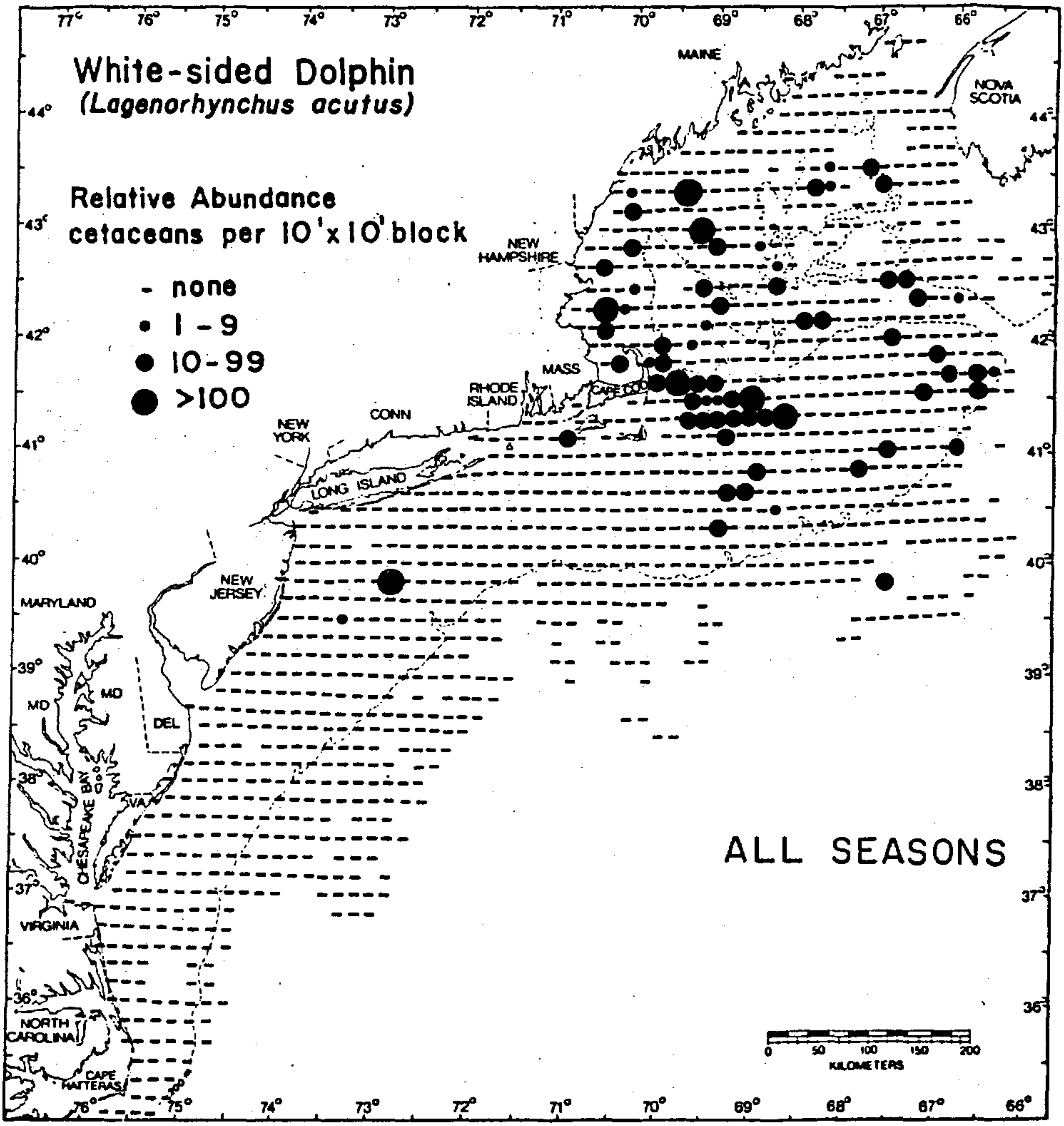

Figure 42. Relative distribution and abundance of White-sided Dolphins for all seasons.

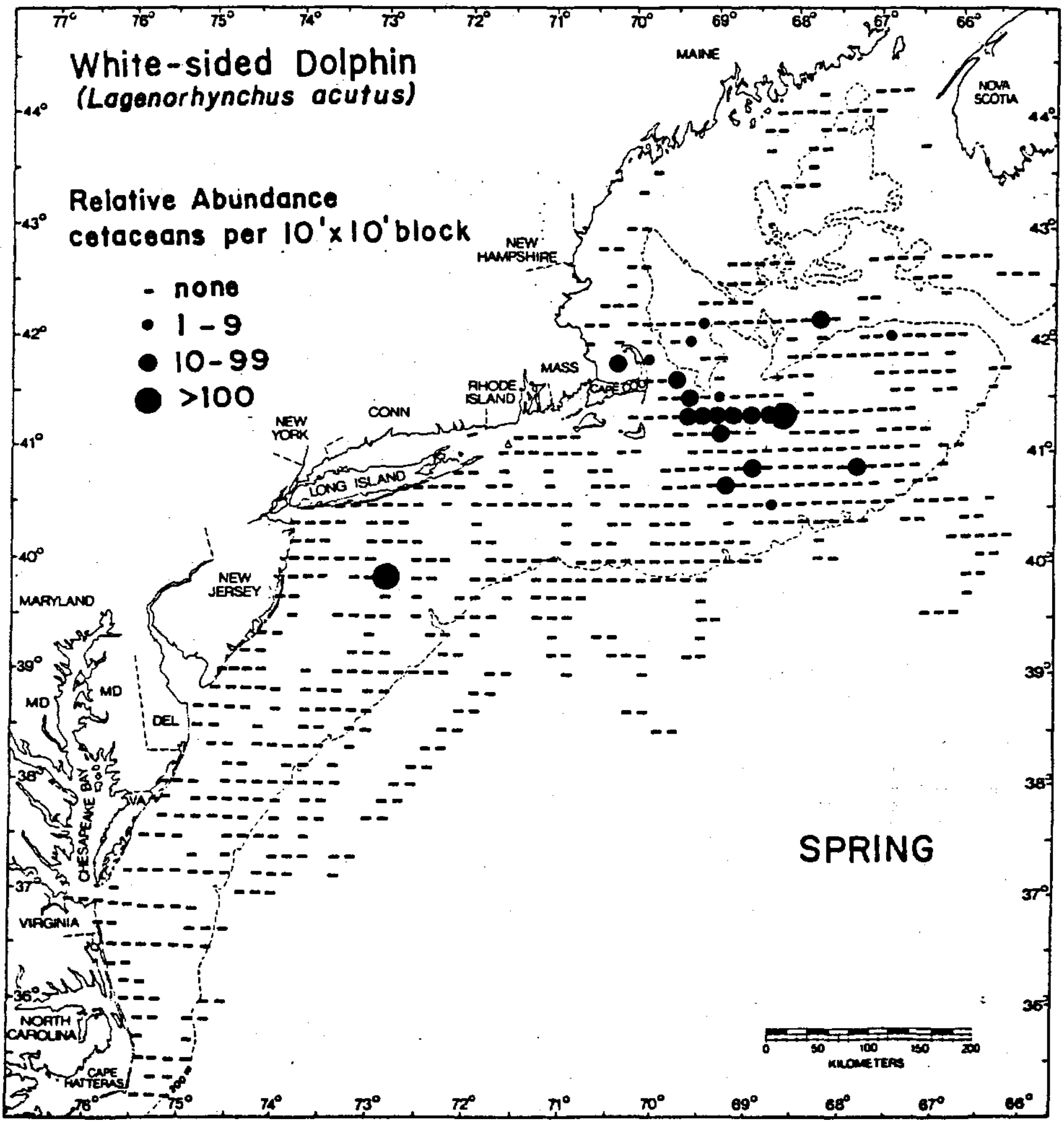

Figure 43. Relative distribution and abundance of White-sided Dolphins in spring.

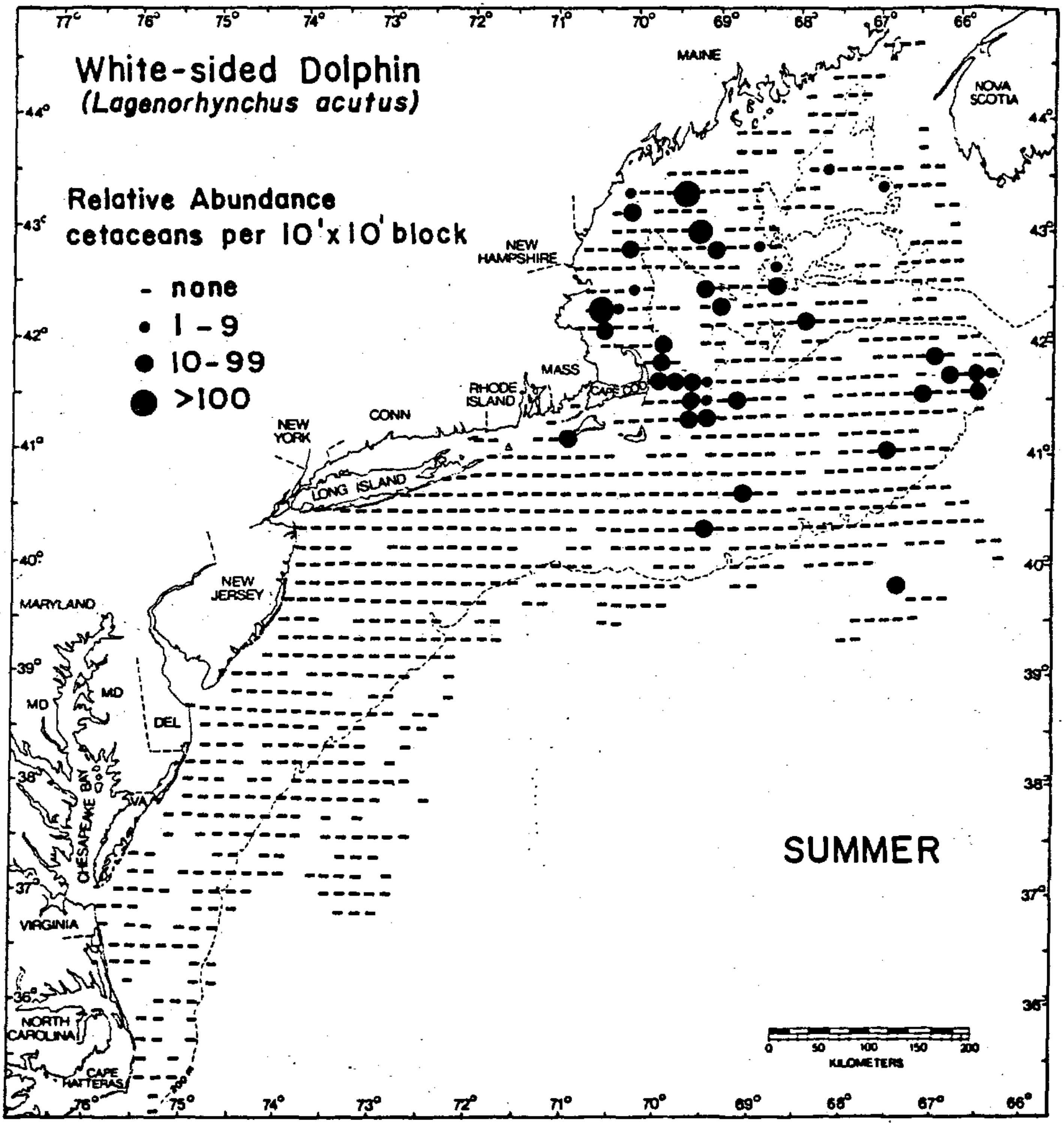

Figure 44. Relative distribution and abundance of White-sided Dolphins in summer.

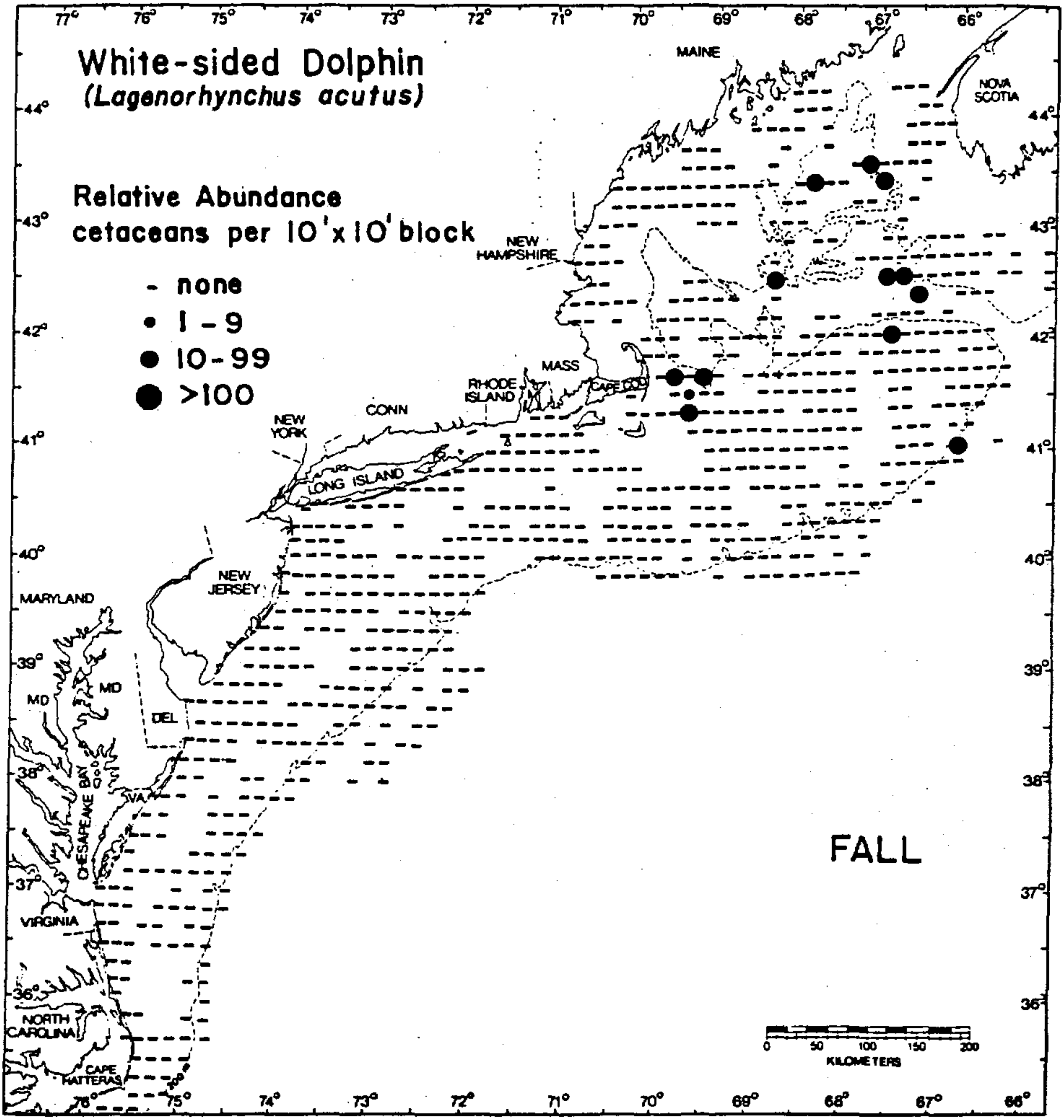

Figure 45. Relative distribution and abundance of White-sided Dolphins in fall.

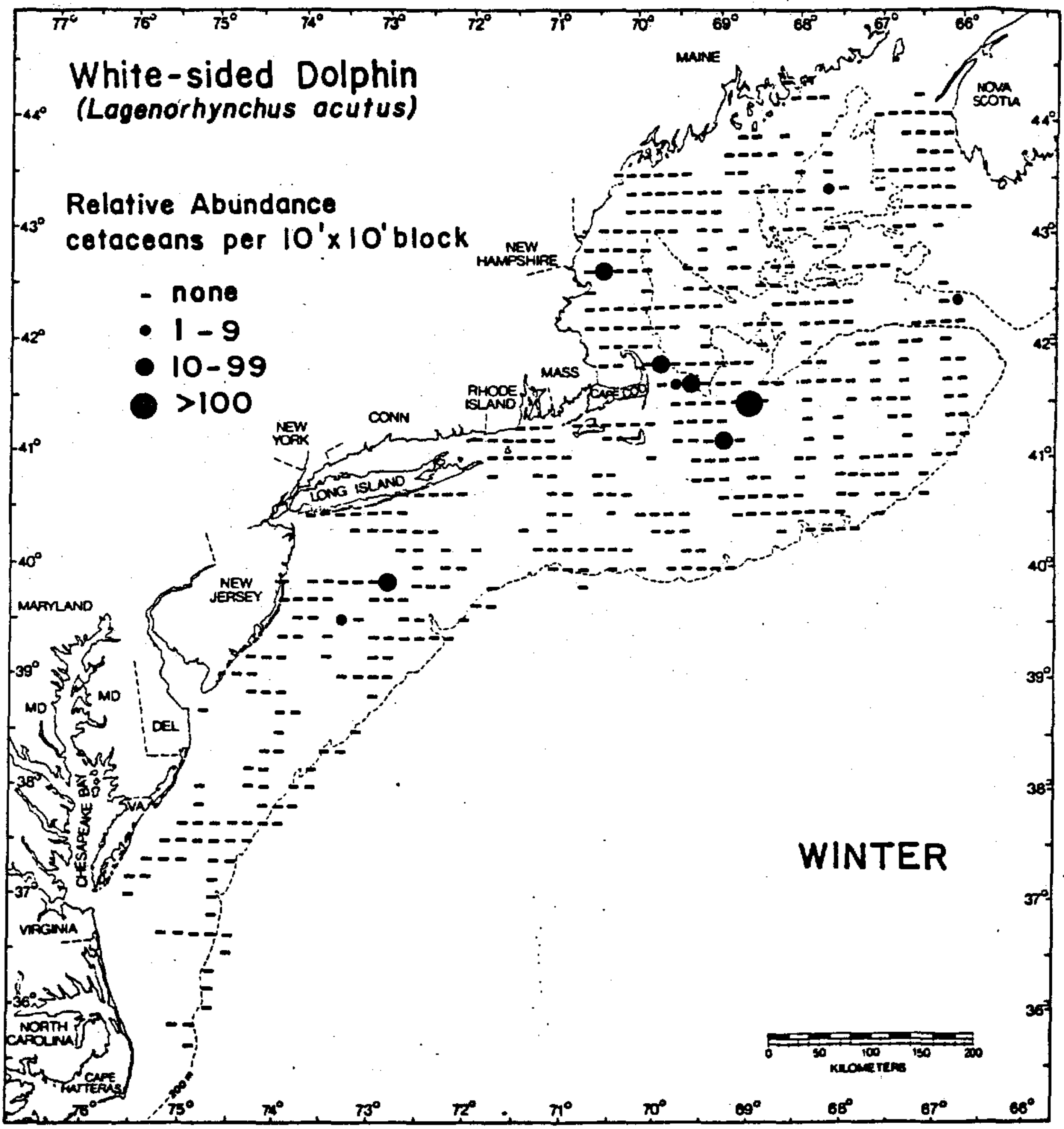

Figure 46. Relative distribution and abundance of White-sided Dolphins in winter.

Table 30. Seasonal estimates of White-sided Dolphin abundance, animals/linear km ($\bar{X}\pm SD$), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter		Spring		Summer		Fall	
GULF OF MAINE								
Central gulf	0.002	(0.051)	0.023	(0.254)	0.102	(1.241)	0.160	(1.275)
South	0.396	(2.956)	0.299	(1.433)	0.189	(1.236)	0.110	(0.805)
Southwest	0.024	(0.335)	0.497	(3.655)	0.112	(0.732)	0.020	(0.191)
Total	0.063	(1.134)	0.234	(2.231)	0.117	(1.089)	0.114	(1.019)
GEORGES BANK								
Northern edge	---		0.047	(0.303)	---		---	
Shelf edge	---		---		---		---	
Shoals	---		---		0.018	(0.244)	---	
Central bank	---		0.042	(0.387)	0.093	(1.082)	---	
Total	---		0.024	(0.286)	0.049	(0.755)	---	
S. NEW ENGLAND								
Inner shelf	---		---		---		---	
Mid shelf	0.022	(0.329)	0.022	(0.237)	0.001	(0.042)	---	
Outer shelf	---		0.204	(1.865)	---		---	
Total	0.011	(0.239)	0.069	(1.032)	<0.001	(0.029)	---	
MID-ATLANTIC								
Inner shelf	0.011	(0.127)	---		---		---	
Mid shelf	---		---		---		---	
Outer shelf	---		0.005	(0.560)	---		---	
Total	0.005	(0.089)	0.001	(0.023)	---		---	
SLOPE	---		---		---		---	

Table 31. Seasonal estimates of White-sided Dolphin densities, animals/km^2 ($\overline{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central Gulf	0.0030 (0.0685)	0.0315 (0.3365)	0.1345 (1.6409)	0.2118 (1.6859)
South	0.5237 (3.9063)	0.3957 (1.8942)	0.2504 (1.6332)	0.1454 (1.0640)
Southwest	0.0325 (0.4429)	0.6688 (4.8304)	0.1481 (0.9674)	0.0269 (0.2524)
Total	0.0841 (1.4987)	0.3139 (2.9496)	0.1554 (1.4399)	0.1518 (1.3476)
GEORGES BANK				
Northern edge	---	0.0634 (0.4011)	---	---
Shelf edge	---	---	---	---
Shoals	---	---	0.0243 (0.3226)	---
Central bank	---	0.0559 (0.5119)	0.1237 (1.4308)	---
Total	---	0.0325 (0.3788)	0.0650 (0.9985)	---
S. NEW ENGLAND				
Inner shelf	---	---	---	---
Mid shelf	0.0299 (0.4355)	0.0300 (0.3141)	0.0021 (0.0559)	---
Outer shelf	---	0.2702 (2.4650)	---	---
Total	0.0158 (0.3167)	0.0922 (1.3637)	0.0010 (0.0392)	---
MID-ATLANTIC				
Inner shelf	0.0148 (0.1681)	---	---	---
Mid shelf	---	---	---	---
Outer shelf	---	0.0077 (0.0743)	---	---
Total	0.0072 (0.1177)	0.0013 (0.0307)	---	---
SLOPE	---	---	---	---

White-beaked Dolphin (*Lagenorhynchus albirostris*)

The White-beaked dolphin was seen on only two occasions throughout our study period (Table 32, Appendix I). *L. albirostris* is considered the more northerly of the two species of *Lagenorhynchus* occurring in our study area (Leatherwood et al. 1976), and is more abundant from the Scotian shelf north. CeTAP (1982) considers this species present, probably year-round and nearshore to Cape Cod, in low numbers.

Table 32. Seasonal estimates of White-beaked Dolphin abundance, animals/linear km ($\bar{X}$+SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	---	---	---	---
South	---	---	---	---
Southwest	---	0.011 (0.137)	---	---
Total	---	0.003 (0.080)	---	---
GEORGES BANK				
Northern edge	---	---	---	---
Shelf edge	---	---	0.005 (0.065)	---
Shoals	---	---	---	---
Central bank	---	---	---	---
Total	---	---	0.001 (0.028)	---
S. NEW ENGLAND				
Inner shelf	---	---	---	---
Mid shelf	---	---	---	---
Outer shelf	---	---	---	---
Total	---	---	---	---
MID-ATLANTIC				
Inner shelf	---	---	---	---
Mid shelf	---	---	---	---
Outer shelf	---	---	---	---
Total	---	---	---	---
SLOPE	---	---	---	---

Grampus (*Grampus griseus*)

Grampus are tertiary carnivores that feed almost exclusively on squid (Nishiwaki 1972; Leatherwood et al. 1976, 1980). CeTAP (1982) considered *Grampus* as sub-surface feeders, who feed throughout their range.

G. griseus are widely distributed in tropical and temperate waters around the world (Leatherwood et al. 1980). In the western North Atlantic, *Grampus* occurs from eastern Newfoundland to the Lesser Antilles (Leatherwood et al. 1976) into the Gulf of Mexico (Gunter 1954; Paul 1968; Fritts and Reynolds 1981).

The center of *G. griseus* sightings within our study area occurs along the shelf-edge-slope waters from Cape Hatteras north to Georges Bank (36°00'N to 41°00'N) during spring, summer and fall (Hain et al. 1981; CeTAP 1982; Powers et al. 1982; Powers and Payne 1983). It is usually not found inshore of the 100 m isobath (Powers and Payne 1983). CeTAP (1982) shows that the range contracts to the Mid-Atlantic Bight during winter, and probably offshore (> 100 m). The species is considered generally absent from the Gulf of Maine, although individuals have been recorded.

Our data reflects a mid-shelf to slope water distribution from Georges Bank through the Mid-Atlantic Bight (Tables 33-34; Figs. 47-50), with the greatest numbers seen in slope waters, primarily summer and fall. *Grampus* have not been recorded in winter (December-February) in our data.

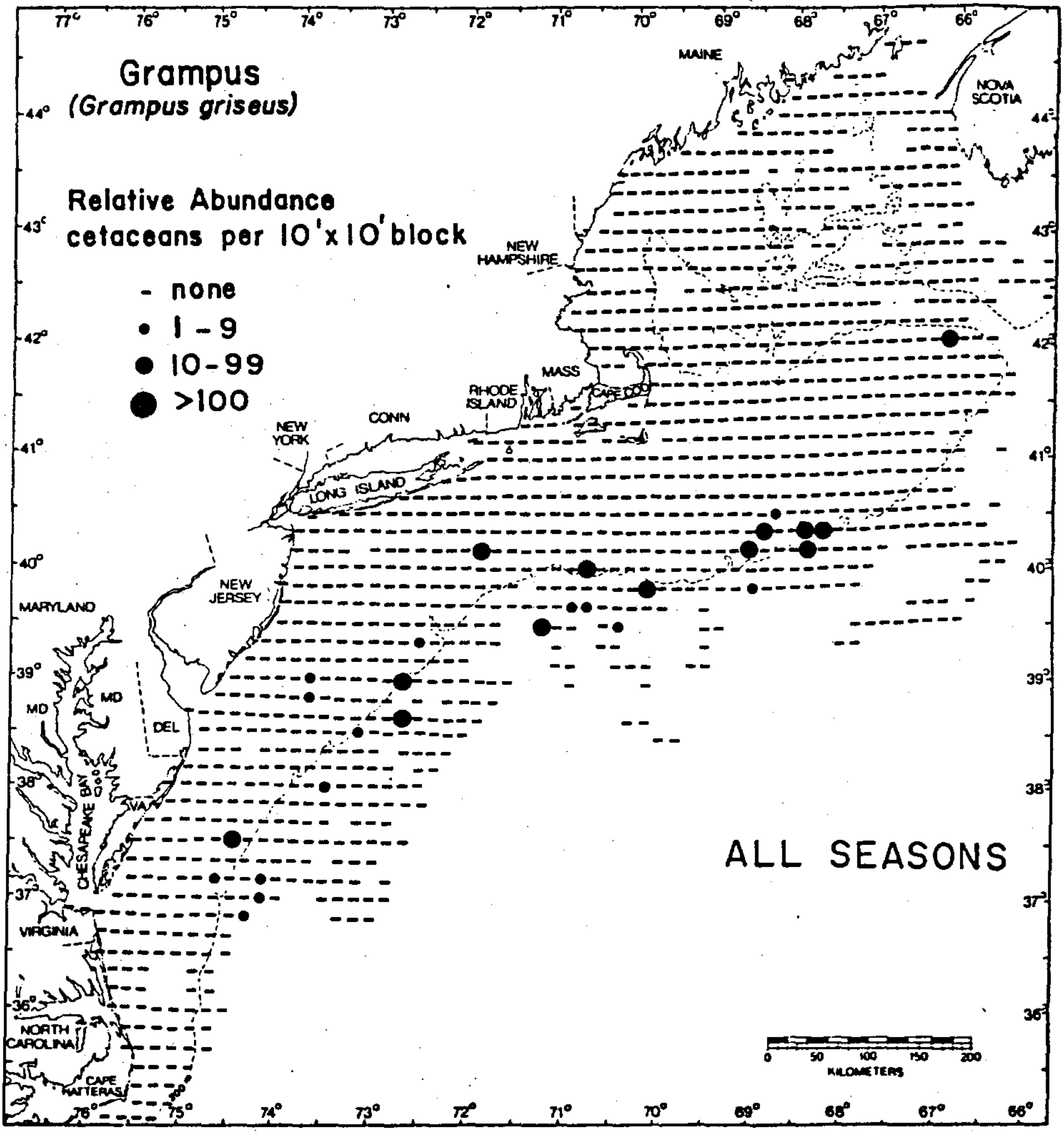

Figure 47. Relative distribution and abundance of Grampus for all seasons.

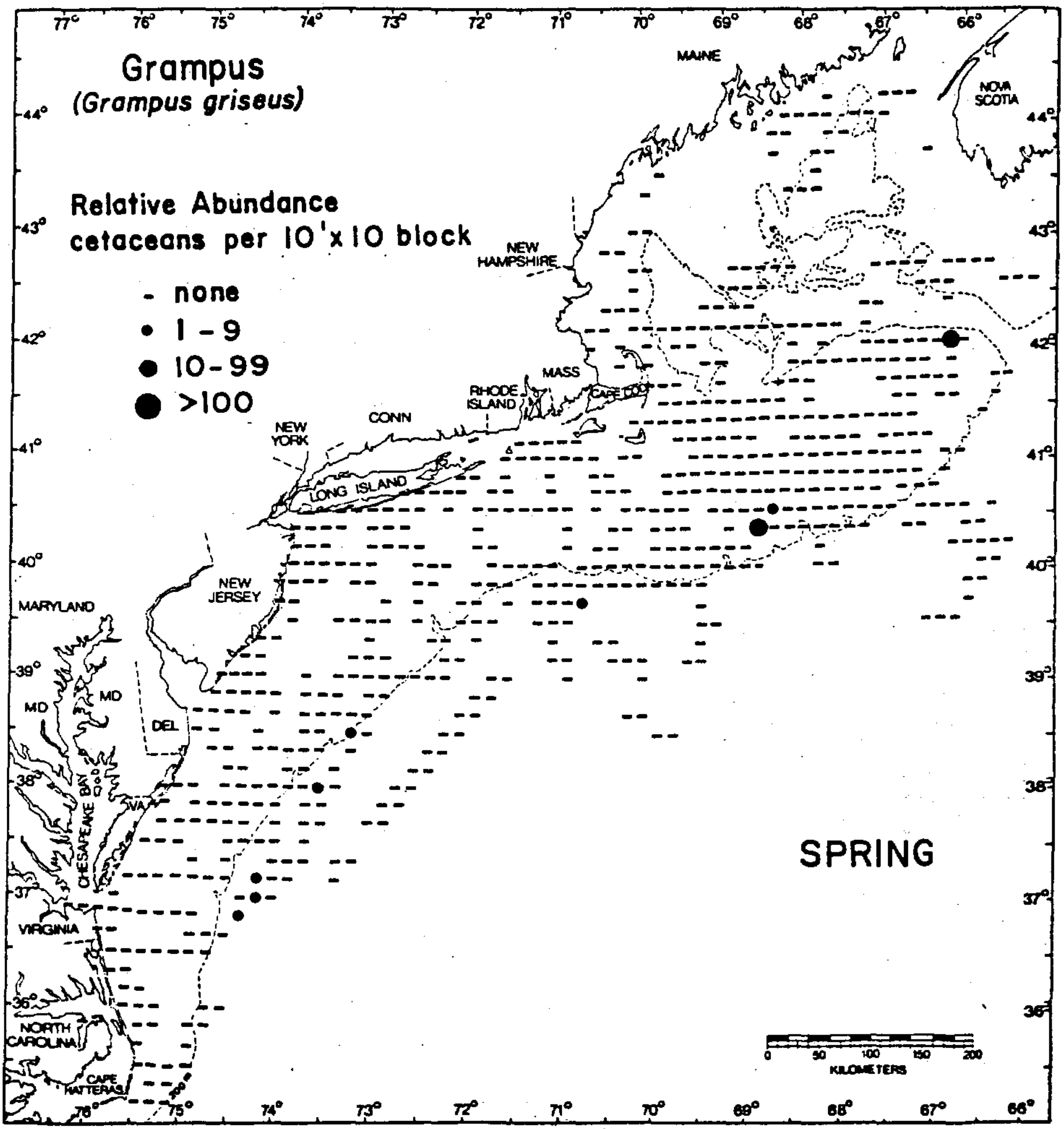

Figure 48. Relative distribution and abundance of Grampus in spring.

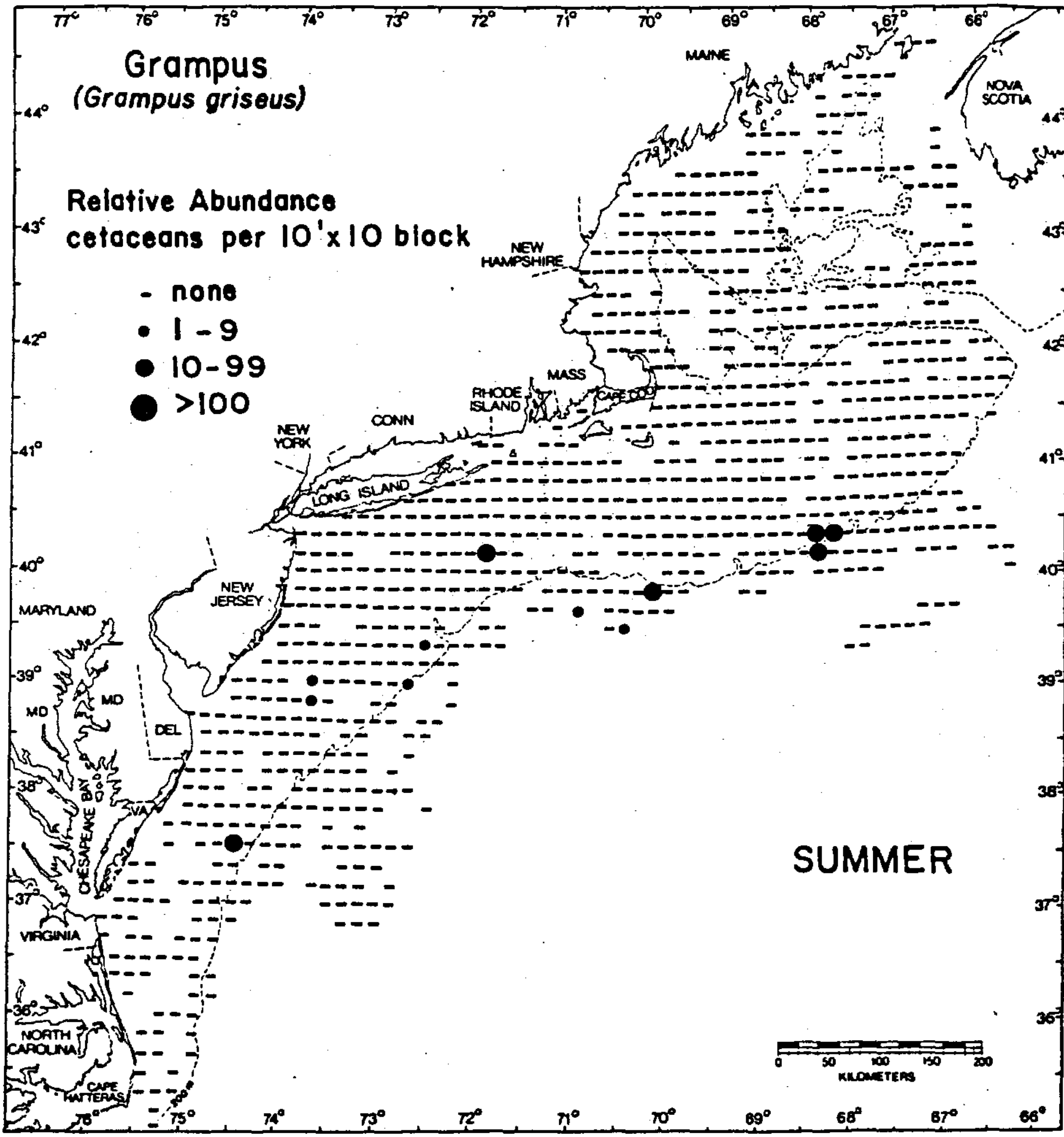

Figure 49. Relative distribution and abundance of Grampus in summer.

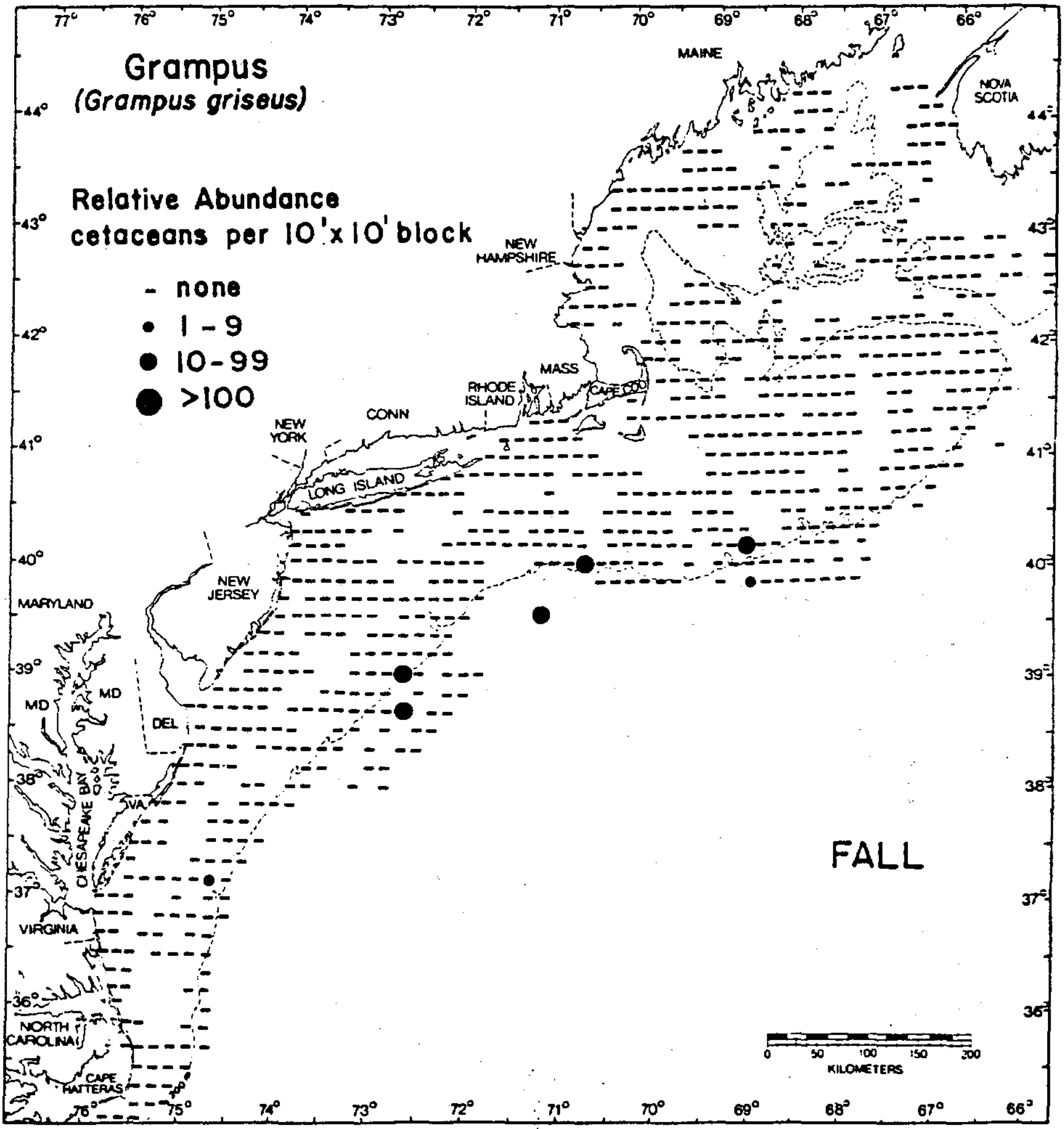

Figure 50. Relative distribution and abundance of Grampus in fall.

Table 33. Seasonal estimates of Grampus abundance, animals/linear km ($\overline{X}\pm SD$), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	---	---	---	---
South	---	---	---	---
Southwest	---	---	---	---
Total	---	---	---	---
GEORGES BANK				
Northern edge	---	0.196 (1.241)	---	---
Shelf edge	---	---	0.206 (1.472)	---
Shoals	---	---	---	---
Central bank	---	0.007 (0.138)	---	---
Total	---	0.017 (0.336)	0.038 (0.638)	---
S. NEW ENGLAND				
Inner shelf	---	---	---	---
Mid shelf	---	---	0.006 (0.120)	0.014 (0.260)
Outer shelf	---	---	---	0.048 (0.489)
Total	---	---	0.003 (0.084)	0.018 (0.297)
MID-ATLANTIC				
Inner shelf	---	---	0.006 (0.110)	---
Mid shelf	---	---	---	0.004 (0.058)
Outer shelf	---	0.002 (0.025)	0.027 (0.210)	0.010 (0.105)
Total	---	<0.001 (0.010)	0.006 (0.105)	0.003 (0.059)
SLOPE	---	0.028 (0.172)	0.011 (0.109)	0.045 (0.351)

Table 34. Seasonal estimates of Grampus densities, animals/km^2 ($\bar{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central Gulf	---	---	---	---
South	---	---	---	---
Southwest	---	---	---	---
Total	---	---	---	---
GEORGES BANK				
Northern edge	---	0.2594 (1.6409)	---	---
Shelf edge	---	---	0.2725 (1.9454)	---
Shoals	---	---	---	---
Central bank	---	0.0105 (0.1830)	---	---
Total	---	0.0228 (0.4450)	0.0507 (0.8432)	---
S. NEW ENGLAND				
Inner shelf	---	---	---	---
Mid shelf	---	---	0.0087 (0.1591)	0.0189 (0.3445)
Outer shelf	---	---	---	0.0637 (0.6468)
Total	---	---	0.0043 (0.1116)	0.0238 (0.3930)
MID-ATLANTIC				
Inner shelf	---	---	0.0090 (0.1462)	---
Mid shelf	---	---	---	0.0063 (0.0776)
Outer shelf	---	0.0034 (0.0330)	0.0362 (0.2786)	0.0135 (0.1392)
Total	---	0.0005 (0.0136)	0.0085 (0.1399)	0.0050 (0.0791)
SLOPE	---	0.0376 (0.2277)	0.0153 (0.1453)	0.0607 (0.4639)

Pilot Whale (*Globicephala* spp.)

Globicephala are tertiary consumers that are considered teuthophagous (Scott et al. 1983), feeding primarily on squid (Mercer 1975; Caldwell et al. 1971), with fish and invertebrates as an alternative (Sergeant 1962; Mercer 1967; Katona et al. 1977). The preferred food of *Globicephala meleana*, off Newfoundland, was the short-finned squid *Illex illecebrosus* (Sergeant 1962). Food eaten when the squid was not present were Atlantic cod *Gadus morhua* (Sergeant 1962) and Greenland turbot *Reinhardtius hippoglossoides* (Mercer 1967). The squid most taken by *G. meleana* in north European waters is is probably *Ommastrephes sagittatus*; fish observed in stomachs in north Britain include horse mackeral *Caranx trachurus* and flatfish *Pleuronectidae* (Mitchell 1975a). The long-finned squid *Loligo pealei* has been suggested as a probable prey item in the Mid-Atlantic Bight of our study area during winter and spring (J. Nicolas, pers. comm.).

The Atlantic pilot whale *G. melaena* is common from Greenland, Iceland, and the Faeroe Islands (Salemundsson 1939; Sergeant 1968; Kapel 1975; Mercer 1975; Mitchell 1975) south to at least Cape Hatteras (Leatherwood et al. 1976; Katona et al. 1977; Hain et al. 1981; CeTAP 1982) and east across the north Atlantic to European waters (Brown 1961). In the southern portion of its western North Atlantic range, *G. melaena* is sympatric with the short-finned pilot whale *G. macrorhyncha*. *G. macrorhyncha* is a more tropical species, common off Florida and Caribbean waters (Mead 1975, Katona et al. 1977; Caldwell et al. 1971; Caldwell and Caldwell 1975; Leatherwood et al. 1976) and into the Gulf of Mexico (Fritts and Reynolds 1981). It has stranded as far north as New Jersey (Katona et al. 1977).

From Cape Hatteras to northeast Georges Bank, including the Gulf of Maine, the distribution of pilot whales (although *G. melaena* is the most common species in our study area, both species are considered together due to difficulties in field identification) generally follows the shelf edge between the 100 m and 1000 m contour. During mid-winter to spring (December to May), sightings are reported along the shelf edge of the mid-Atlantic and southern New England regions. Throughout spring, sightings increase along the shelf edge and north to and including Georges Bank. They are most abundant on Georges Bank from May to October (Hain et al. 1981; Powers et al. 1982). Therefore mid-winter through spring, pilot whales move onto the shelf edge in the mid-Atlantic region of our study area and continue northward along the edge to Georges Bank. This is consistent with the findings reported by Katona et al. (1977) and CeTAP (1982). During summer and fall, sightings occur on central Georges Bank north along the northern edge of the bank, and into the central Gulf of Maine. This trend continues northward as pilot whales move to inshore Newfoundland waters by June (Sergeant and Fisher 1957; Sergeant et al. 1970).

Our sightings of pilot whales indicated their presence on Georges Bank summer through winter (Figs. 51-55), with scattered sightings along the shelf edge of Georges Bank throughout the year. Sightings are clustered along the northern edge of the bank and the Great South Channel in fall as pilot whales move south into the mid-Atlantic region and possibly offshore waters (Fig. 54). Therefore summer through fall sightings occur over a broader area of the shelf than during the northward spring movement which occurs principally along the shelf edge. During late-summer and fall there is also a cluster of sightings near Cape Hatteras (CeTAP 1982; Powers et al. 1982). These sightings are possibly *G. macrorhyncha* during a northern extension of their summer range. Pilot whales were only sighted throughout the year in the mid-Atlantic region (Tables 35-36).

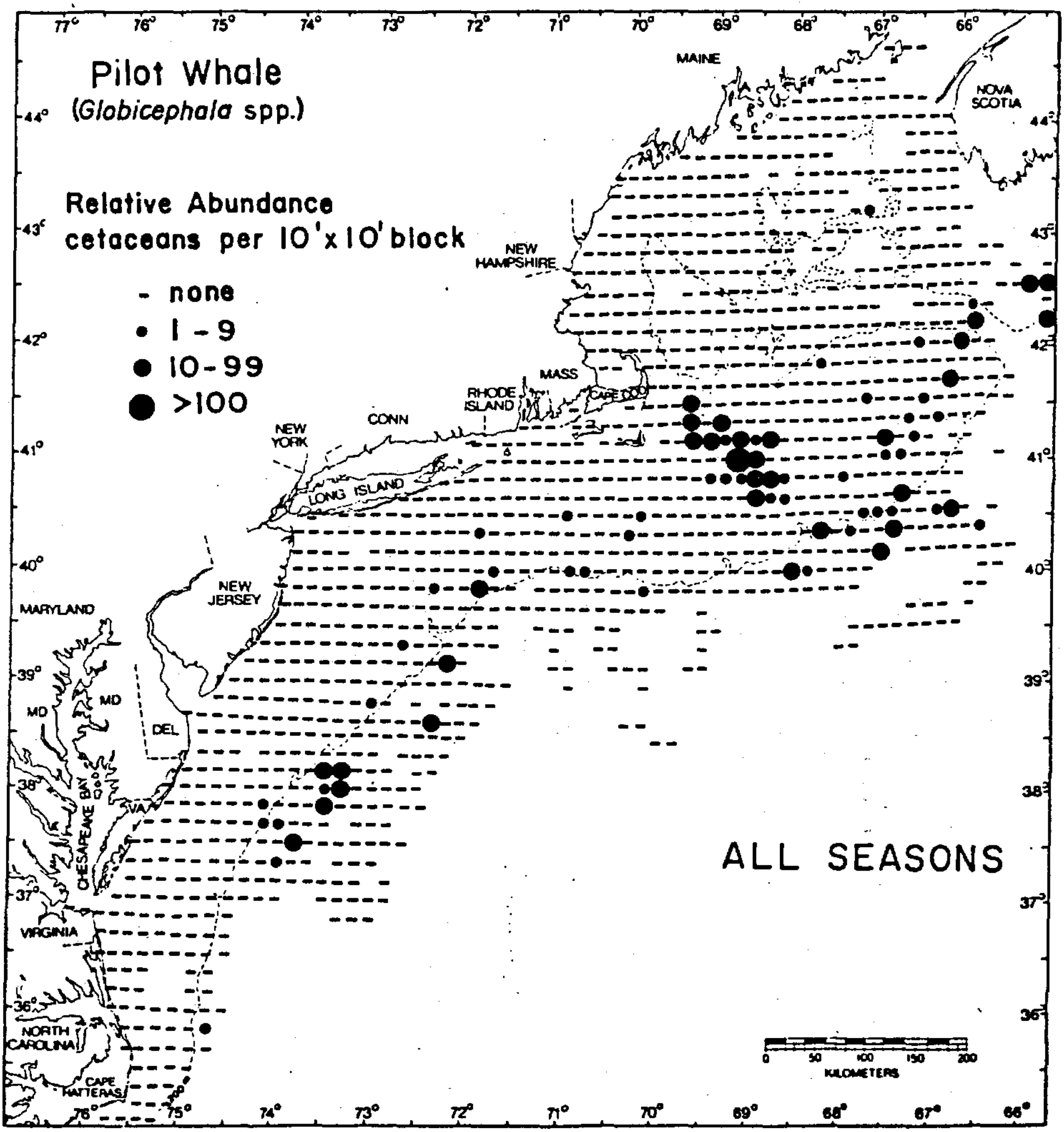

Figure 51. Relative distribution and abundance of Pilot Whales (Globicephala spp.) for all seasons.

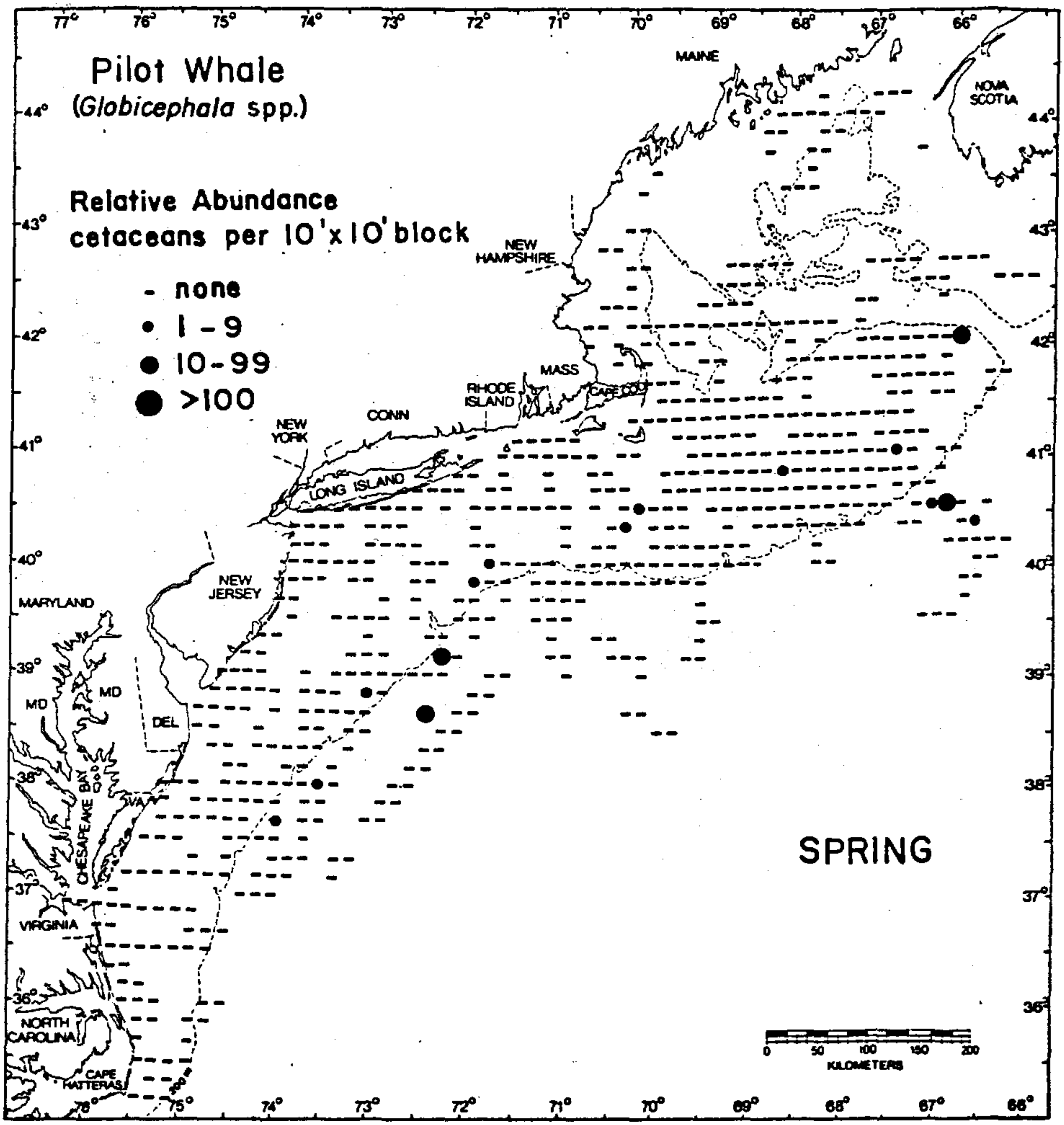

Figure 52. Relative distribution and abundance of Pilot Whales (Globicephala spp.) in spring.

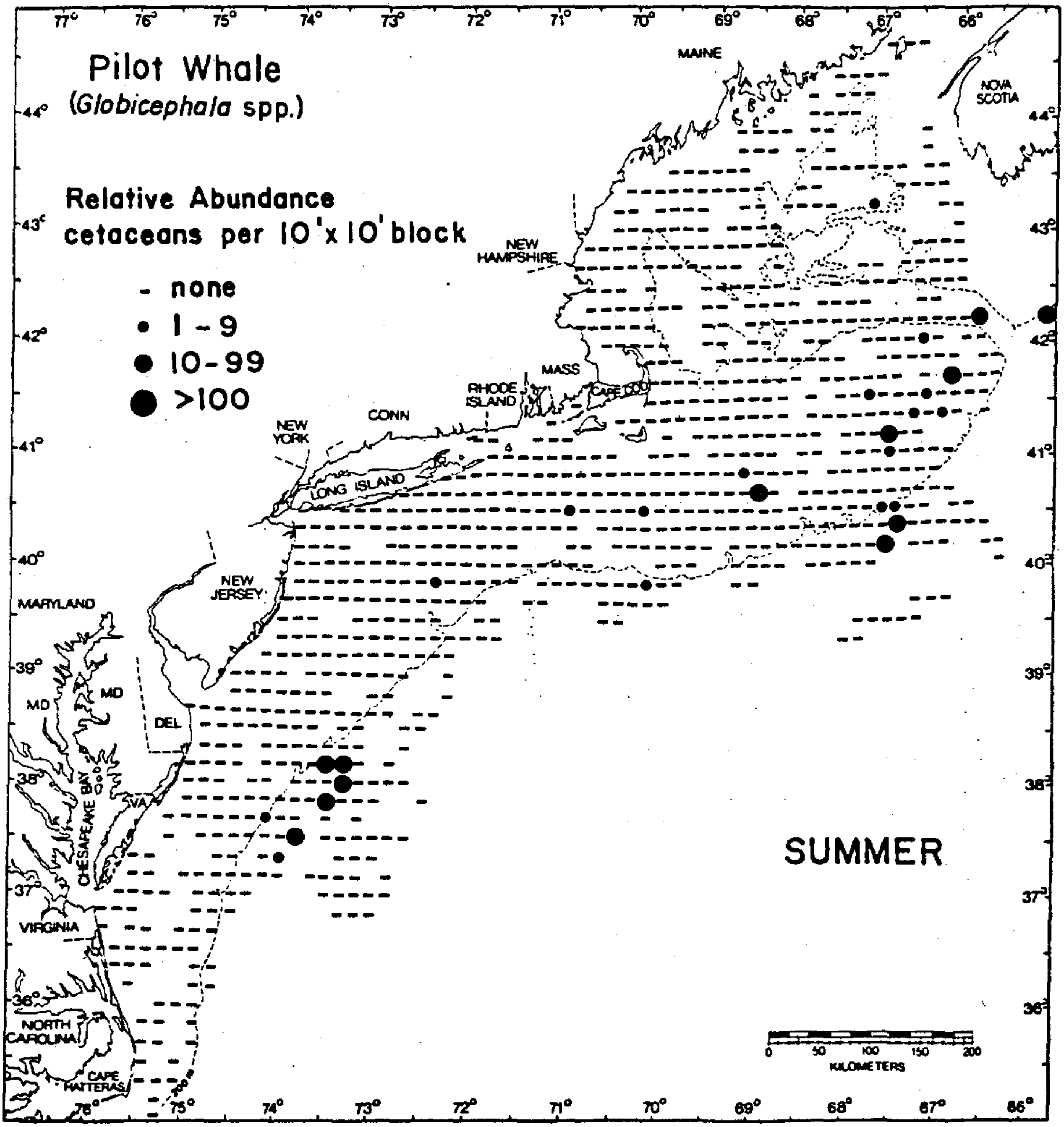

Figure 53. Relative distribution and abundance of Pilot Whales (Globicephala spp.) in summer.

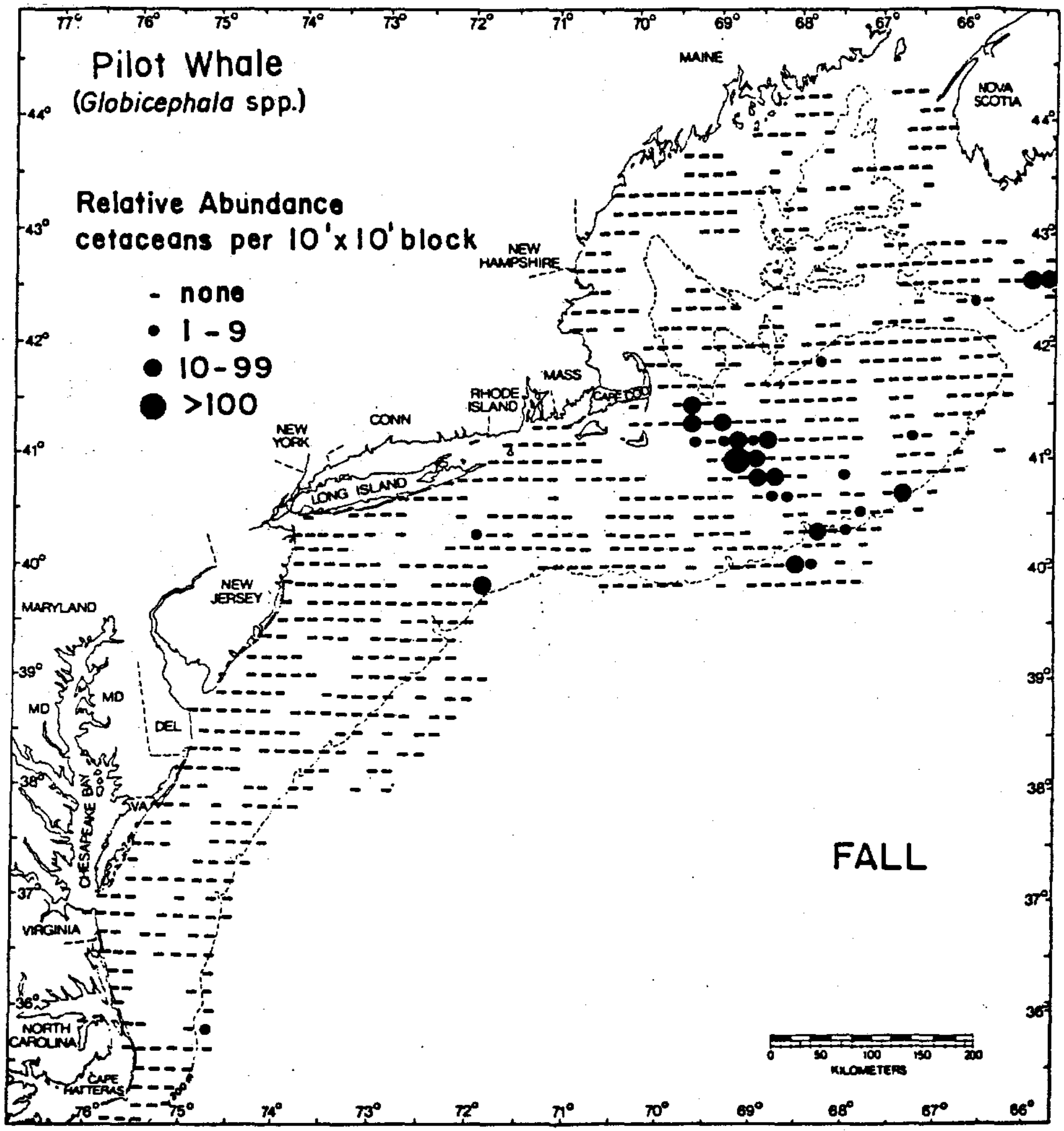

Figure 54. Relative distribution and abundance of Pilot Whales (Globicephala spp.) in fall.

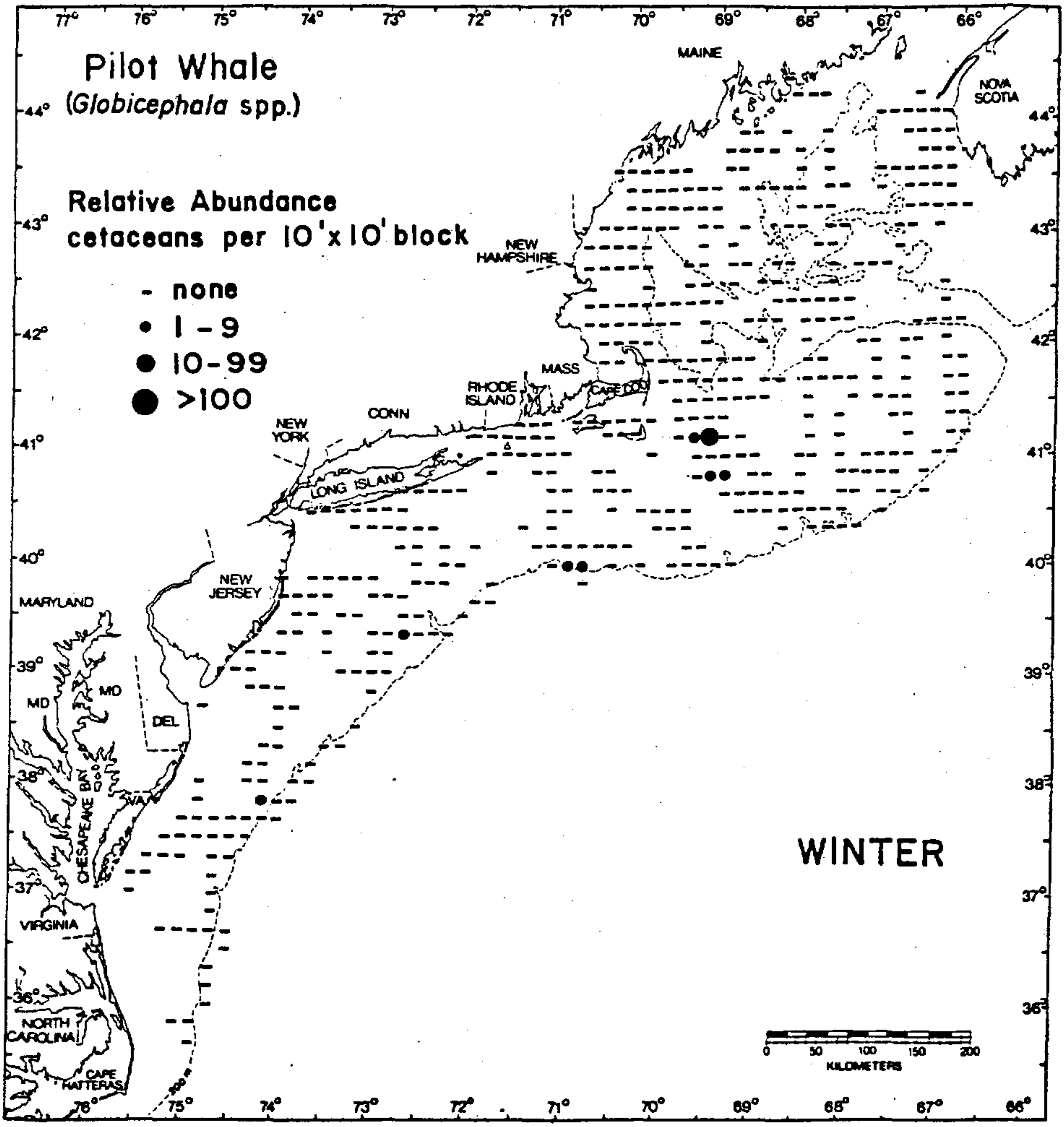

Figure 55. Relative distribution and abundance of Pilot Whales (Globicephala spp.) in winter.

Table 35. Seasonal estimates of Pilot Whale abundance, animals/linear km ($\overline{X} \pm SD$), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	---	---	0.025 (0.375)	0.004 (0.087)
South	---	---	---	0.113 (0.507)
Southwest	0.035 (0.288)	---	---	0.219 (1.428)
Total	0.007 (0.137)	---	0.013 (0.269)	0.080 (0.767)
GEORGES BANK				
Northern edge	---	---	0.013 (0.090)	0.027 (0.171)
Shelf edge	---	---	0.039 (0.344)	0.310 (1.888)
Shoals	---	0.006 (0.082)	0.018 (0.147)	0.045 (0.275)
Central bank	---	0.003 (0.069)	0.053 (0.629)	0.076 (0.738)
Total	---	0.003 (0.066)	0.038 (0.463)	0.106 (0.967)
S. NEW ENGLAND				
Inner shelf	---	---	0.002 (0.042)	---
Mid shelf	0.013 (0.157)	0.006 (0.055)	---	0.098 (0.869)
Outer shelf	0.129 (0.474)	0.030 (0.392)	0.006 (0.076)	---
Total	0.015 (0.164)	0.011 (0.217)	0.001 (0.037)	0.043 (0.578)
MID-ATLANTIC				
Inner shelf	---	---	---	---
Mid shelf	0.016 (0.145)	0.022 (0.284)	---	---
Outer shelf	---	---	0.144 (0.976)	---
Total	0.004 (0.080)	0.006 (0.155)	0.011 (0.274)	---
SLOPE	---	0.029 (0.241)	0.050 (0.371)	0.011 (0.111)

Table 36. Seasonal estimates of Pilot Whale densities, animals/km^2 ($\bar{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central Gulf	---	---	0.0336 (0.4959)	0.0062 (0.1157)
South	---	---	---	0.1502 (0.6704)
Southwest	0.0462 (0.3806)	---	---	0.2904 (1.8875)
Total	0.0104 (0.1816)	---	0.0173 (0.3563)	0.1060 (1.0135)
GEORGES BANK				
Northern edge	---	---	0.0177 (0.1202)	0.0365 (0.2270)
Shelf edge	---	---	0.0524 (0.4546)	0.4102 (2.4952)
Shoals	---	0.0082 (0.1084)	0.0238 (0.1951)	0.0598 (0.3648)
Central bank	---	0.0052 (0.0915)	0.0702 (0.8314)	0.1005 (0.9764)
Total	---	0.0050 (0.0874)	0.0506 (0.6131)	0.1409 (1.2795)
S. NEW ENGLAND				
Inner shelf	---	---	0.0034 (0.0567)	---
Mid shelf	0.0183 (0.2082)	0.0087 (0.0728)	---	0.1304 (1.1487)
Outer Shelf	0.1717 (0 6271)	0.0403 (0.5184)	0.0079 (0.1005)	---
Total	0.0199 (0.2168)	0.0153 (0.2868)	0.0023 (0.0496)	0.0574 (0.7643)
MID-ATLANTIC				
Inner shelf	---	---	---	---
Mid shelf	0.0216 (0.1926)	0.0297 (0.3760)	---	---
Outer shelf	---	---	0.1908 (1.2900)	---
Total	0.0065 (0.1509)	0.0088 (0.2050)	0.0149 (0.3621)	---
SLOPE	---	0.0389 (0.3190)	0.0667 (0.4909)	0.0151 (0.1471)

Harbor Porpoise (Phocoena phocoena)

A review of the distribution and abundance of P. phocoena throughout its range is provided by Prescott and Fiorelli (1980) and Prescott et al. (1981). In the western Atlantic, harbor porpoise are found from the Davis Strait south to at least Cape Hatteras (Sergeant and Fisher 1957; Sergeant et al. 1970; Mercer 1973; Katona et al. 1977; Hain et al. 1981).

Throughout our study area, the locations most extensively studied for harbor porpoise are the Gulf of Maine and Bay of Fundy (Gaskin et al. 1975; Gaskin 1977; Kraus et al. 1983). Regional accounts of distribution and abundance to Cape Hatteras are provided by Katona et al. (1977); Hain et al. (1981); CeTAP 1982). Harbor porpoise are distributed throughout the Gulf of Maine throughout the year but most abundant spring to fall (CeTAP 1982). Throughout the colder months the range extends farther south to include Georges Bank and the shelf waters to Chesapeake Bay.

Most of our shipboard sightings occur spring through fall in the northern Gulf of Maine (Figs. 56-58) with greatest abundances in the northern Central Gulf (Table 37). We had only one sighting prior to 1982 (Powers et al. 1982), the remainder of the sightings have been since that period. Due to the coastal habits of the harbor porpoise, and difficulties in detectability, Powers et al. (1982) did not feel that our surveys could adequately monitor the species.

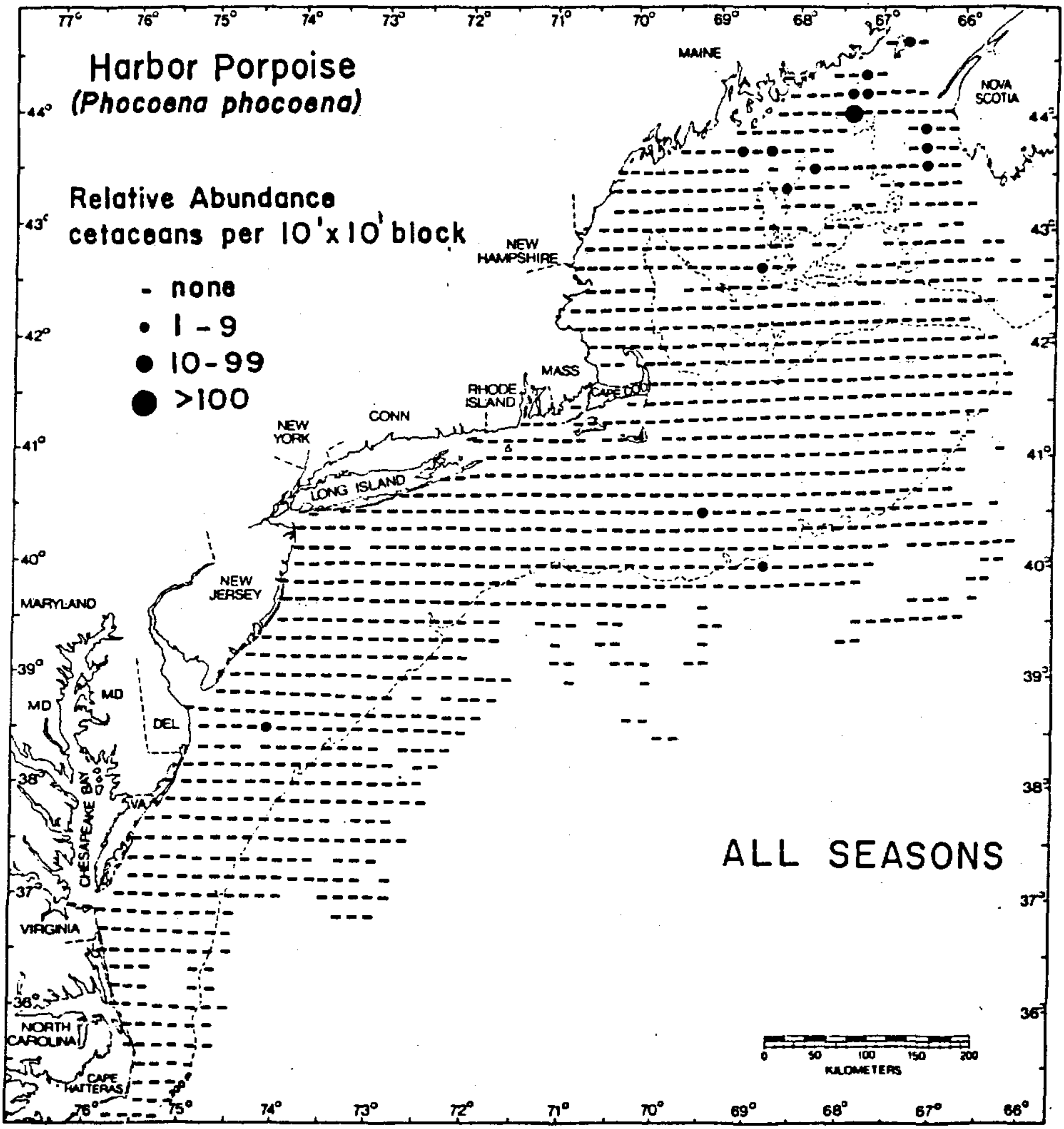

Figure 56. Relative distribution and abundance of Harbor Porpoise for all seasons.

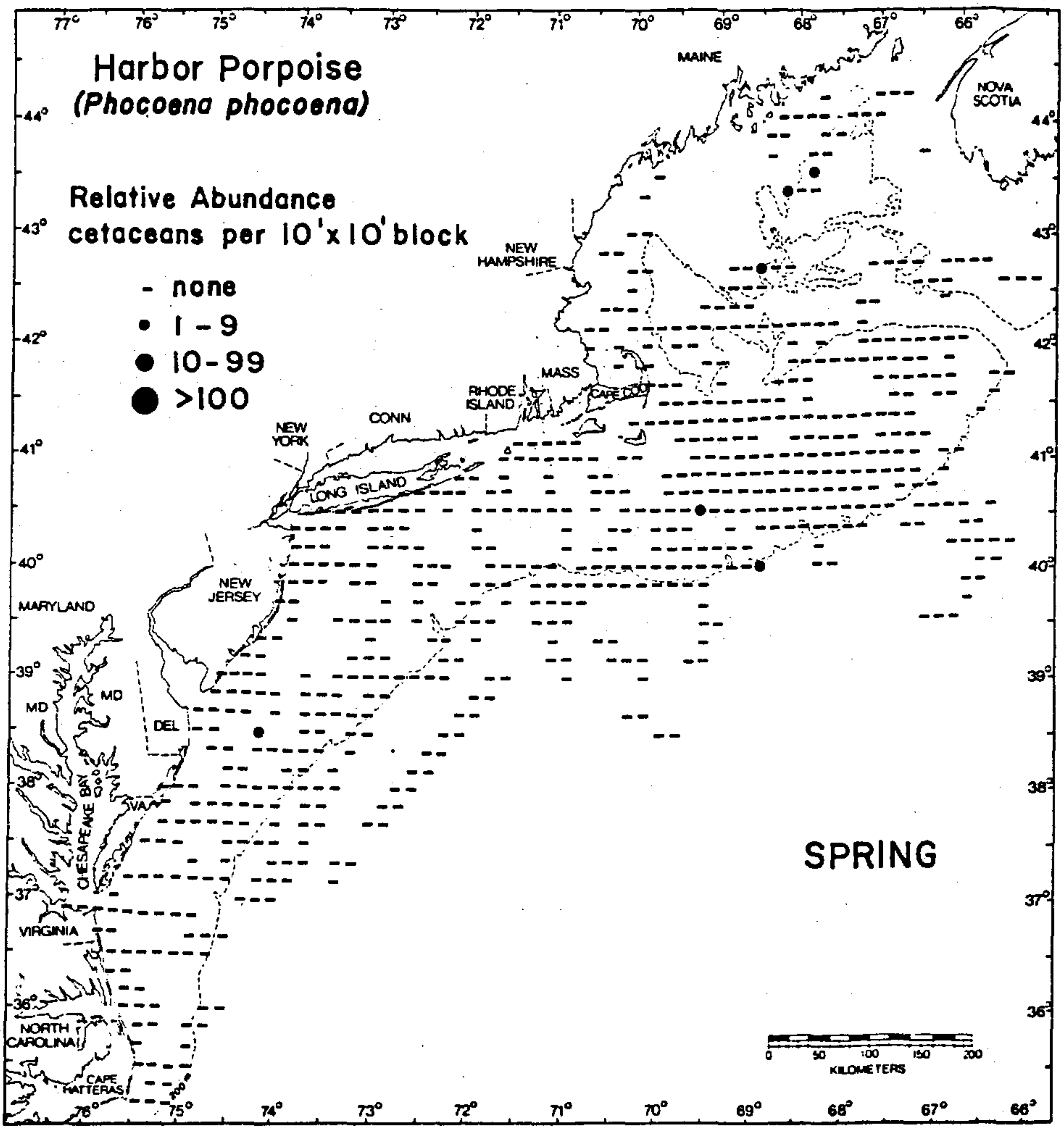

Figure 57. Relative distribution and abundance of Harbor Porpoise in spring.

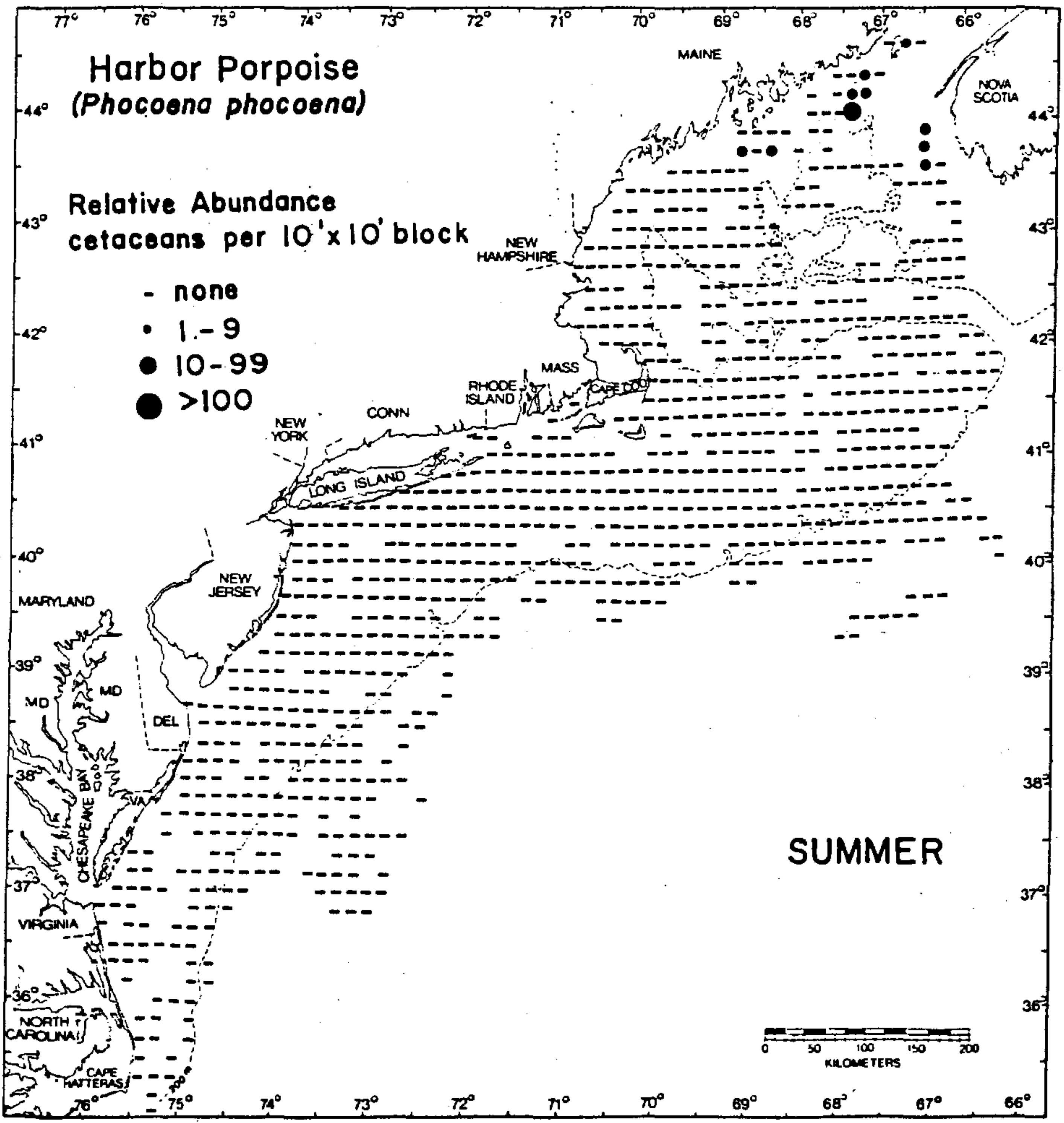

Figure 58. Relative distribution and abundance of Harbor Porpoise in summer.

Table 37. Seasonal estimates of Harbor Porpoise abundance, animals/linear km ($\bar{X}$+SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	---	0.014 (0.129)	0.015 (0.153)	---
South	---	---	---	---
Southwest	---	---	---	---
Total	---	0.006 (0.090)	0.008 (0.110)	---
GEORGES BANK				
Northern edge	---	---	---	---
Shelf edge	---	0.006 (0.059)	---	0.002 (0.025)
Shoals	---	---	---	---
Central bank	---	---	---	0.014 (0.194)
Total	---	<0.001 (0.022)	---	0.005 (0.116)
S. NEW ENGLAND				
Inner shelf	---	0.002 (0.029)	---	---
Mid shelf	---	---	---	---
Outer shelf	---	---	---	---
Total	---	<0.001 (0.016)	---	---
MID-ATLANTIC				
Inner shelf	---	0.007 (0.103)	---	---
Mid shelf	---	---	---	---
Outer shelf	---	---	---	---
Total	---	0.004 (0.075)	---	---
SLOPE	---	---	---	---

Sperm Whale (Physeter macrocephalus)

P. macrocephalus feed primarily on squid (Caldwell et al. 1966; Gambell 1972), mainly deepwater species (Katona et al. 1977). Deep-sea fishes and octopus are also occasionally taken (Leatherwood et al. 1976).

P. macrocephalus is an endangered species which is widely distributed throughout the deep waters of the North Atlantic between 30°00' and 60°00'N (Brown 1958). Sightings are concentrated along the edge of the continental shelf east of Nova Scotia (Sutcliffe and Brodie 1977) and throughout slope waters of the eastern United States (Katona et al. 1977). Traditional whaling grounds occurred southeast of the Grand Banks, off the Carolinas and to the southwest Caribbean (Leatherwood et al. 1976; Gunter 1954), and Gulf of Mexico (Fritts and Reynolds 1981).

The distribution of this species in our study area is generally along the shelf-edge and seaward into slope waters in all seasons (Hain et al. 1981; CeTAP 1982; Powers et al. 1982). In winter, P. macrocephalus are concentrated in the southernmost portion of our study area east of Cape Hatteras (CeTAP 1982). Although sperm whales are recorded throughout the year, peak numbers occurred in spring and summer along the shelf-edge along the Mid-Atlantic Bight, and on the shelf south of Nantucket May to November and on Georges Bank during the same period (Hain et al. 1981; CeTAP 1982). Sightings also occur in the Gulf of Maine, in the deepwater Northeast Channel between northeast Georges Bank and Browns Bank in the fall. These shelf sightings are correlated in timing with intrusions of warmer slope water onto the shelf, as well as movements of squid spp. into shallower, shelf waters. The shelf-edge, slope water distribution suggests that this species occurs well beyond the seaward limits of our study area. Throughout the year, the area along the Mid-Atlantic Bight shelf-edge (100 m $\geq$ 1000 m) is an area of concentration (Hain et al. 1981; CeTAP 1982).

Our sightings of sperm whales were centered in the SNE-MA and slope (Figs. 59-63; Tables 39-40), spring and summer. Sightings have also occurred in the Gulf of Maine, inside the Northeast Channel each fall during this study (Fig. 62).

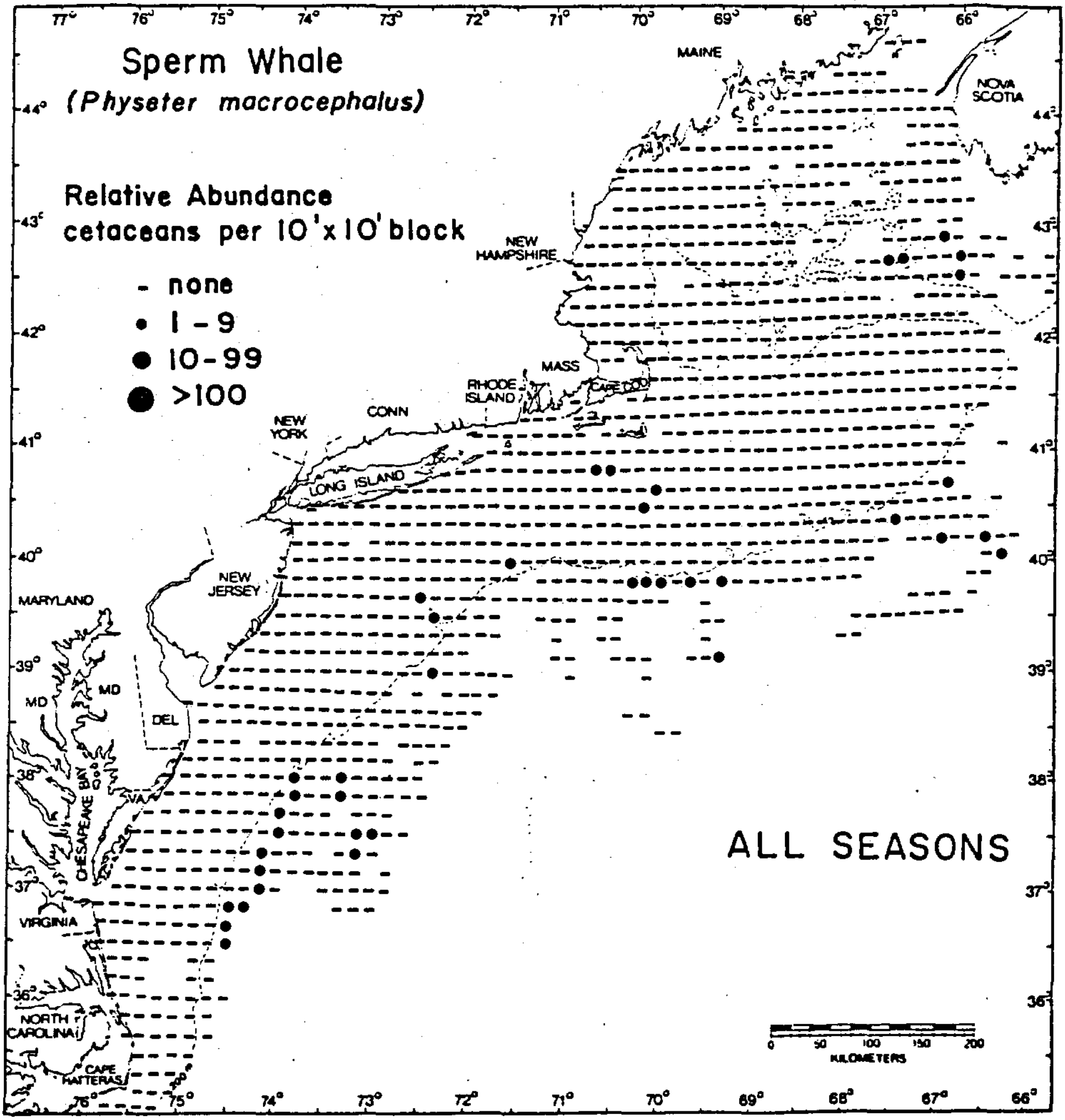

Figure 59. Relative distribution and abundance of Sperm Whales for all seasons.

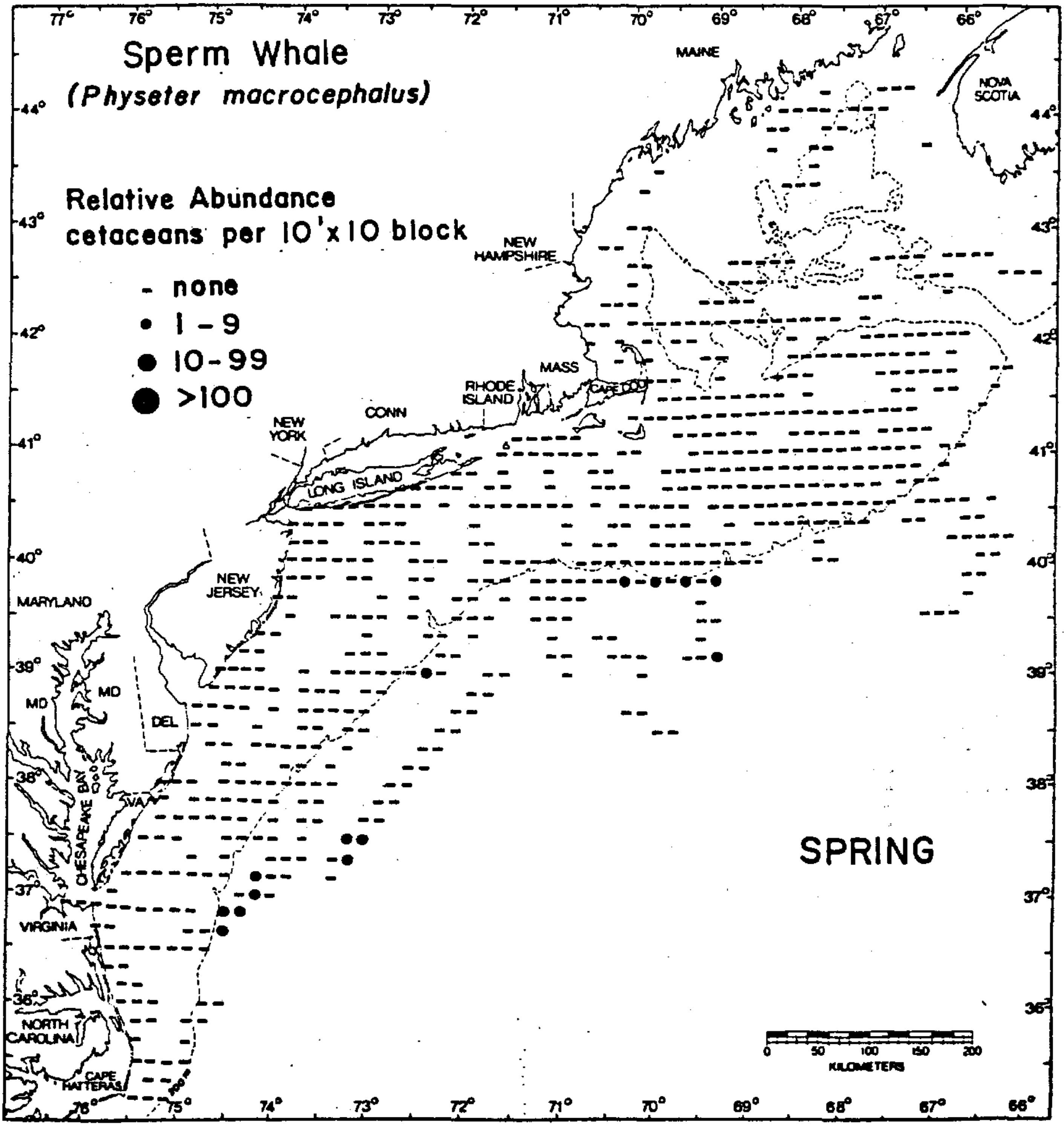

Figure 60. Relative distribution and abundance of Sperm Whales in spring.

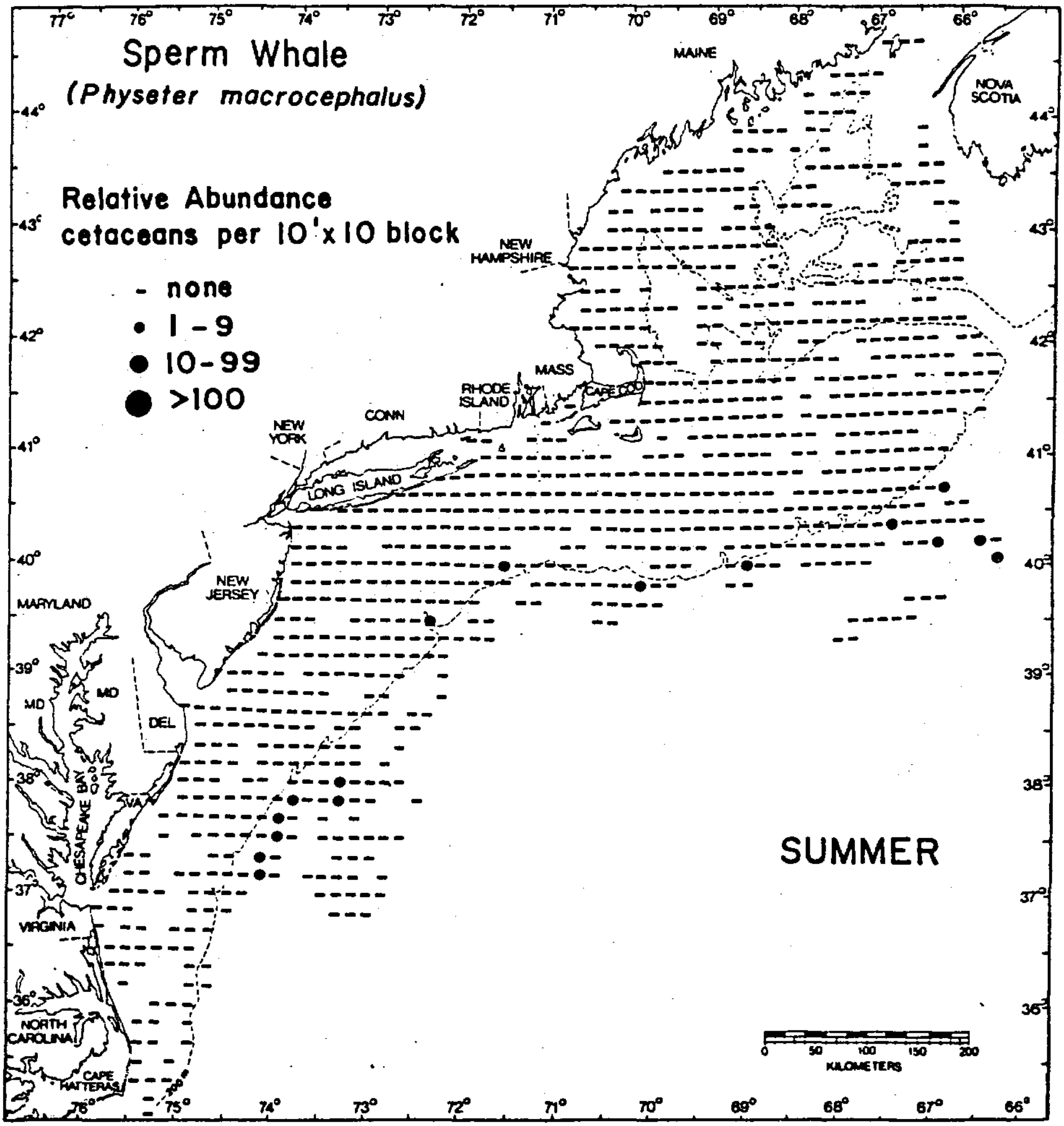

Figure 61. Relative distribution and abundance of Sperm Whales in summer.

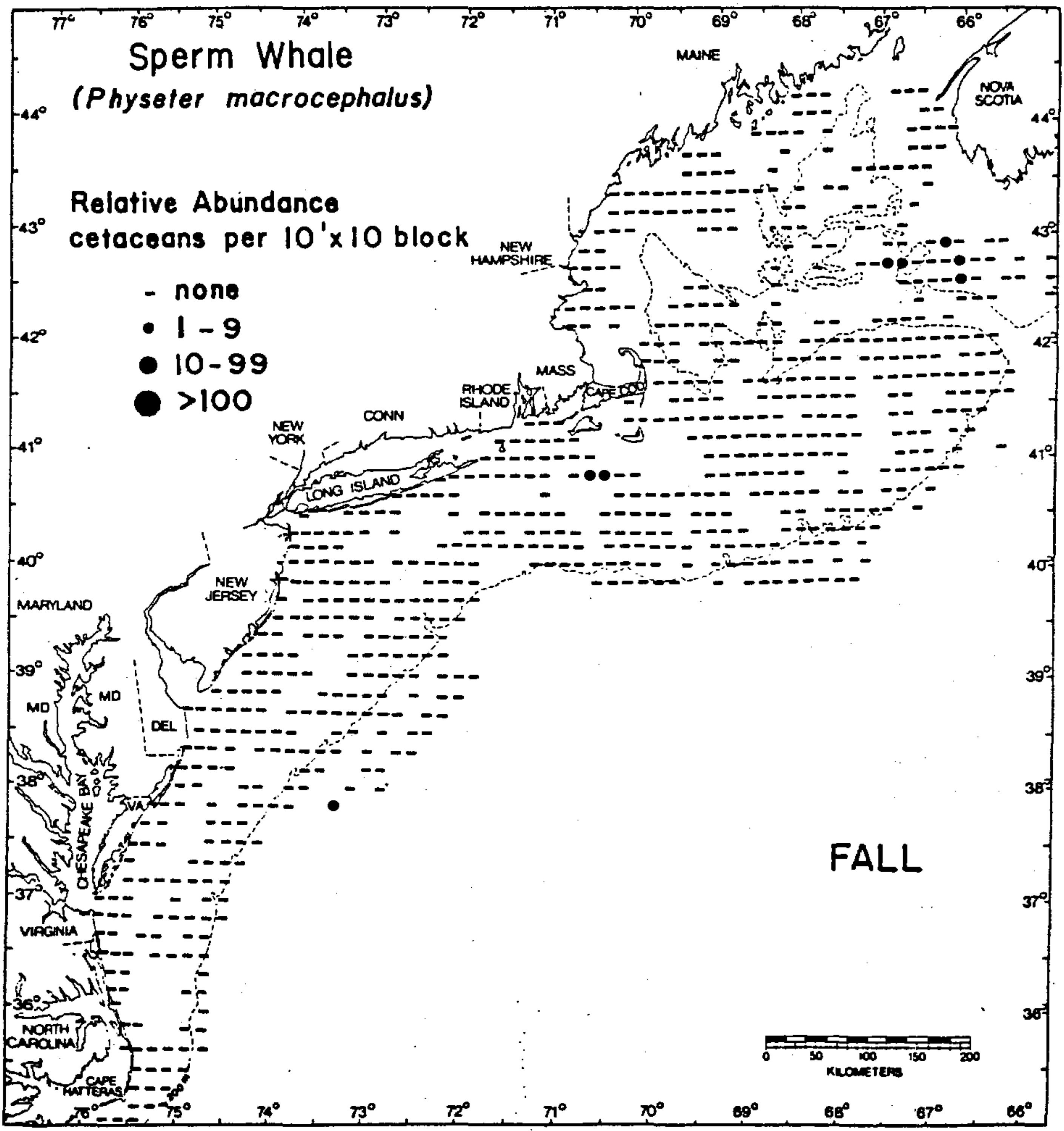

Figure 62. Relative distribution and abundance of Sperm Whales in fall.

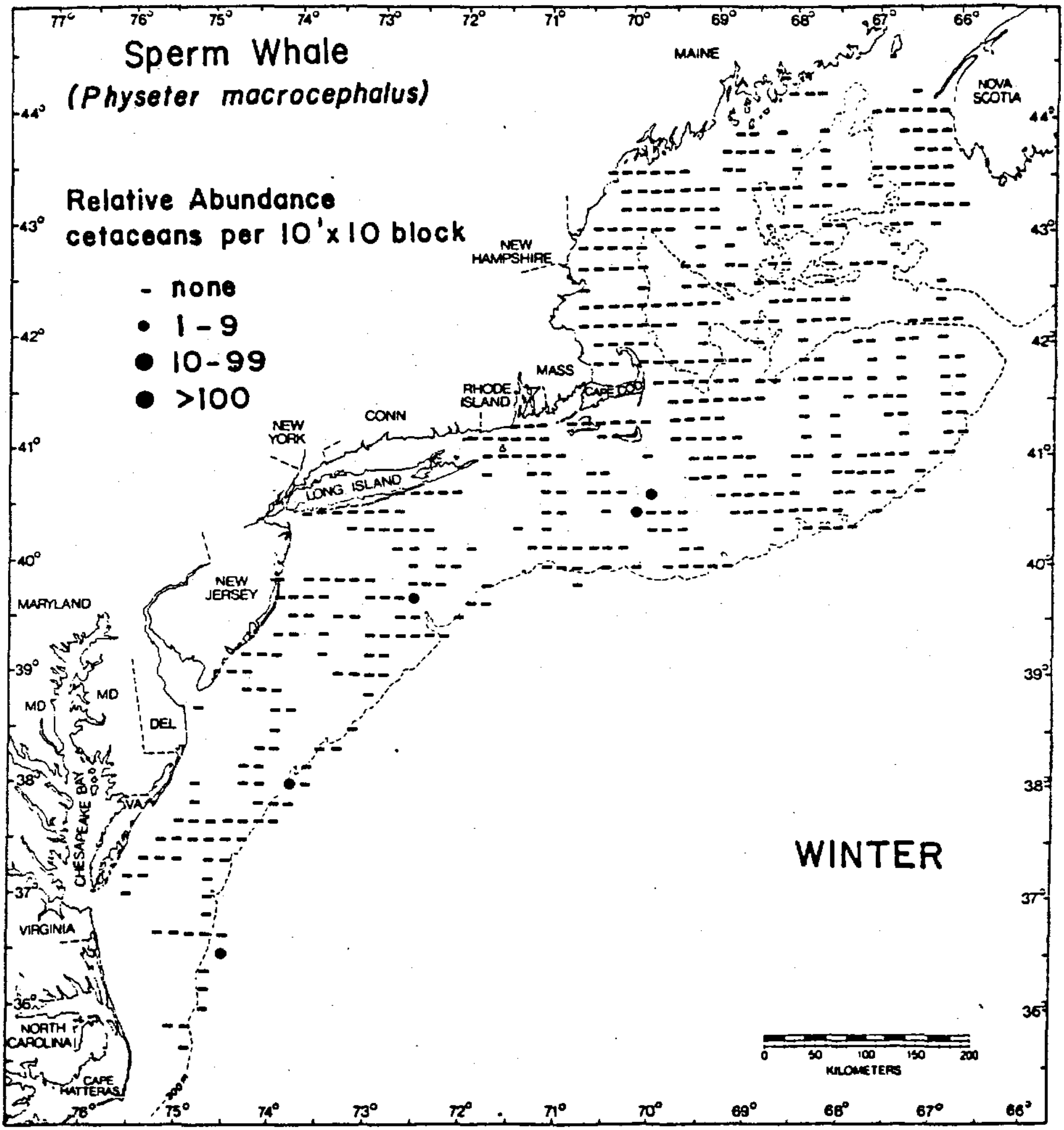

Figure 63. Relative distribution and abundance of Sperm Whales in winter.

Table 39. Seasonal estimates of Sperm Whale abundance, animals/linear km ($\bar{X} \pm SD$), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	---	---	---	0.002 (0.036)
South	---	---	---	---
Southwest	---	---	---	---
Total	---	---	---	0.001 (0.027)
GEORGES BANK				
Northern edge	---	---	---	---
Shelf edge	---	---	0.005 (0.036)	---
Shoals	---	---	---	---
Central bank	---	---	---	---
Total	---	---	0.001 (0.015)	---
S. NEW ENGLAND				
Inner shelf	0.006 (0.065)	---	---	0.002 (0.021)
Mid shelf	0.006 (0.098)	---	<0.001 (0.014)	---
Outer shelf	---	0.013 (0.071)	0.001 (0.019)	---
Total	0.006 (0.083)	0.003 (0.039)	<0.001 (0.011)	<0.001 (0.012)
MID-ATLANTIC				
Inner shelf	---	---	---	---
Mid shelf	---	---	---	---
Outer shelf	0.021 (0.105)	---	---	---
Total	0.004 (0.048)	---	---	---
SLOPE	---	0.022 (0.125)	0.021 (0.127)	---

Table 40. Seasonal estimates of Sperm Whale densities, animals/km^2 ($\overline{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central Gulf	---	---	---	0.0014 (0.0206)
South	---	---	---	---
Southwest	---	---	---	---
Total	---	---	---	0.0008 (0.0154)
GEORGES BANK				
Northern edge	---	---	---	---
Shelf edge	---	---	0.0032 (0.0205)	---
Shoals	---	---	---	---
Central bank	---	---	---	---
Total	---	---	0.0006 (0.0089)	---
S. NEW ENGLAND				
Inner shelf	0.0039 (0.0369)	---	---	0.0011 (0.0124)
Mid shelf	0.0038 (0.0561)	---	0.0004 (0.0080)	---
Outer shelf	---	0.0074 (0.0407)	0.0008 (0.0107)	---
Total	0.0036 (0.0471)	0.0022 (0.0224)	0.0003 (0.0067)	0.0003 (0.0070)
MID-ATLANTIC				
Inner shelf	---	---	---	---
Mid shelf	---	---	---	---
Outer shelf	0.0121 (0.0598)	---	---	---
Total	0.0025 (0.0274)	---	---	---
SLOPE	---	0.0126 (0.0711)	0.0121 (0.0721)	---

Beaked Whales (Mesoplodon spp.)

Sightings identified as Mesoplodon species were identified on two occasions in our data. One sighting occurred along the shelf edge (Table 41) at 40°08'N, 68°32'W (Appendix I) of three individuals. A second sighting of a single individual occurred as a general observation (therefore not in Table 41) at 41°30'N, 69°00'W (Appendix I)

CeTAP (1982) generally considered beaked whales as widely distributed over the shelf-edge and seaward between Cape Hatteras and Georges Bank. Carter et al. (1981) observed thirty-seven beaked whale sightings (Ziphiidae) between 100 and 2050 fathoms and sea surface temperatures between 8.1°C and 27.6°C. Strandings have occurred from the Gulf of Mexico (Schmidly 1981) to Nova Scotia (Katona et al. 1977).

Table 41. Seasonal estimates of unidentified beaked-whale abundance, animals/linear km ($\bar{X}$+SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	---	---	---	---
South	---	---	---	---
Southwest	---	---	---	---
Total	---	---	---	---
GEORGES BANK				
Northern edge	---	---	---	---
Shelf edge	---	---	---	0.005 (0.062)
Shoals	---	---	---	---
Central bank	---	---	---	---
Total	---	---	---	0.001 (0.027)
S. NEW ENGLAND				
Inner shelf	---	---	---	---
Mid shelf	---	---	---	---
Outer shelf	---	---	---	---
Total	---	---	---	---
MID-ATLANTIC				
Inner shelf	---	---	---	---
Mid shelf	---	---	---	---
Outer shelf	---	---	---	---
Total	---	---	---	---
SLOPE	---	---	---	---

Minke Whale (Balaenoptera acutorostrata)

B. acutorostrata is a secondary and tertiary carnivore which feeds primarily on euphausiids in the Antarctic (Mitchell 1974a, 1975), but mostly on schooling fishes in the North Atlantic (Mitchell 1974b; 1974c). Spring and summer concentrations of minkes along the eastern Canadian coast correspond to concentrations of capelin, cod and herring (Leatherwood et al. 1976). In our area the Minke Whale eats fish, especially herring and sand lance (Katona et al. 1977).

The range of Minke Whale extends from Virginia to Baffin Island during spring and summer (Sergeant 1963; Leatherwood et al. 1976; Katona et al. 1977), but sightings south of Nova Scotia in summer are concentrated in the western Gulf of Maine, the Great South Channel and western Georges Bank and into SNE waters (north of 40°00'N) (Hain et al. 1981; CeTAP 1982). No winter sightings were reported for this species southwest of Nantucket (Hain et al. 1981), although winter sightings have been reported from the Gulf of Mexico (Gunter 1954), northeast Florida and the Bahamas (Katona et al. 1977), and this report.

Within our study area, B. acuturostrata occupies wide regions of the shelf, especially in spring and summer. The area of greatest abundance is described by CeTAP (1982) as a "U" shaped distribution which extends east from Montauk Pt., Long Island, southeast of Nantucket Shoals to the Great South Channel, then northward along the outside of Cape Cod to Stellwagen Bank and Jeffreys Ledge. Sighting frequency within this area is greatest from April to October (Hain et al. 1981; Powers et al. 1982). In summer the range extends north to the Bay of Fundy. Their range is contracted in fall and winter. Only one fall sighting, and no winter sightings, were reported south of 40°00'N by CeTAP (1982) for this species.

B. acutorostrata was seen during summer and fall, on Georges Bank and in the Gulf of Maine (Figs. 64-68; Tables 42-43). Winter sightings are difficult due to detectability of this species, as well as a general decline in number during that season (CeTAP 1982). Most sightings occurred north of 40°00'N latitude in spring and summer (Figs. 65-66), although three sightings occurred as far south as Virginia in fall and winter (Figs. 67-68). Sightings occurred within the "U-shaped" region described by CeTAP (1982); however greatest abundances occurred on the central portion and shelf-edge of GB (Tables 42-43).

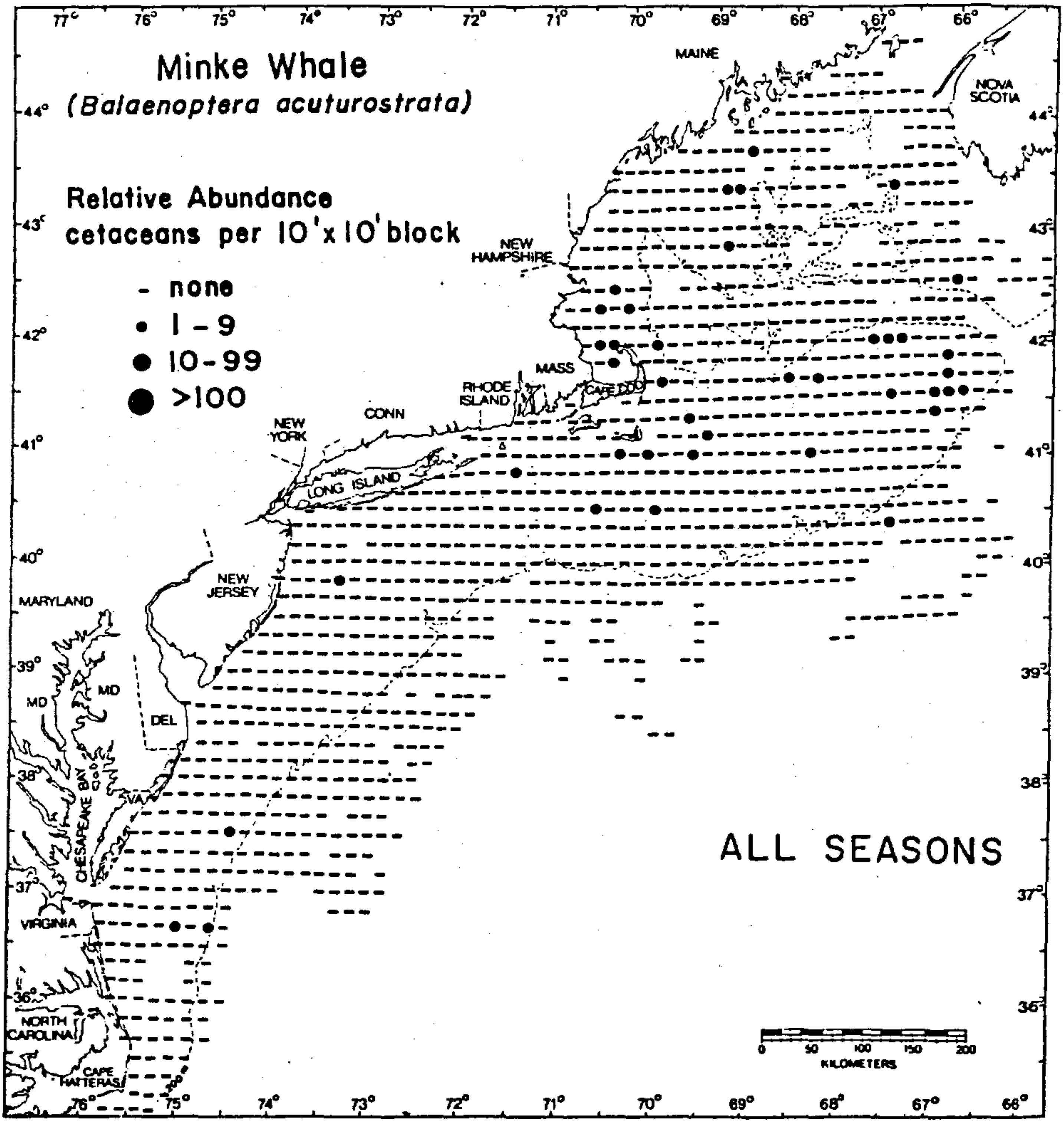

Figure 64. Relative distribution and abundance of Minke Whales for all seasons.

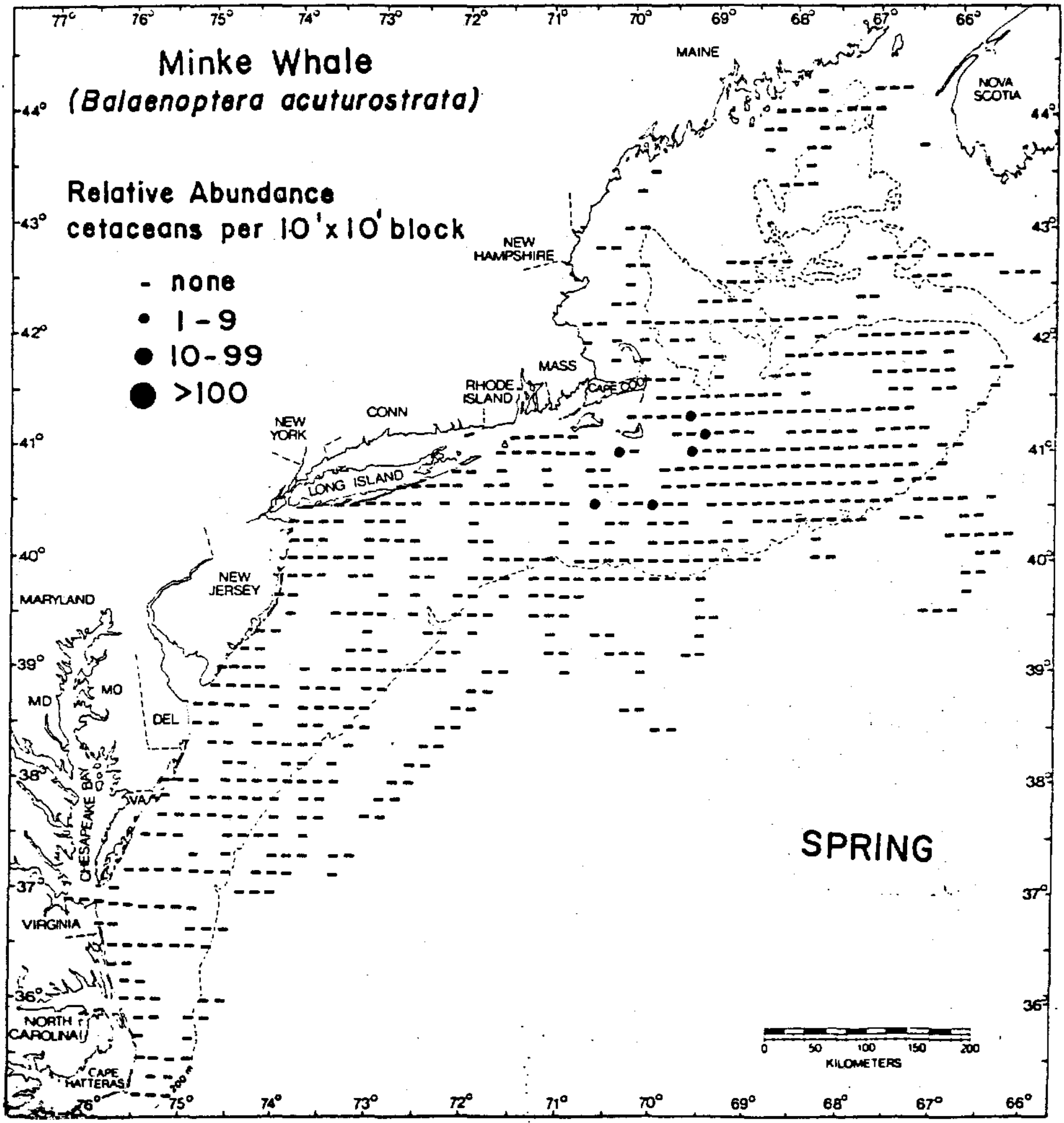

Figure 65. Relative distribution and abundance of Minke Whales in spring.

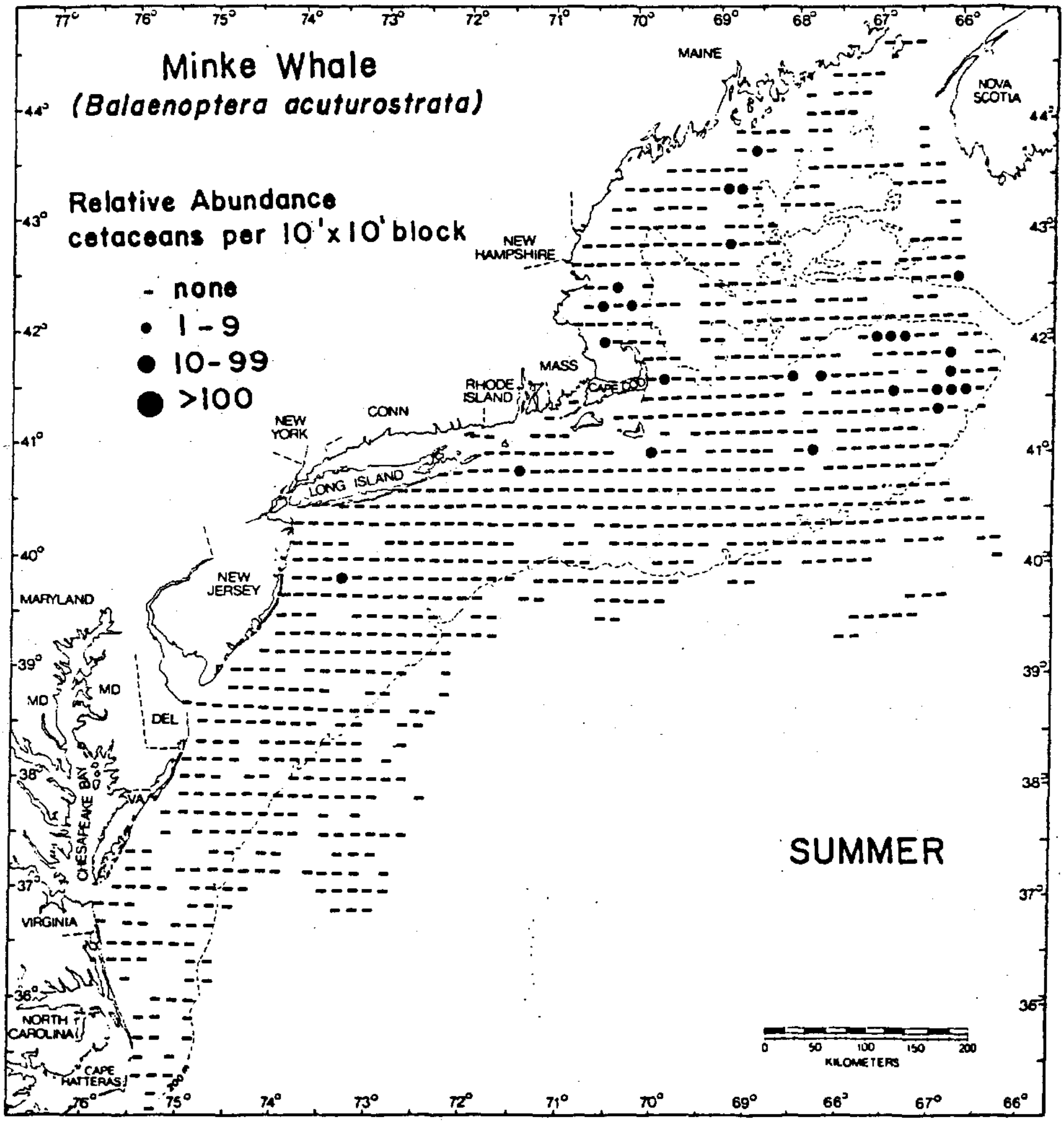

Figure 66. Relative distribution and abundance of Minke Whales in summer.

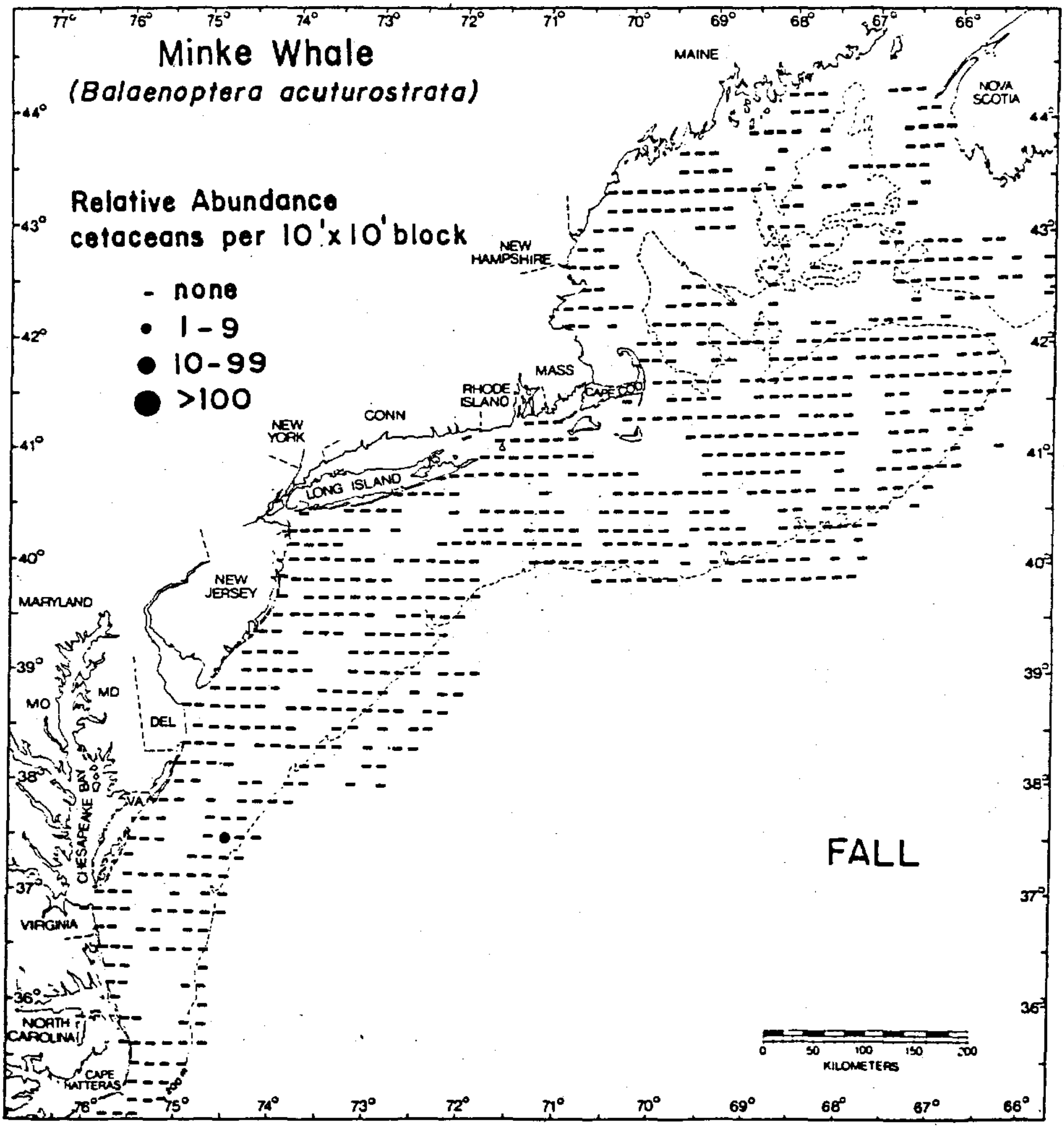

Figure 67. Relative distribution and abundance of Minke Whales in fall.

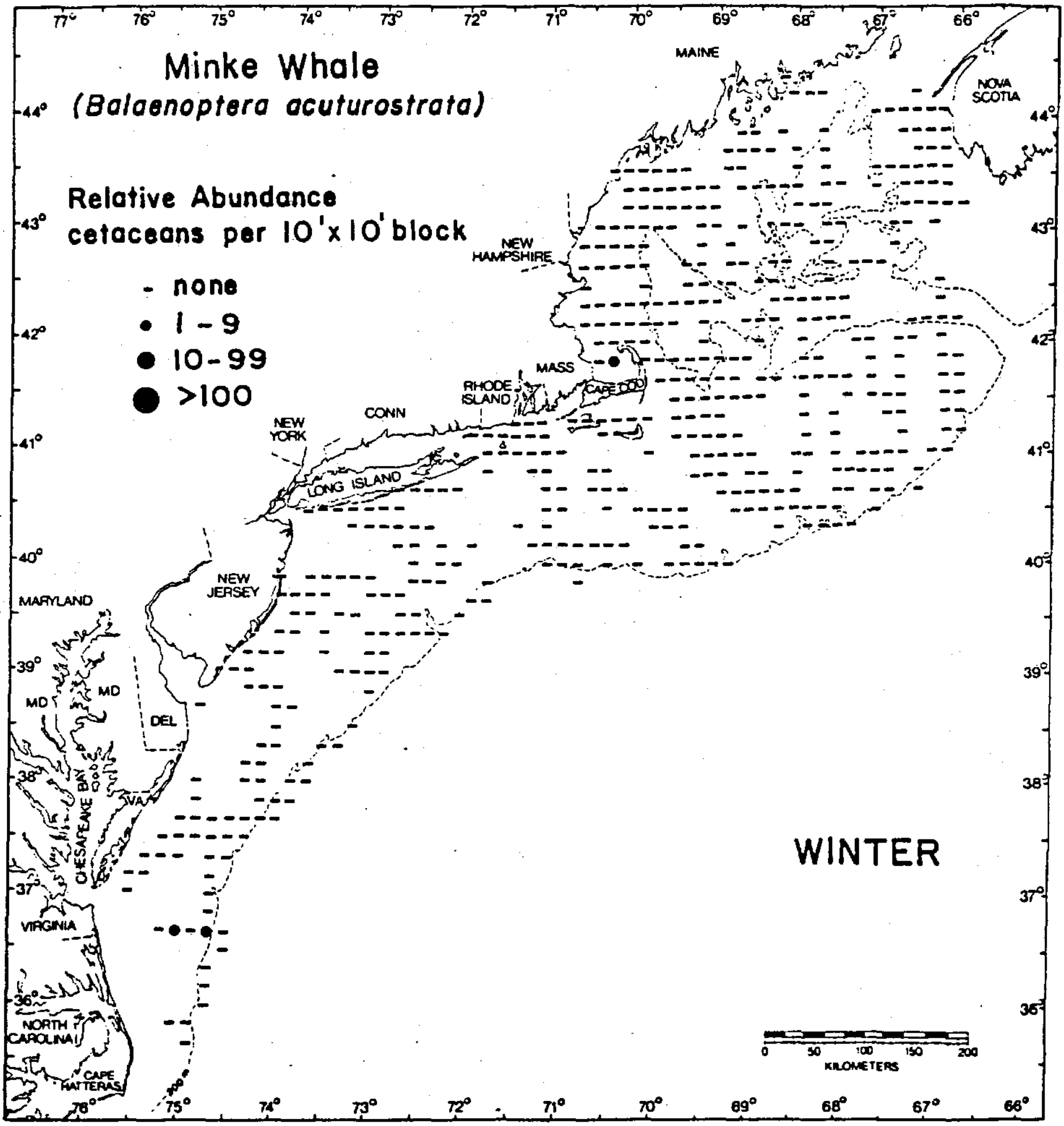

Figure 68. Relative distribution and abundance of Minke Whales in winter.

Table 42. Seasonal estimates of Minke Whale abundance, animals/linear km ($\bar{X} \pm SD$), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	<0.001 (0.010)	---	0.003 (0.031)	<0.001 (0.011)
South	---	---	0.004 (0.048)	---
Southwest	---	0.003 (0.027)	0.002 (0.024)	0.001 (0.021)
Total	<0.001 (0.008)	0.001 (0.016)	0.003 (0.032)	<0.001 (0.013)
GEORGES BANK				
Northern edge	---	---	0.004 (0.031)	---
Shelf edge	---	---	0.005 (0.065)	0.003 (0.041)
Shoals	---	---	0.001 (0.018)	---
Central bank	---	---	0.005 (0.047)	---
Total	---	---	0.004 (0.044)	<0.001 (0.018)
S. NEW ENGLAND				
Inner shelf	---	---	0.001 (0.021)	---
Mid shelf	---	0.002 (0.024)	---	---
Outer shelf	---	0.001 (0.021)	---	0.001 (0.017)
Total	---	0.001 (0.018)	<0.001 (0.013)	<0.001 (0.008)
MID-ATLANTIC				
Inner shelf	0.001 (0.019)	---	---	---
Mid shelf	0.003 (0.026)	---	---	---
Outer shelf	---	---	---	0.002 (0.023)
Total	0.001 (0.019)	---	---	<0.001 (0.011)
SLOPE	---	---	---	---

Table 43. Seasonal estimates of Minke Whale densities, animals/km^2 ($\overline{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central Gulf	0.0010 (0.0239)	---	0.0069 (0.0710)	0.0014 (0.0265)
South	---	---	0.0099 (0.1105)	---
Southwest	---	0.0070 (0.0624)	0.0054 (0.0058)	0.0038 (0.0485)
Total	0.0006 (0.0190)	0.0023 (0.0365)	0.0068 (0.0730)	0.0018 (0.0317)
GEORGES BANK				
Northern edge	---	---	0.0106 (0.0722)	---
Shelf edge	---	---	0.0135 (0.1485)	0.0089 (0.0939)
Shoals	---	---	0.0030 (0.0410)	---
Central bank	---	---	0.0129 (0.1077)	---
Total	---	---	0.0102 (0.1019)	0.0017 (0.0419)
S. NEW ENGLAND				
Inner shelf	---	---	0.0028 (0.0483)	---
Mid shelf	---	0.0065 (0.0547)	---	---
Outer shelf	---	0.0037 (0.0477)	---	0.0029 (0.0401)
Total	---	0.0036 (0.0427)	0.0011 (0.0301)	0.0007 (0.0198)
MID-ATLANTIC				
Inner shelf	0.0038 (0.0433)	---	---	---
Mid shelf	0.0068 (0.0612)	---	---	---
Outer shelf	---	---	---	0.0051 (0.0531)
Total	0.0039 (0.0452)	---	---	0.0011 (0.0251)
SLOPE	---	---	---	---

Fin Whale (Balaenoptera physalus)

B. physalus are secondary and tertiary, euryphagous carnivores in the northern hemisphere, feeding on euphausiids, copepods and schooling fishes, depending on availability (Mitchell 1974c; Sergeant 1977; Brodie et al. 1978; Katona et al. 1977; Overholtz and Nicolas 1979; Watkins and Schevill 1979; Mayo 1980). In our study area schooling fishes are the apparent, principal food preference, principally Clupea harengus and Ammodytes americanus. Herring has been a major diet component (Katona 1975; Katona et al 1975; 1977). They are still a likely prey in the Gulf of Maine (Mullane and Rivers 1982); however due to a decline in herring stocks (Grosslein et al. 1980; Anthony and Waring 1980), a subsequent increase in sand lance in our study area (Sherman et al. 1981), and observed feeding of Ammodytes by B. physalus (Overholtz and Nicolas 1979; Mayo 1980), Ammodytes may now be the dominant food item in our study area. Surface-feeding fin whales occurred principally from the Great South Channel and western Georges Bank north to Jeffreys Ledge, centered along the 100 m contour. CeTAP (1982) recorded a second major feeding area east of Montauk Point, Cox Ledge area.

B. physalus is the most abundant and widely distributed both spatially and temporally over the shelf waters of the western North Atlantic (Leatherwood et al. 1976; Reeves and Brownnel 1982). An increase in fin whale sightings occurs spring-summer through fall (Hain et al. 1981; CeTAP 1982; Powers et al. 1982). The areas of Jeffreys Ledge, Stellwagen Bank and the Great South Channel have the greatest concentrations of whales during these seasons (CeTAP 1982). The majority of sightings in the Mid-Atlantic Bight also occurs spring and summer (CeTAP 1982; Powers and Payne 1983). Rowlett (1980) also reported sightings of B. physalus from April to September between Delaware Bay and Baltimore Canyon with most sightings from April to June. Although a decrease in on-shelf fin whales occurs in winter, B. physalus does over winter on Stellwagen Bank and along the Great South Channel (Hain et al. 1981), apparently at abundance levels similar to other seasons (CeTAP 1982). However, Leatherwood et al. (1976) suggested that most fin whales in the western North Atlantic move south and offshore during winter months. CeTAP (1982) also suggested that a portion of the fin whale population off the northeastern United States may have a general northward shift in spring from a wintering area off the Delmarva Peninsula with a subsequent southward return in fall.

Our data support the widespread shelf distribution (Figs. 69-73) with summer concentrations in the southwest Gulf of Maine between Jeffreys Ledge and Great South Channel (Fig. 71). Densities were greatest in the southwest GOM (NMFS/NEFC strata No. 23, 25-27) in summer (Tables 44-45), but present throughout the year in all regions (Tables 44-45).

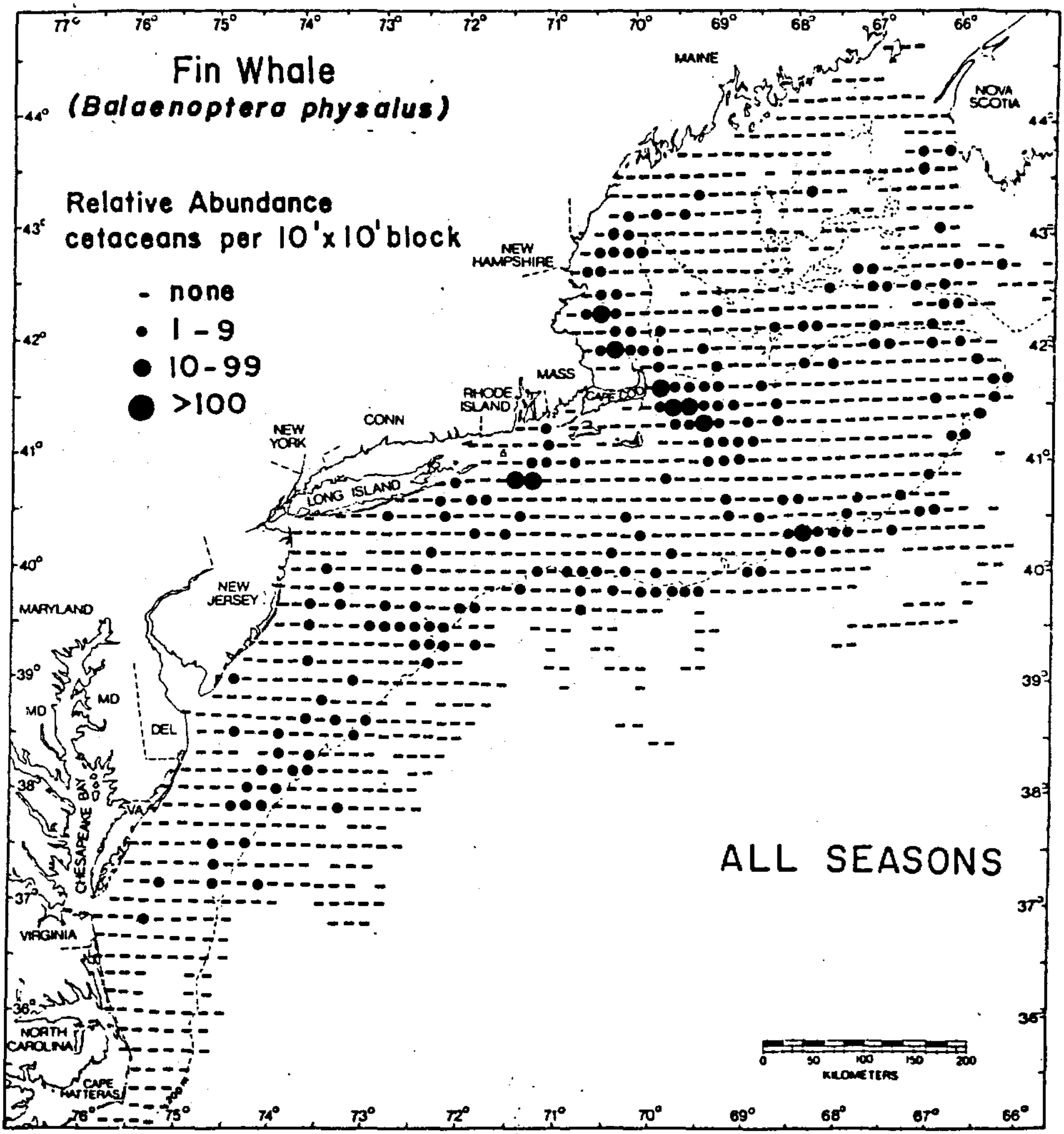

Figure 69. Relative distribution and abundance of Fin Whales for all seasons.

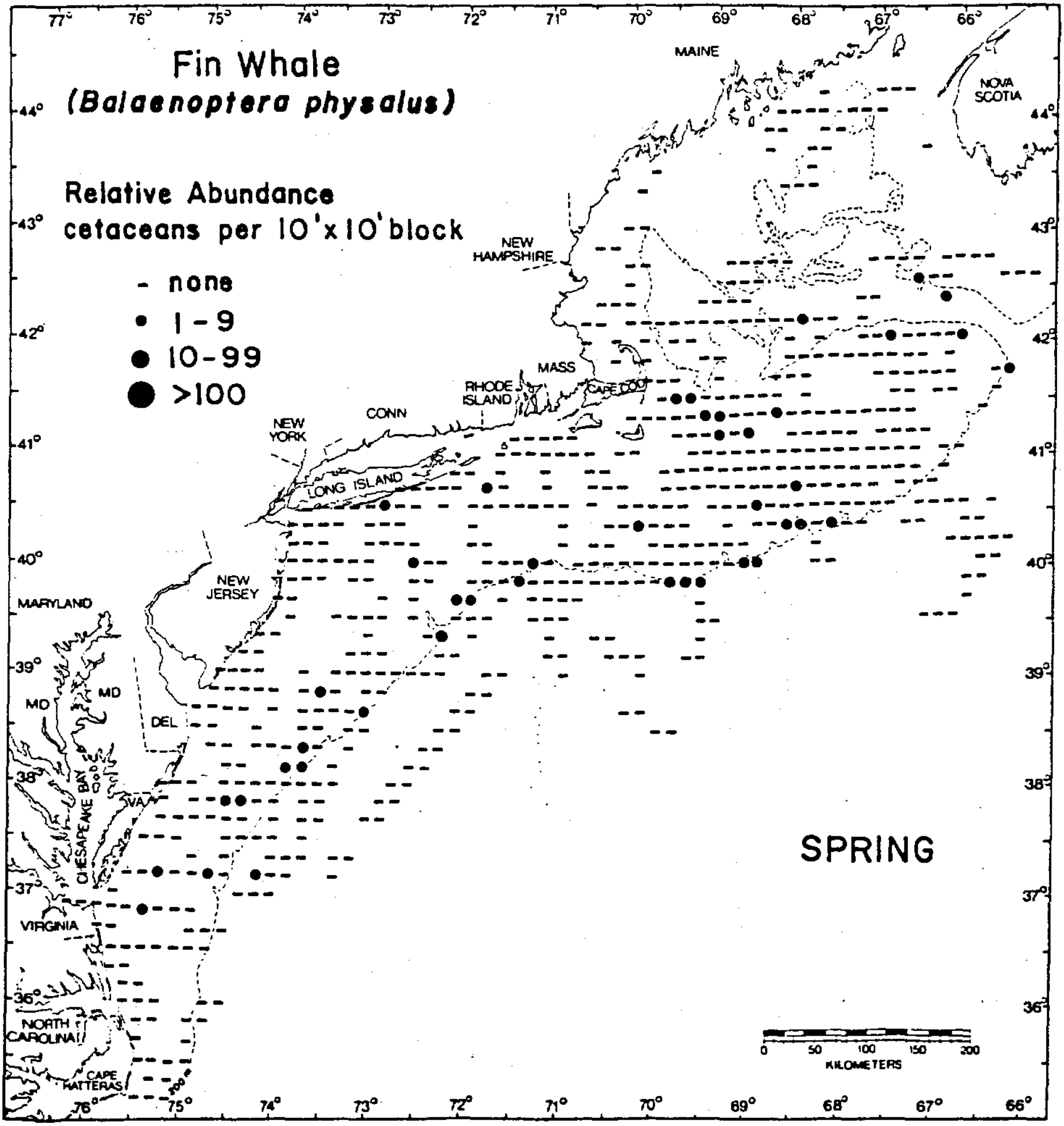

Figure 70. Relative distribution and abundance of Fin Whales in spring.

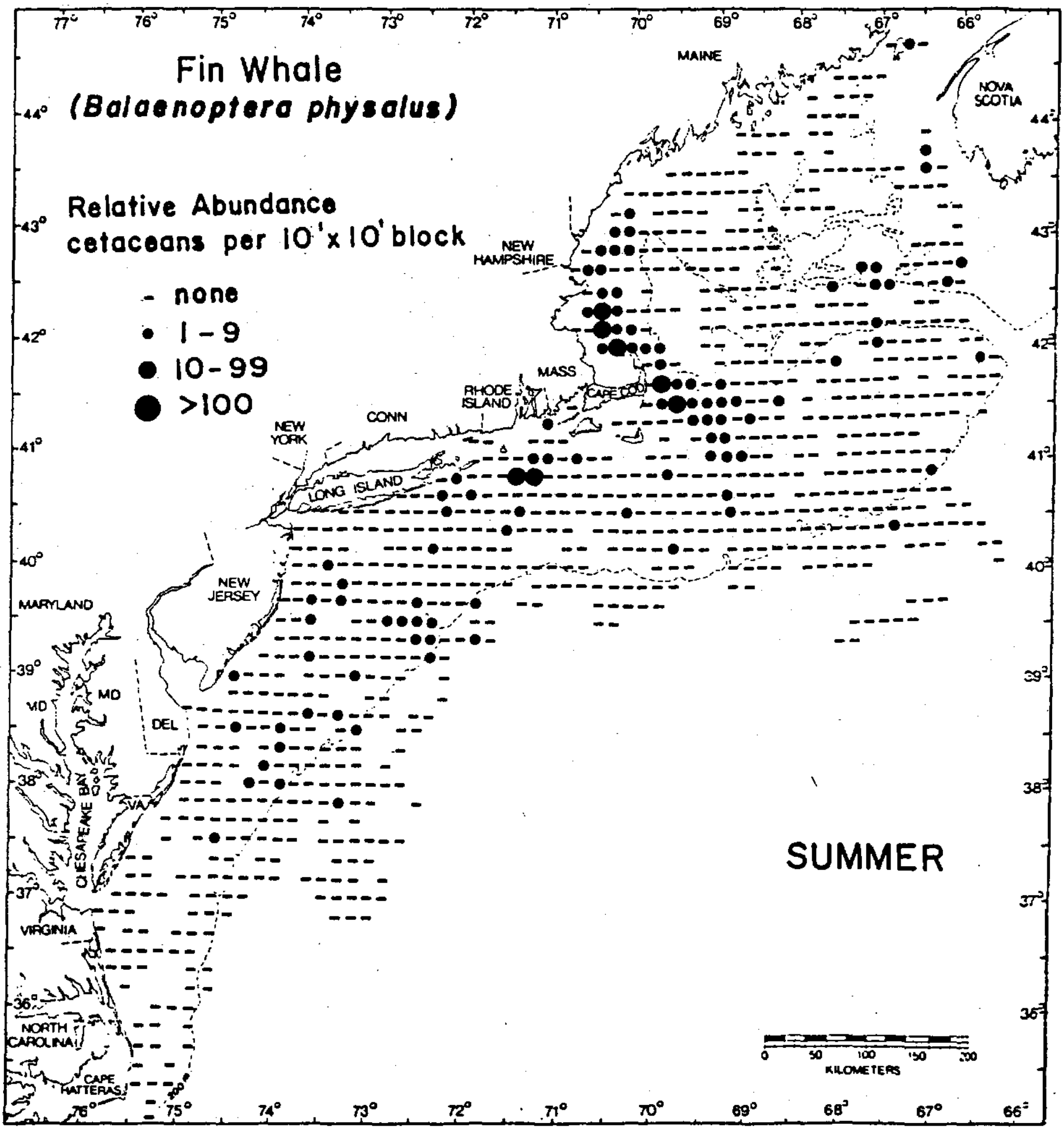

Figure 71. Relative distribution and abundance of Fin Whales in summer.

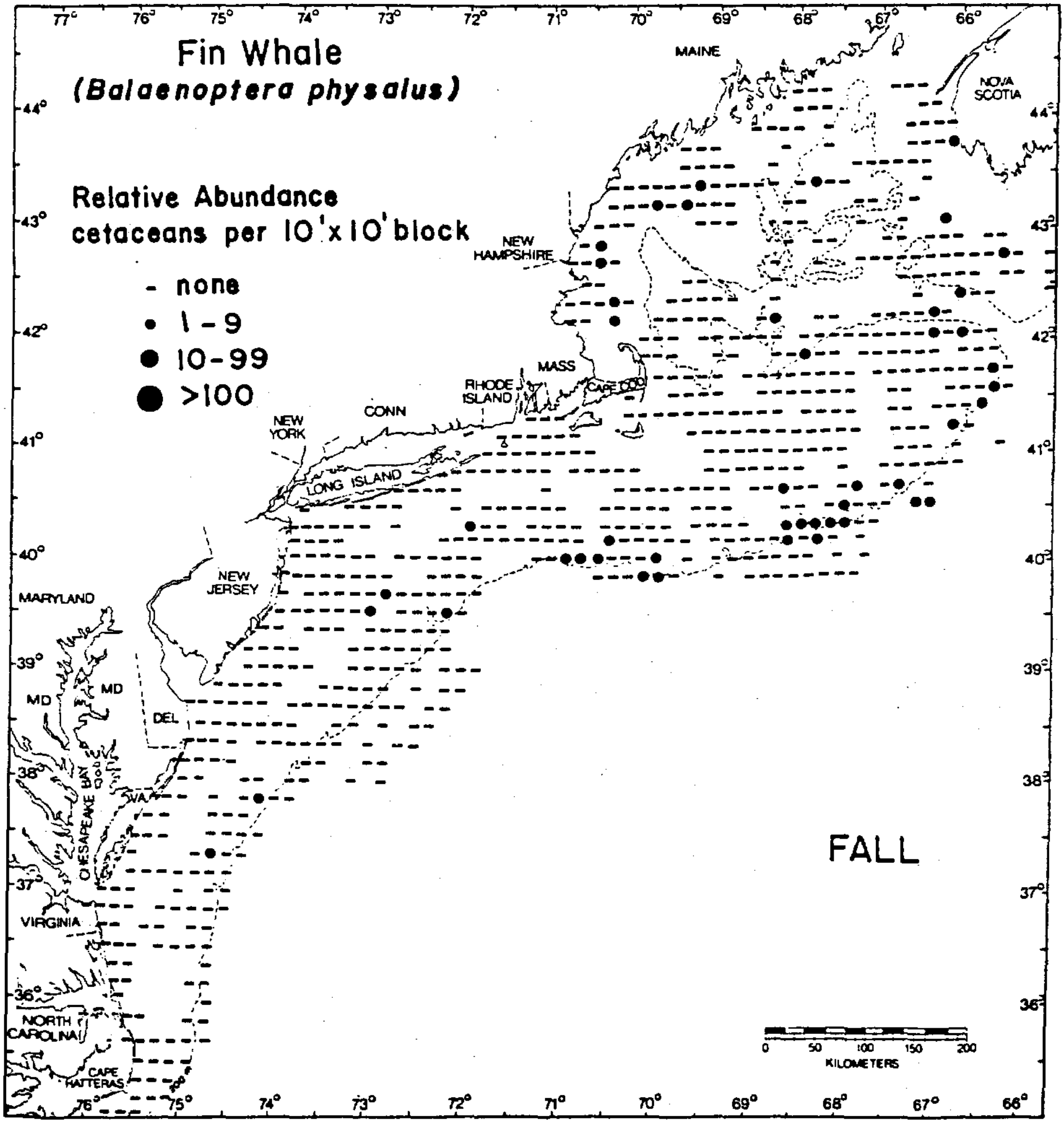

Figure 72. Relative distribution and abundance of Fin Whales in fall.

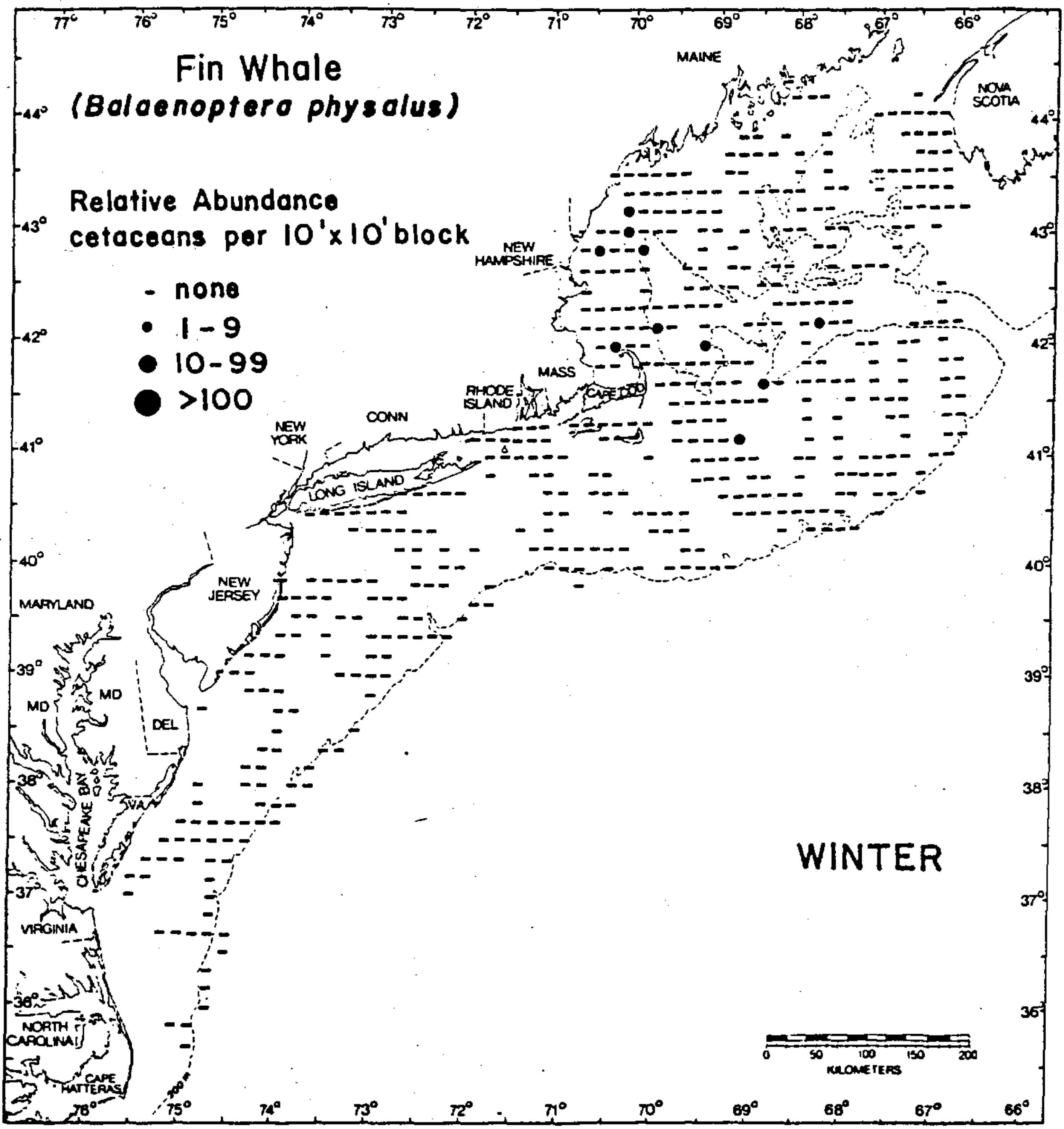

Figure 73. Relative distribution and abundance of Fin Whales in winter.

Table 44. Seasonal estimates of Fin Whale abundance, animals/linear km ($\bar{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter		Spring		Summer		Fall	
GULF OF MAINE								
Central gulf	<0.001	(0.015)	0.002	(0.022)	0.009	(0.088)	0.007	(0.049)
South	0.002	(0.022)	0.011	(0.064)	0.050	(0.169)	0.008	(0.042)
Southwest	0.010	(0.059)	0.015	(0.086)	0.095	(0.324)	0.074	(0.410)
Total	0.003	(0.032)	0.008	(0.059)	0.045	(0.214)	0.024	(0.215)
GEORGES BANK								
Northern edge	0.011	(0.056)	0.017	(0.113)	0.010	(0.070)	0.002	(0.024)
Shelf edge	---		0.042	(0.134)	0.001	(0.021)	0.087	(0.224)
Shoals	---		---		0.001	(0.018)	0.002	(0.033)
Central bank	0.001	(0.021)	0.004	(0.063)	<0.001	(0.013)	0.027	(0.168)
Total	0.001	(0.022)	0.009	(0.074)	0.001	(0.024)	0.028	(0.146)
S. NEW ENGLAND								
Inner shelf	0.001	(0.018)	0.001	(0.018)	0.019	(0.126)	0.002	(0.023)
Mid shelf	---		0.003	(0.039)	0.010	(0.089)	0.002	(0.031)
Outer shelf	---		0.022	(0.105)	0.021	(0.117)	0.006	(0.039)
Total	<0.001	(0.011)	0.008	(0.064)	0.015	(0.108)	0.003	(0.031)
MID-ATLANTIC								
Inner shelf	---		0.004	(0.036)	0.014	(0.145)	---	
Mid shelf	0.002	(0.024)	0.002	(0.026)	0.021	(0.148)	0.014	(0.118)
Outer shelf	0.003	(0.026)	0.025	(0.091)	---		---	
Total	0.001	(0.018)	0.007	(0.048)	0.015	(0.140)	0.004	(0.067)
SLOPE	---		---		0.001	(0.029)	---	

Table 45. Seasonal estimates of Fin Whale densities, animals/km^2 ($\overline{X}$ $\underline{+}$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central Gulf	0.0005 (0.0086)	0.0012 (0.0129)	0.0055 (0.0503)	0.0040 (0.0281)
South	0.0011 (0.0125)	0.0066 (0.0366)	0.0287 (0.0961)	0.0046 (0.0238)
Southwest	0.0058 (0.0338)	0.0087 (0.0487)	0.0541 (0.1840)	0.0421 (0.2331)
Total	0.0018 (0.0182)	0.0047 (0.0337)	0.0256 (0.1217)	0.0141 (0.1222)
GEORGES BANK				
Northern edge	0.0066 (0.0319)	0.0102 (0.0645)	0.0059 (0.0401)	0.0015 (0.0138)
Shelf edge	---	0.0243 (0.0764)	0.0011 (0.0123)	0.0493 (0.1276)
Shoals	---	---	0.0007 (0.0102)	0.0014 (0.0190)
Central bank	0.0008 (0.0124)	0.0028 (0.0360)	0.0004 (0.0077)	0.0154 (0.0956)
Total	0.0009 (0.0125)	0.0054 (0.0421)	0.0010 (0.0141)	0.0159 (0.0830)
S. NEW ENGLAND				
Inner shelf	0.0008 (0.0105)	0.0007 (0.0102)	0.0110 (0.0717)	0.0012 (0.0132)
Mid shelf	---	0.0019 (0.0224)	0.0061 (0.0505)	0.0012 (0.0178)
Outer shelf	---	0.0126 (0.0599)	0.0120 (0.0666)	0.0037 (0.0223)
Total	0.0003 (0.0067)	0.0047 (0.0363)	0.0087 (0.0615)	0.0018 (0.0178)
MID-ATLANTIC				
Inner shelf	---	0.0023 (0.0204)	0.0080 (0.0828)	---
Mid shelf	0.0015 (0.0137)	0.0017 (0.0151)	0.0123 (0.0840)	0.0084 (0.0670)
Outer shelf	0.0020 (0.0151)	0.0146 (0.0520)	---	---
Total	0.0008 (0.0102)	0.0042 (0.0277)	0.0086 (0.0798)	0.0026 (0.0380)
SLOPE	---	---	0.0010 (0.0165)	---

Sei Whale (B. borealis)

B. borealis feeds principally on zooplankton (Jonsgard and Darling 1977; Mitchell 1974d) in the northern Atlantic.

Sei whales are distributed in shelf waters of the northwest Atlantic, seasonally along the slope edge arriving in the Georges Bank Northeast Channel and Browns Bank regions by mid-June (Mitchell and Chapman 1977) and were part of a shore-based fishery in that region (Mitchell 1975c; Sutcliffe and Brodie 1977). Strandings have occurred along the eastern coastline (Mead 1977), but principally from the mid-Atlantic region south to Florida. In our study area CeTAP (1982) reported limited sightings in spring and summer along the shelf edge from southern GB to the northeast peak of GB. There are few fall and winter sightings.

Only nine verified sightings (11 individuals) of Sei whale have been seen in our study. Identification similarities between this species and B. physalus make distinction in the field difficult. Our verified sightings were primarily in the SNE region, spring and summer (5 sightings). Summer sightings were not during quantitative counts therefore not on Table 46.

Table 46. Seasonal estimates of Sei Whale abundance, animals/linear km ($\overline{X}\pm SD$), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	---	---	---	---
South	---	---	---	---
Southwest	---	---	<0.001 (0.015)	---
Total	---	---	<0.001 (0.008)	---
GEORGES BANK				
Northern edge	---	---	---	---
Shelf edge	---	---	---	---
Shoals	---	---	---	---
Central bank	---	---	---	---
Total	---	---	---	---
S. NEW ENGLAND				
Inner shelf	---	---	---	---
Mid shelf	---	---	---	---
Outer shelf	---	0.009 (0.093)	---	---
Total	---	0.002 (0.051)	---	---
MID-ATLANTIC				
Inner shelf	---	<0.001 (0.014)	---	---
Mid shelf	---	---	---	---
Outer shelf	---	---	---	---
Total	---	<0.001 (0.010)	---	---
SLOPE	---	---	---	---

Humpback Whale (Megaptera novaeangliae)

M. novaeangliae are secondary and tertiary carnivores which have been described as generalists in their feeding habits (Mitchell 1974d). Whitehead et al. (1980) showed that humpbacks along the northeast coast of Newfoundland monitored the movements of capelin Mallotus villosus, the primary prey species in that region (Mitchell 1973). Humpbacks in the Scotian Shelf feed on krill and capelin (Mitchell 1973; Reeves and Brownell 1982). The principal prey of humpbacks in the Gulf of Maine are small fishes, e.g. Atlantic herring Clupea harengus, mackerel Scomber scombrus, pollock Pollachius virens, and the American sand eel Ammodytes americanus (Gaskin 1976; Katona et al. 1977; Watkins and Schevill 1979; Kraus and Prescott 1981). In recent years, observations of feeding humpbacks indicate that sand eels are an important prey item in the Gulf of Maine. Overholtz and Nicolas (1979) suggested that humpback and fin whales were feeding on sand eel on Stellwagen Bank, north of Cape Cod. Hain et al. (1982) identified sand eel in 50% and 75% of the feeding observations on Stellwagen Bank during 1978 and 1979 respectively. Sand eel were the only confirmed prey eaten by humpback whales between 1975-79 on Stellwagen Bank (Mayo 1980). Kenney et al. (1981) hypothesized that the observed distribution of the Gulf of Maine humpbacks was due to the distribution of sand lance; however, Payne et al. (in review) suggested that feeding behavior (as described by Hain et al. 1982) and bottom topography are also critical factors in the foraging strategy of humpbacks. Humpback whales follow a general north-south migration pattern between feeding and breeding areas (Mackintosh 1965).

In the northwest Atlantic, the major summer concentrations of humpback whales occur off the coasts of Newfoundland - Labrador and off the coast of New England in the Gulf of Maine which includes Georges Bank (Katona et al. 1980; Whitehead et al. 1982). During this period feeding is their principal activity. The major winter concentrations in the western North Atlantic occur along the Antillean Chain in the West Indies, principally on Silver and Navidad Banks which lie north of the Dominican Republic (Winn et al. 1975; Balcomb and Nichols 1978; Whitehead and Moore 1982). During this season conception and calving are their primary activities; food does not seem to be an important determinant of the humpbacks in these areas (Whitehead and Moore 1982).

Although humpbacks have been generally considered coastal animals (Mackintosh 1965), their migratory route between regions of winter breeding and summer feeding in the northwest Atlantic (based on sighting data) occurs in deeper, slope waters off the continental shelf (Hain et al. 1981; Kenney et al. 1981; Powers et al. 1982). Several stocks have been suggested in the north Atlantic although delineation is difficult (Mitchell and Reeves 1983). However, two possible offshore routes between winter and summer grounds, 1) Dominican Republic to the Gulf of Maine and 2) Puerto Rico to Newfoundland, suggest reasonably distinct stocks (Katona et al. 1980). Kenney et al. (1981) suggested that for the Gulf of Maine stock, the Great South Channel is the major exit/entry between the Gulf of Maine feeding area and the deeper, offshore migration route.

M. novaeangliae are generally restricted to the SNE shelf waters north into the Gulf of Maine and western Georges Bank (north of 40°00'N latitude) between April and October (Hain et al. 1981; Kenney et al. 1981; CeTAP 1982; Powers et al. 1982). Within that spatial and temporal framework, concentrations are greatest in a narrow band between 41°00' and 43°00'N latitudes, from the Great South Channel north along the outside of Cape Cod, to Stellwagen Bank and Jeffreys Ledge in the Gulf of Maine (CeTAP 1982). CeTAP (1982) reported only ten winter sightings between 1978 and 1981, and Powers et al. (1982) reported only three winter sightings during approximately the same period; therefore humpbacks are considered nearly absent from the study area in winter. Humpback whales are also rarely seen in shelf waters between 40°00'N and Cape Hatteras (Hain et al. 1981; CeTAP 1982; Powers et al. 1982; Powers and Payne 1982), although they are reported in coastal waters south of Cape Hatteras to Miami, Florida (Schmidley 1981). This lack of sightings in the Mid-Atlantic Bight supports the offshore movement patterns of *M. novaeangliae* south of 40°00'N latitude suggested by Winn and Scott (1979) and Katona et al. (1980).

M. novaeangliae are seen principally spring-fall in the Gulf of Maine although winter sightings are also reported on Stellwagen Bank and in the South Channel (Figs. 74-78). Most humpback sightings and greatest densities occur in the Gulf of Maine-southwest region (Tables 47-48) in spring through fall.

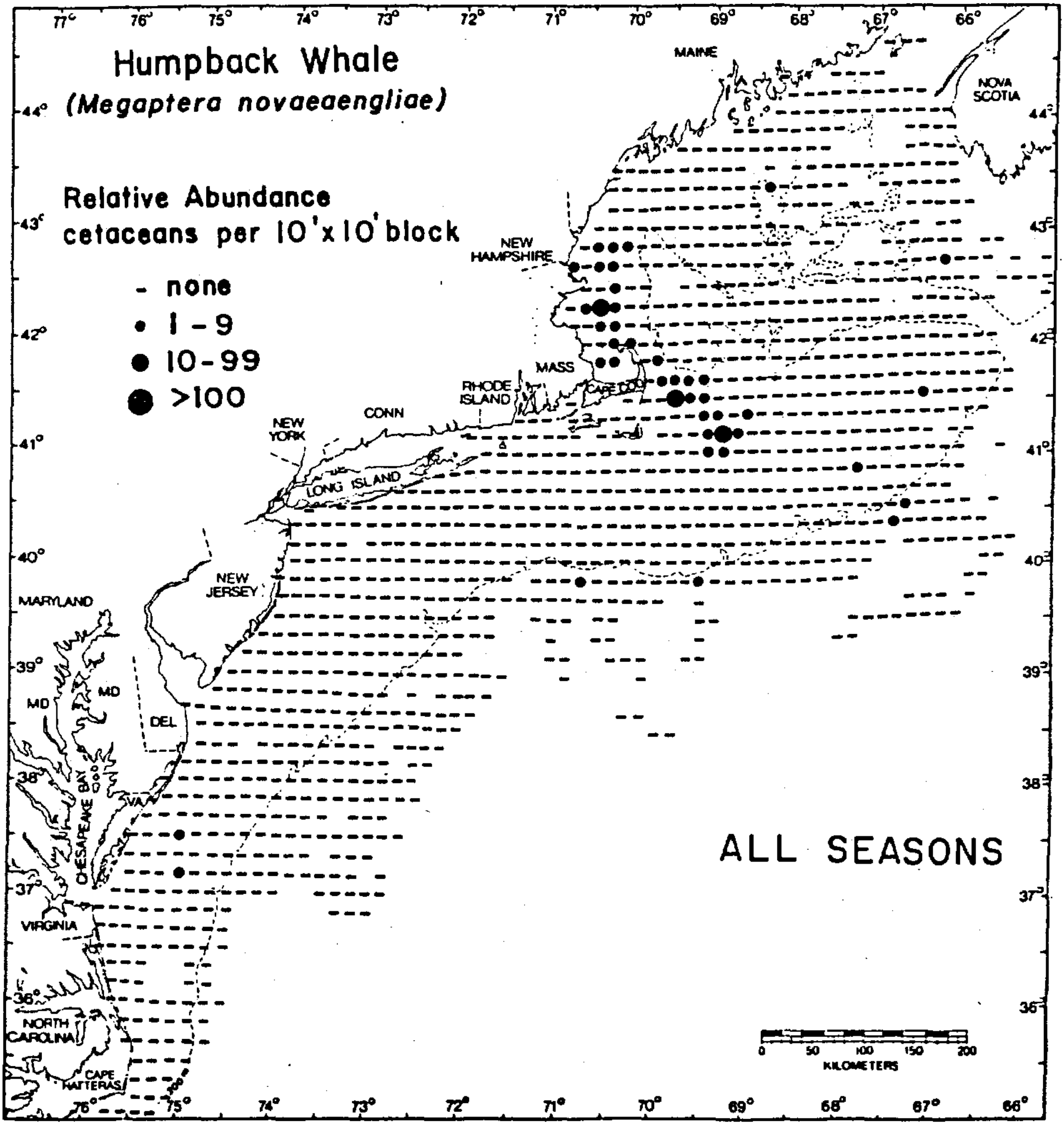

Figure 74. Relative distribution and abundance of Humpback Whales for all seasons.

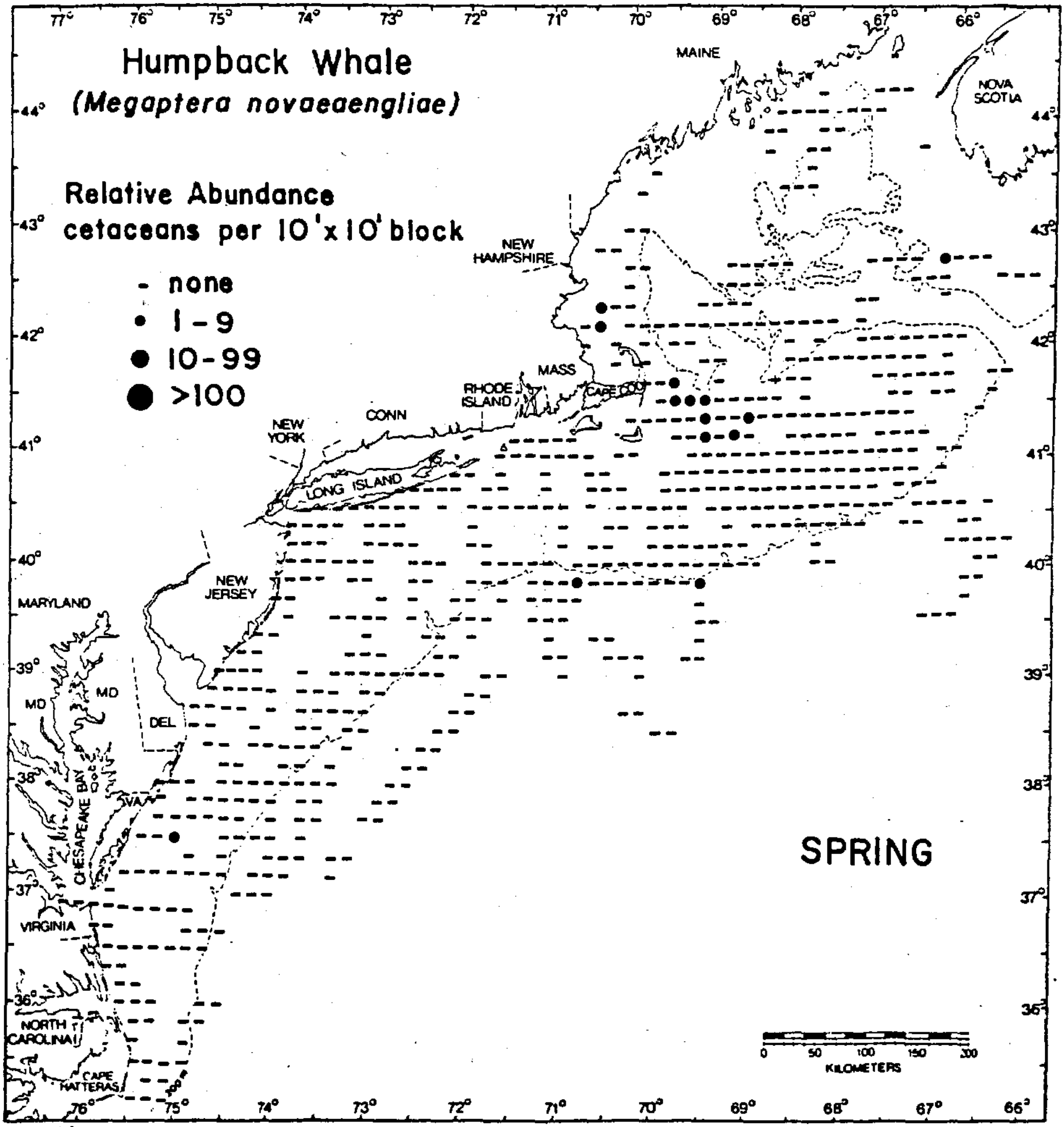

Figure 75. Relative distribution and abundance of Humpback Whales in spring.

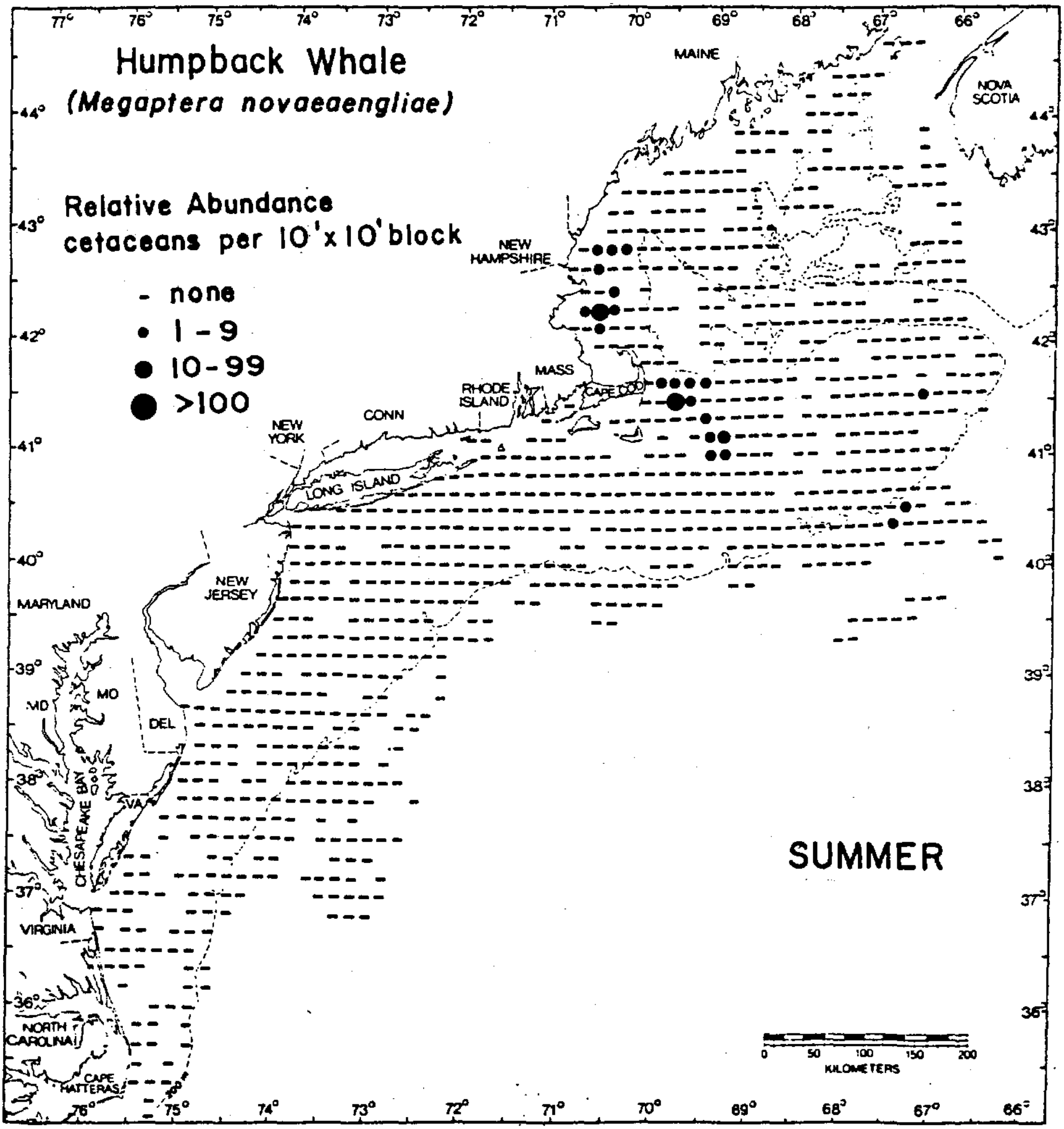

Figure 76. Relative distribution and abundance of Humpback Whales in summer.

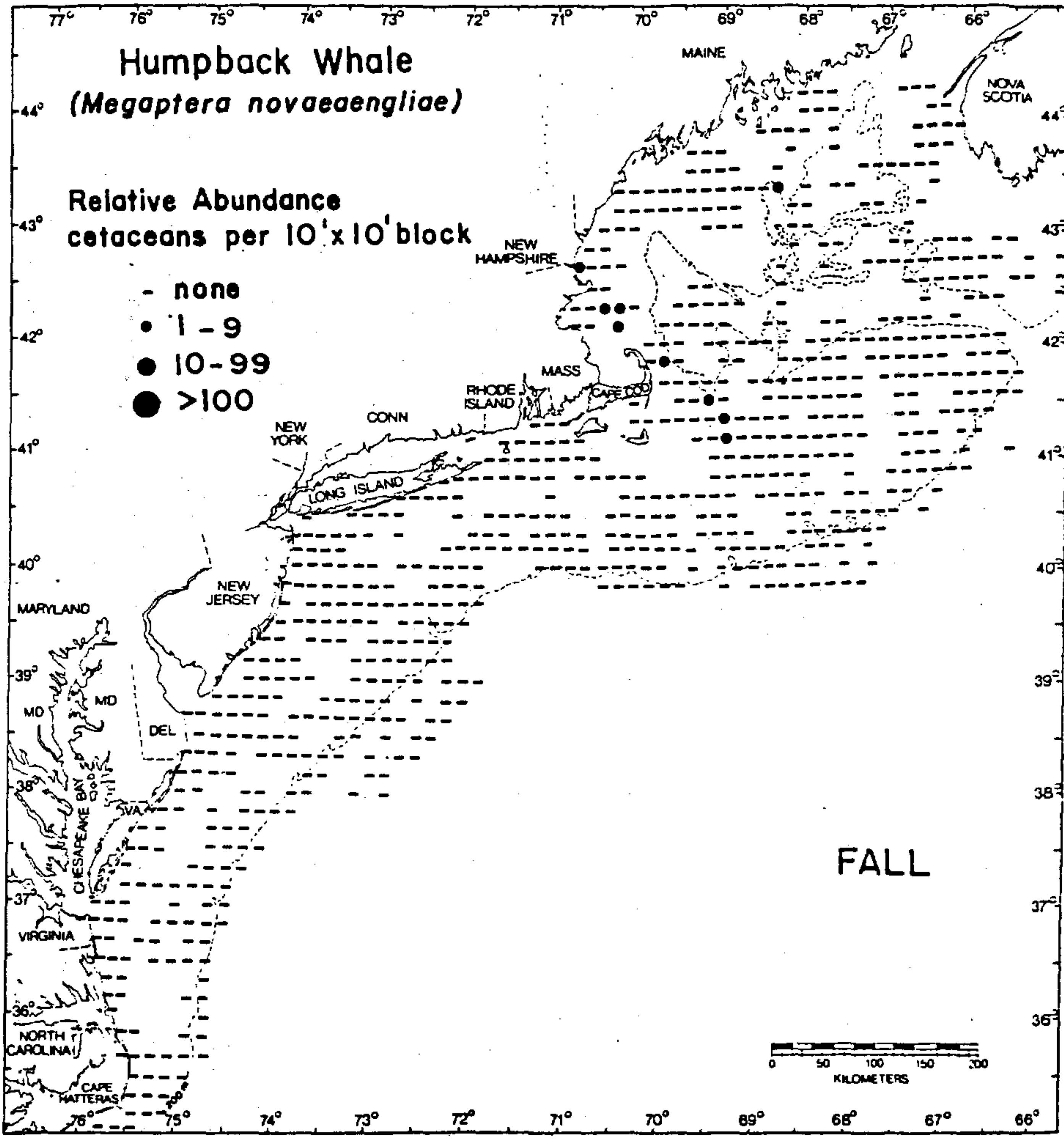

Figure 77. Relative distribution and abundance of Humpback Whales in fall.

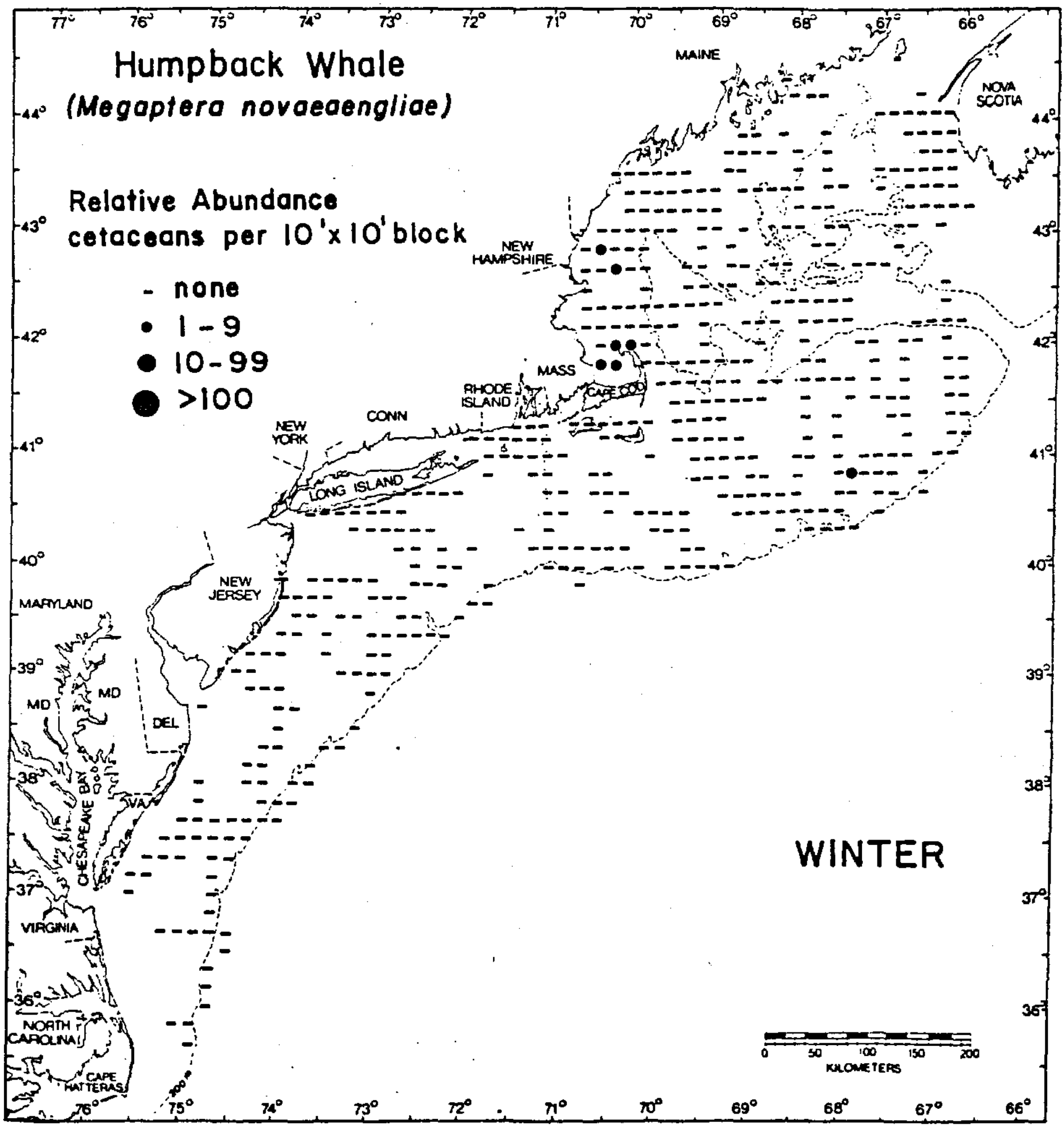

Figure 78. Relative distribution and abundance of Humpback Whales in winter.

Table 47. Seasonal estimates of Humpback Whale abundance, animals/linear km ($\overline{X}\pm SD$), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	---	---	0.002 (0.044)	0.001 (0.023)
South	---	0.015 (0.082)	0.025 (0.200)	0.009 (0.073)
Southwest	0.010 (0.077)	0.028 (0.136)	0.031 (0.151)	0.054 (0.369)
Total	0.002 (0.036)	0.012 (0.087)	0.015 (0.120)	0.016 (0.192)
GEORGES BANK				
Northern edge	---	---	---	---
Shelf edge	---	---	---	---
Shoals	---	---	---	---
Central bank	0.001 (0.017)	---	---	---
Total	<0.001 (0.012)	---	---	---
S. NEW ENGLAND				
Inner shelf	0.003 (0.050)	---	---	---
Mid shelf	---	---	---	---
Outer shelf	---	0.003 (0.028)	---	---
Total	0.001 (0.032)	<0.001 (0.015)	---	---
MID-ATLANTIC				
Inner shelf	---	---	---	<0.001 (0.013)
Mid shelf	---	---	---	---
Outer shelf	---	---	---	---
Total	---	---	---	<0.001 (0.009)
SLOPE	---	---	<0.001 (0.014)	---

Table 48. Seasonal estimates of Humpback Whale densities, animals/km^2 ($\overline{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central Gulf	---	---	0.0011 (0.0252)	0.0007 (0.0132)
South	---	0.0085 (0.0467)	0.0141 (0.1136)	0.0052 (0.0418)
Southwest	0.0061 (0.0436)	0.0200 (0.0908)	0.0177 (0.0856)	0.0311 (0.2095)
Total	0.0013 (0.0208)	0.0083 (0.0571)	0.0087 (0.0684)	0.0094 (0.1094)
GEORGES BANK				
Northern edge	---	---	---	---
Shelf edge	---	---	---	---
Shoals	---	---	---	---
Central bank	0.0006 (0.0096)	---	---	---
Total	0.0003 (0.0073)	---	---	---
S. NEW ENGLAND				
Inner shelf	0.0022 (0.0286)	---	---	---
Mid shelf	---	---	---	---
Outer Shelf	---	0.0017 (0.0158)	---	---
Total	0.0009 (0.0183)	0.0005 (0.0087)	---	---
MID-ATLANTIC				
Inner shelf	---	---	---	0.0005 (0.0076)
Mid shelf	---	---	---	---
Outer shelf	---	---	---	---
Total	---	---	---	0.0002 (0.0051)
SLOPE	---	---	0.0005 (0.0082)	---

Right Whale (Eubalaena glacialis)

E. glacialis are secondary carnivores that feed on zooplankton, primarily copepods and euphausiids (Leatherwood et al. 1976; Katona et al. 1977). Feeding often occurs in regions where zooplankton is concentrated (Watkins and Schevill 1976). Winn et al. (1981) believed distribution of Right Whales in a spring survey to be clustered about dense aggregations of the copepod Calanus finmarchicus. Watkins and Schevill (1976) conducted plankton tows near feeding Right Whales and collected equal numbers of small euphausiids and C. finmarchicus.

The Right Whale is found throughout our study area. During winter Eubalaena sightings are sparce. In late winter and early spring (March to May) they appear over the shelf between Cape Hatteras and Cape Cod Bay (Winn et al. 1981). During March 1984, right whales were recorded in the Mid-Atlantic Bight, including several matched sightings between the Mid-Atlantic Bight and Gulf of Maine (S. Kraus, pers. comm.). During April to June, they are observed from the New York Bight (Reeves 1975), north to Cape Cod and into the Gulf of Maine, with sightings near Jeffreys Ledge, north and east of Provincetown and southeast of Nantucket Island (Watkins and Schevill 1976, 1979; Hain et al. 1981; Schevill et al. 1981; Winn et al. 1981). During late summer, a group of right whales occur in the lower Bay of Fundy (Neave and Wright 1968; Arnold and Gaskin 1972; CeTAP 1982; Kraus and Prescott 1981, 1982). There are sightings in all four seasons north of 40°30'N latitutde (Hain et al. 1981). Right whales also occur in Passamaquoddy Bay (Arnold and Gaskin 1972), and near Nova Scotia and Newfoundland (Sergeant 1966; Mitchell 1974c; Sutcliffe and Brodie 1977).

During late summer and fall most Right Whales appear to leave the Gulf of Maine by migrating southwestward (Winn et al. 1981). Reeves et al. (1978) assumed Right Whales migrate nearshore in spring and offshore in fall; however Winn et al. (1981) hypothesize that a majority of Right Whales move offshore during both periods. Recent, matched-identifications between right whales in the mid-Atlantic and Florida, and the Gulf of Maine-Bay of Fundy (S. Kraus, pers. comm.) indicate winter and summer concentrations of the same population.

Our data only has sightings spring and summer, in the Gulf of Maine (Fig. 79), principally strata No. 24 (Table 49). Inshore sightings in the Cape Cod Bay region, winter through spring (Mayo 1982) and those sightings in the Bay of Fundy and Scotian shelf, are generally out of the survey area, therefore not represented in our data.

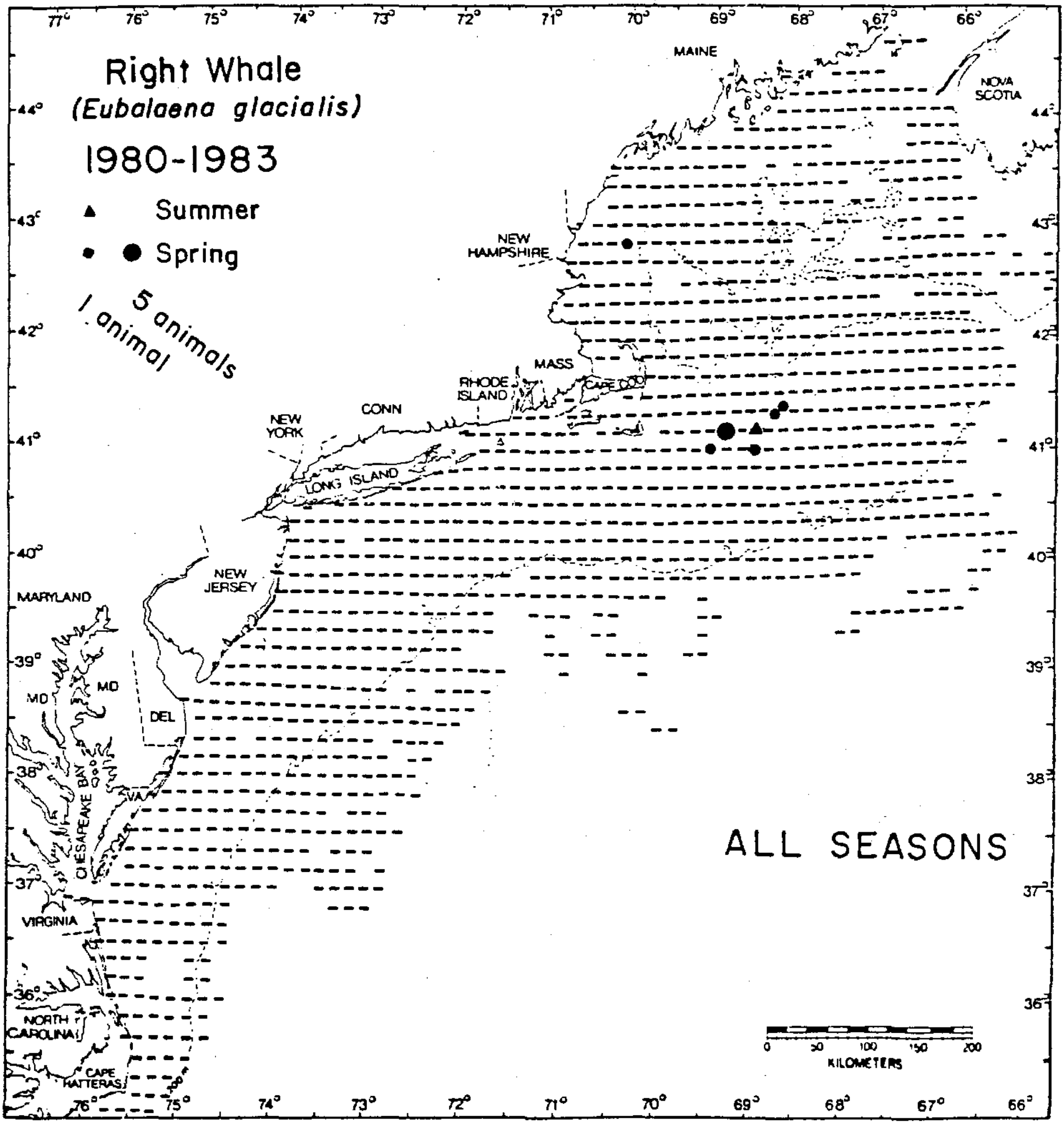

Figure 79. Relative distribution and abundance of Right Whales for all seasons.

Table 49. Seasonal estimates of Right Whale abundance, animals/linear km ($\overline{X}$+SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	---	---	---	---
South	---	0.013 (0.119)	0.001 (0.021)	---
Southwest	---	0.002 (0.034)	---	---
Total	---	0.003 (0.054)	<0.001 (0.007)	---
GEORGES BANK				
Northern edge	---	---	---	---
Shelf edge	---	---	---	---
Shoals	---	---	---	---
Central bank	---	---	---	---
Total	---	---	---	---
S. NEW ENGLAND				
Inner shelf	---	---	---	---
Mid shelf	---	---	---	---
Outer shelf	---	---	---	---
Total	---	---	---	---
MID-ATLANTIC				
Inner shelf	---	---	---	---
Mid shelf	---	---	---	---
Outer shelf	---	---	---	---
Total	---	---	---	---
SLOPE	---	---	---	---

Cetaceans

Seasonal Estimates by Regions (Tables only)

Only recently have seabird (Powers 1983; Powers and Brown, in press) and marine mammal (CeTAP 1982) populations in the northwest Atlantic been investigated in relation to physical oceanographic features. This section (Tables 50-77) tabularizes cetacean abundance (from shipboard observations) in relation to the subregions (Table 2) used in calculation of density estimates (subregions based on NMFS/NEFC strata, Fig. 4).

Table 50. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X}$ +SD) (lower number), by species and species groups for the Gulf of Maine, Central Gulf, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
DOLPHINS				
Bottle-nosed	--- ---	--- ---	--- ---	--- ---
Spotted	--- ---	--- ---	--- ---	--- ---
Striped	--- ---	--- ---	--- ---	--- ---
Saddleback	0.001 (0.030) 0.0022 (0.0401)	--- ---	--- ---	--- ---
White-sided	0.002 (0.051) 0.0030 (0.0685)	0.023 (0.254) 0.0315 (0.3365)	0.102 (1.241) 0.1345 (1.6409)	0.160 (1.275) 0.2118 (1.6859)
White-beaked	--- ---	--- ---	--- ---	--- ---
Grampus	--- ---	--- ---	--- ---	--- ---
Pilot Whale	--- ---	--- ---	0.025 (0.375) 0.0336 (0.4959)	0.004 (0.087) 0.0062 (0.1157)
Harbor Porpoise	--- ---	0.014 (0.129) 0.0289 (0.2662)	0.015 (0.153) 0.0327 (0.3154)	--- ---
All Dolphins (Delphinidae and Harbor Porpoise)	0.004 (0.060) 0.0052 (0.0793)	0.038 (0.284) 0.0604 (0.4291)	0.186 (1.508) 0.2584 (2.4926)	0.176 (1.292) 0.2337 (1.7080)

Table 51. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X}$ +SD) (lower number), by species and species groups for the Gulf of Maine South, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
DOLPHINS				
Bottle-nosed	--- ---	--- ---	--- ---	--- ---
Spotted	--- ---	--- ---	--- ---	--- ---
Striped	--- ---	--- ---	--- ---	--- ---
Saddleback	--- ---	--- ---	--- ---	--- ---
White-sided	0.396 (2.956) 0.5237 (3.9063)	0.299 (1.433) 0.3957 (1.8942)	0.189 (1.236) 0.2504 (1.6332)	0.110 (0.805) 0.1454 (1.0640)
White-beaked	--- ---	--- ---	--- ---	--- ---
Grampus	--- ---	--- ---	--- ---	--- ---
Pilot Whale	--- ---	--- ---	--- ---	0.113 (0.507) 0.1502 (0.6704)
Harbor Porpoise	--- ---	--- ---	--- ---	--- ---
All Dolphins (Delphinidae and Harbor Porpoise)	0.396 (2.956) 0.5237 (3.9063)	0.299 (1.433) 0.3957 (1.8942)	0.210 (1.243) 0.2775 (1.6430)	0.238 (0.942) 0.3005 (1.2398)

Table 52. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X}$ $\pm$SD) (lower number), by species and species groups for the Gulf of Maine Southwest, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
DOLPHINS				
Bottle-nosed	--- ---	--- ---	--- ---	--- ---
Spotted	--- ---	--- ---	--- ---	--- ---
Striped	--- ---	--- ---	--- ---	--- ---
Saddleback	0.095 (1.024) 0.1256 (1.3533)	--- ---	--- ---	--- ---
White-sided	0.024 (0.335) 0.0325 (0.4429)	0.497 (3.655) 0.6688 (4.8304)	0.122 (0.732) 0.1481 (0.9674)	0.020 (0.191) 0.0269 (0.2524)
White-beaked	--- ---	0.011 (0.137) ---	--- ---	--- ---
Grampus	--- ---	--- ---	--- ---	--- ---
Pilot Whale	0.035 (0.288) 0.0462 (0.3806)	--- ---	--- ---	0.219 (1.428) 0.2904 (1.8875)
Harbor Porpoise	--- ---	--- ---	--- ---	--- ---
All Dolphins (Delphinidae and Harbor Porpoise)	0.155 (1.109) 0.2060 (1.4661)	0.517 (3.656) 0.6688 (4.8304)	0.122 (0.739) 0.1599 (0.9774)	0.240 (1.444) 0.3174 (1.9043)

Table 53. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X}$ $\pm$SD) (lower number), by species and species groups for Georges Bank Northern Edge, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
DOLPHINS				
Bottle-nosed	--- ---	--- ---	--- ---	--- ---
Spotted	--- ---	--- ---	--- ---	--- ---
Striped	--- ---	--- ---	--- ---	--- ---
Saddleback	0.137 (0.405) 0.1817 (0.5364)	--- ---	--- ---	0.529 (4.585) 0.6997 (6.0587)
White-sided	--- ---	0.047 (0.303) 0.0634 (0.4011)	--- ---	--- ---
White-beaked	--- ---	--- ---	--- ---	--- ---
Grampus	--- ---	0.196 (1.241) 0.2594 (1.6409)	--- ---	--- ---
Pilot Whale	--- ---	--- ---	0.013 (0.090) 0.0177 (0.1202)	0.027 (0.171) 0.0365 (0.2270)
Harbor Porpoise	--- ---	--- ---	--- ---	--- ---
All Dolphins (Delphinidae and Harbor Porpoise)	0.137 (0.405) 0.1817 (0.5364)	0.354 (1.878) 0.3387 (1.6790)	0.063 (0.484) 0.1107 (0.6399)	0.557 (4.585) 0.7363 (6.0586)

Table 54. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X}$ +SD) (lower number), by species and species groups for Georges Bank Shelf Edge, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
DOLPHINS				
Bottle-nosed	--- ---	--- ---	0.215 (1.225) 0.2849 (1.6187)	0.015 (0.139) 0.0200 (0.1840)
Spotted	--- ---	--- ---	--- ---	--- ---
Striped	--- ---	--- ---	--- ---	--- ---
Saddleback	0.485 (1.897) 0.6421 (2.5071)	0.132 (0.722) 0.1755 (0.9542)	0.013 (0.147) 0.0176 (0.1945)	2.126 (19.616) 2.8099(25.9206)
White-sided	--- ---	--- ---	--- ---	--- ---
White-beaked	--- ---	--- ---	0.005 (0.065) ---	--- ---
Grampus	--- ---	--- ---	0.206 (1.472) 0.2725 (1.9454)	--- ---
Pilot Whale	--- ---	--- ---	0.039 (0.344) 0.0524 (0.4546)	0.310 (1.888) 0.4102 (2.4952)
Harbor Porpoise	--- ---	0.006 (0.059) 0.0136 (0.1232)	--- ---	0.002 (0.025) 0.0050 (0.0531)
All Dolphins (Delphinidae and Harbor Porpoise)	0.485 (1.897) 0.6421 (2.5071)	0.139 (0.723) 0.1891 (0.9621)	1.078 (4.910) 1.4168 (6.4904)	2.605 (19.715) 3.4442(26.0519)

Table 55. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X}$ $\pm$SD) (lower number), by species and species groups for Georges Bank Shoals, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
DOLPHINS				
Bottle-nosed	--- ---	--- ---	--- ---	--- ---
Spotted	--- ---	--- ---	--- ---	--- ---
Striped	--- ---	--- ---	--- ---	--- ---
Saddleback	0.013 (0.128) 0.0173 (0.1699)	--- ---	--- ---	0.016 (0.208) 0.0214 (0.2768)
White-sided	--- ---	--- ---	0.018 (0.244) 0.0243 (0.3226)	--- ---
White-beaked	--- ---	--- ---	--- ---	--- ---
Grampus	--- ---	--- ---	--- ---	--- ---
Pilot Whale	--- ---	0.006 (0.082) 0.0082 (0.1084)	0.018 (0.147) 0.0238 (0.1951)	0.045 (0.275) 0.0598 (0.3648)
Harbor Porpoise	--- ---	--- ---	--- ---	--- ---
All Dolphins (Delphinidae and Harbor Porpoise)	0.013 (0.128) 0.0173 (0.1699)	0.006 (0.082) 0.0082 (0.1084)	0.061 (0.367) 0.0806 (0.4855)	0.061 (0.343) 0.0813 (0.4551)

Table 56. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X} \pm SD$) (lower number), by species and species groups for Georges Bank Central Bank, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
DOLPHINS				
Bottle-nosed	---	---	0.015 (0.148)	0.004 (0.069)
	---	---	0.0202 (0.1966)	0.0066 (0.0915)
Spotted	---	---	---	---
	---	---	---	---
Striped	---	---	---	---
	---	---	---	---
Saddleback	0.325 (1.327)	0.033 (0.317)	0.108 (1.003)	5.372 (66.827)
	0.4296 (1.7538)	0.0446 (0.4200)	0.1429 (1.3263)	7.0987(88.3060)
White-sided	---	0.042 (0.387)	0.093 (1.082)	---
	---	0.0559 (0.5119)	0.1237 (1.4308)	---
White-beaked	---	---	---	---
	---	---	---	---
Grampus	---	0.007 (0.138)	---	---
	---	0.0105 (0.1830)	---	---
Pilot Whale	---	0.003 (0.069)	0.053 (0.629)	0.076 (0.738)
	---	0.0052 (0.0915)	0.0702 (0.8314)	0.1005 (0.9764)
Harbor Porpoise	---	---	---	0.014 (0.194)
	---	---	---	0.0288 (0.4001)
All Dolphins	0.325 (1.327)	0.088 (0.519)	0.341 (1.984)	5.476 (66.823)
(Delphinidae and Harbor Porpoise)	0.4296 (1.7538)	0.1165 (0.6870)	0.4486 (2.6211)	7.2466(88.3028)

Table 57. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\overline{X}$ $\pm$SD) (lower number), by species and species groups for Southern New England Near Shelf, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
DOLPHINS				
Bottle-nosed	--- ---	--- ---	--- ---	--- ---
Spotted	--- ---	--- ---	--- ---	--- ---
Striped	--- ---	--- ---	--- ---	--- ---
Saddleback	0.032 (0.426) 0.0432 (0.5554)	--- ---	--- ---	--- ---
White-sided	--- ---	--- ---	--- ---	--- ---
White-beaked	--- ---	--- ---	--- ---	--- ---
Grampus	--- ---	--- ---	--- ---	--- ---
Pilot Whale	--- ---	--- ---	0.002 (0.042) 0.0034 (0.0567)	--- ---
Harbor Porpoise	--- ---	0.002 (0.029) 0.0045 (0.0607)	--- ---	--- ---
All Dolphins (Delphinidae and Harbor Porpoise)	0.032 (0.420) 0.0432 (0.5554)	0.002 (0.029) 0.0045 (0.0607)	0.002 (0.042) 0.0034 (0.0567)	--- ---

Table 58. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X}$ $\underline{+}$SD) (lower number), by species and species groups for Southern New England Mid-Shelf, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
DOLPHINS				
Bottle-nosed	--- ---	0.013 (0.156) 0.0180 (0.2068)	0.004 (0.094) 0.0053 (0.1249)	0.019 (0.277) 0.0255 (0.3670)
Spotted	--- ---	--- ---	--- ---	--- ---
Striped	--- ---	--- ---	0.002 (0.056) 0.0029 (0.0746)	--- ---
Saddleback	0.161 (0.751) 0.2138 (0.9930)	0.094 (0.838) 0.1247 (1.1073)	0.088 (1.000) 0.1174 (1.3223)	0.184 (2.076) 0.2438 (2.7445)
White-sided	0.022 (0.329) 0.0299 (0.4355)	0.022 (0.237) 0.0300 (0.3141)	0.001 (0.042) 0.0021 (0.0559)	--- ---
White-beaked	--- ---	--- ---	--- ---	--- ---
Grampus	--- ---	--- ---	0.006 (0.120) 0.0087 (0.1591)	0.014 (0.260) 0.0189 (0.3445)
Pilot Whale	0.013 (0.157) 0.0183 (0.2082)	0.006 (0.055) 0.0087 (0.0728)	--- ---	0.098 (0.889) 0.1304 (1.1487)
Harbor Porpoise	--- ---	--- ---	--- ---	--- ---
All Dolphins (Delphinidae and Harbor Porpoise)	0.243 (1.049) 0.3219 (1.3873)	0.146 (0.891) 0.1935 (1.1784)	0.125 (1.052) 0.1543 (1.3765)	0.316 (2.321) 0.4187 (3.0681)

Table 59. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\overline{X}$ $\pm$SD) (lower number), by species and species groups for Southern New England Outer Shelf, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
DOLPHINS				
Bottle-nosed	---	0.002 (0.037)	0.090 (1.141)	---
	---	0.0038 (0.0493)	0.1196 (1.5089)	---
Spotted	---	---	0.009 (0.114)	0.008 (0.119)
	---	---	0.0119 (0.1508)	0.0116 (0.1577)
Striped	---	---	---	---
	---	---	---	---
Saddleback	0.049 (0.244)	0.027 (0.258)	0.020 (0.263)	---
	0.0660 (0.3236)	0.0365 (0.3420)	0.0276 (0.3482)	---
White-sided	---	0.204 (1.865)	---	---
	---	0.2702 (2.4650)	---	---
White-beaked	---	---	---	---
	---	---	---	---
Grampus	---	---	---	0.048 (0.489)
	---	---	---	0.0637 (0.6468)
Pilot Whale	0.129 (0.474)	0.030 (0.392)	0.006 (0.076)	---
	0.1717 (0.6271)	0.0403 (0.5184)	0.0079 (0.1005)	---
Harbor Porpoise	---	---	---	---
	---	---	---	---
All Dolphins (Delphinidae and Harbor Porpoise)	0.179 (0.521)	0.274 (1.917)	0.161 (1.211)	0.057 (0.503)
	0.2378 (0.6887)	0.3629 (2.5331)	0.2135 (1.6010)	0.0753 (0.6647)

Table 60. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X}$ $\pm$SD) (lower number), by species and species groups for the Mid-Atlantic Near Shelf, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
DOLPHINS				
Bottle-nosed	--- ---	0.002 (0.037) 0.0038 (0.0493)	0.090 (1.141) 0.1196 (1.5089)	--- ---
Spotted	--- ---	--- ---	0.009 (0.114) 0.0119 (0.1508)	0.008 (0.119) 0.0116 (0.1577)
Striped	--- ---	--- ---	--- ---	--- ---
Saddleback	0.049 (0.244) 0.0660 (0.3236)	0.027 (0.258) 0.0365 (0.3420)	0.020 (0.263) 0.0276 (0.3482)	--- ---
White-sided	--- ---	0.204 (1.865) 0.2702 (2.4650)	--- ---	--- ---
White-beaked	--- ---	--- ---	--- ---	--- ---
Grampus	--- ---	--- ---	--- ---	0.048 (0.489) 0.0637 (0.6468)
Pilot Whale	0.129 (0.474) 0.1717 (0.6271)	0.030 (0.392) 0.0403 (0.5184)	0.006 (0.076) 0.0079 (0.1005)	--- ---
Harbor Porpoise	--- ---	--- ---	--- ---	--- ---
All Dolphins (Delphinidae and Harbor Porpoise)	0.179 (0.521) 0.2378 (0.6887)	0.274 (1.917) 0.3269 (2.5331)	0.161 (1.211) 0.2135 (1.6010)	0.057 (0.503) 0.0753 (0.6647)

Table 61. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X}$ $\pm$SD) (lower number), by species and species groups for the Mid-Atlantic Mid-Shelf, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
DOLPHINS				
Bottle-nosed	---	0.022 (0.284)	0.018 (0.177)	0.057 (0.429)
	---	0.0297 (0.3760)	0.0248 (0.2344)	0.0761 (0.5675)
Spotted	---	---	---	0.001 (0.019)
	---	---	---	0.0021 (0.0258)
Striped	---	---	---	---
	---	---	---	---
Saddleback	0.774 (3.608)	0.149 (1.794)	0.049 (0.526)	---
	1.0227 (4.7678)	0.1994 (2.3716)	0.0654 (0.6954)	---
White-sided	---	---	---	---
	---	---	---	---
White-beaked	---	---	---	---
	---	---	---	---
Grampus	---	---	---	0.004 (0.058)
	---	---	---	0.0063 (0.0776)
Pilot Whale	0.016 (0.145)	0.022 (0.284)	---	---
	0.0216 (0.1926)	0.0297 (0.3760)	---	---
Harbor Porpoise	---	---	---	---
	---	---	---	---
All Dolphins (Delphinidae and Harbor Porpoise)	0.790 (3.607)	0.254 (2.225)	0.068 (0.553)	0.079 (0.504)
	1.0444 (4.7669)	0.3381 (2.9408)	0.0902 (0.7316)	0.1057 (0.6660)

Table 62. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X}$ $\pm$SD) (lower number), by species and species groups for the Mid-Atlantic Outer Shelf, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
DOLPHINS				
Bottle-nosed	0.063 (0.326) 0.0840 (0.4314)	0.007 (0.067) 0.0093 (0.0892)	0.268 (1.143) 0.3550 (1.5108)	0.026 (0.188) 0.0344 (0.2486)
Spotted	--- ---	0.293 (2.814) 0.3877 (3.7193)	0.073 (0.562) 0.0967 (0.7431)	--- ---
Striped	--- ---	--- ---	--- ---	--- ---
Saddleback	--- ---	5.229 (41.140) 6.9099(54.3627)	--- ---	0.057 (0.585) 0.0755 (0.7763)
White-sided	--- ---	0.005 (0.560) 0.0077 (0.0743)	--- ---	--- ---
White-beaked	--- ---	--- ---	--- ---	--- ---
Grampus	--- ---	0.002 (0.025) 0.0034 (0.0330)	0.027 (0.210) 0.0362 (0.2786)	0.010 (0.105) 0.0135 (0.1392)
Pilot Whale	--- ---	--- ---	0.144 (0.976) 0.1908 (1.2900)	--- ---
Harbor Porpoise	--- ---	--- ---	--- ---	--- ---
All Dolphins (Delphinidae and Harbor Porpoise)	0.063 (0.326) 0.0840 (0.4314)	5.679 (41.193) 7.5043(54.4336)	0.546 (1.626) 0.7223 (2.1486)	0.093 (0.620) 0.1235 (0.8194)

Table 63. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X}$ $\pm$SD) (lower number), by species and species groups for Slope, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
DOLPHINS				
Bottle-nosed	---	0.050 (0.385)	0.214 (1.762)	0.038 (0.371)
	---	0.0669 (0.5090)	0.2838 (2.3288)	0.0506 (0.4906)
Spotted	---	0.009 (0.099)	0.031 (0.446)	---
	---	0.0120 (0.1313)	0.0422 (0.5900)	---
Striped	---	0.231 (2.222)	0.155 (2.219)	0.010 (0.101)
	---	0.3063 (2.9372)	0.2055 (2.9329)	0.0138 (0.1338)
Saddleback	---	0.628 (2.591)	---	---
	---	0.8310 (3.4245)	---	---
White-sided	---	---	---	---
	---	---	---	---
White-beaked	---	---	---	---
	---	---	---	---
Grampus	---	0.028 (0.172)	0.011 (0.109)	0.045 (0.351)
	---	0.0376 (0.2277)	0.0153 (0.1453)	0.0607 (0.4639)
Pilot Whale	---	0.029 (0.241)	0.050 (0.371)	0.011 (0.111)
	---	0.0389 (0.3190)	0.0667 (0.4909)	0.0151 (0.1471)
Harbor Porpoise	---	---	---	---
	---	---	---	---
All Dolphins	---	1.180 (4.415)	0.670 (3.350)	0.106 (0.525)
(Delphinidae and Harbor Porpoise)	---	1.5617 (5.8340)	0.8863 (4.4278)	0.1403 (0.6945)

Table 64. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X}$ $\pm$SD) (lower number), by species and species groups for the Gulf of Maine Central Gulf, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
LARGE WHALES				
Sperm whale	--- ---	--- ---	--- ---	0.002 (0.036) 0.0014 (0.0206)
Minke whale	<0.001 (0.010) 0.0010 (0.0239)	--- ---	0.003 (0.031) 0.0069 (0.0710)	<0.001 (0.011) 0.0014 (0.0265)
Fin whale	<0.001 (0.015) 0.0005 (0.0086)	0.002 (0.022) 0.0012 (0.0129)	0.009 (0.088) 0.0055 (0.0503)	0.007 (0.049) 0.0040 (0.0281)
Sei whale	--- ---	--- ---	--- ---	--- ---
Humpback whale	--- ---	--- ---	0.002 (0.044) 0.0011 (0.0252)	0.001 (0.023) 0.0007 (0.0132)
Right whale	--- ---	--- ---	--- ---	--- ---
Unidentified Beaked-whale	--- ---	--- ---	--- ---	--- ---
All Large whales (Balaenopteridae and Sperm whale)	0.001 (0.010) 0.0015 (0.0254)	0.002 (0.022) 0.0012 (0.0129)	0.016 (0.109) 0.0147 (0.0925)	0.015 (0.087) 0.0104 (0.0555)

Table 65. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X}$ ±SD) (lower number), by species and species groups for the Gulf of Maine South, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
LARGE WHALES				
Sperm whale	--- ---	--- ---	--- ---	--- ---
Minke whale	--- ---	--- ---	0.004 (0.048) 0.0099 (0.1105)	--- ---
Fin whale	0.002 (0.022) 0.0011 (0.0125)	0.011 (0.064) 0.0066 (0.0366)	0.050 (0.169) 0.0287 (0.0961)	0.008 (0.042) 0.0046 (0.0238)
Sei whale	--- ---	--- ---	--- ---	--- ---
Humpback whale	--- ---	0.015 (0.082) 0.0085 (0.0467)	0.025 (0.200) 0.0141 (0.1136)	0.009 (0.073) 0.0052 (0.0418)
Right whale	--- ---	0.013 (0.119) ---	0.001 (0.021) ---	--- ---
Unidentified Beaked-whale	--- ---	--- ---	--- ---	--- ---
All Large whales (Balaenopteridae and Sperm whale)	0.002 (0.022) 0.0011 (0.0125)	0.040 (0.176) 0.0227 (0.1003)	0.087 (0.290) 0.0571 (0.1964)	0.024 (0.092) 0.0136 (0.0523)

Table 66. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X}$ ±SD) (lower number), by species and species groups for the Gulf of Maine Southwest, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
LARGE WHALES				
Sperm whale	--- ---	--- ---	--- ---	--- ---
Minke whale	--- ---	0.003 (0.027) 0.0070 (0.0624)	0.002 (0.024) 0.0054 (0.0558)	0.001 (0.021) 0.0038 (0.0485)
Fin whale	0.010 (0.059) 0.0058 (0.0338)	0.015 (0.086) 0.0087 (0.0487)	0.095 (0.324) 0.0541 (0.1840)	0.074 (0.410) 0.0421 (0.2331)
Sei whale	--- ---	--- ---	<0.001 (0.015) ---	--- ---
Humpback whale	0.010 (0.077) 0.0061 (0.0436)	0.028 (0.136) 0.0200 (0.0908)	0.031 (0.151) 0.0177 (0.0856)	0.054 (0.369) 0.0311 (0.2095)
Right whale	--- ---	0.002 (0.034) ---	--- ---	--- ---
Unidentified Beaked-whale	--- ---	--- ---	--- ---	--- ---
All Large whales (Balaenopteridae and Sperm whale)	0.024 (0.108) 0.0141 (0.0612)	0.073 (0.252) 0.0468 (0.1557)	0.137 (0.393) 0.0823 (0.2297)	0.152 (0.607) 0.0894 (0.3482)

Table 67. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X}$ $\pm$SD) (lower number), by species and species groups for Georges Bank Northern Edge, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
LARGE WHALES				
Sperm whale	--- ---	--- ---	--- ---	--- ---
Minke whale	--- ---	--- ---	0.004 (0.031) 0.0106 (0.0722)	--- ---
Fin whale	0.011 (0.056) 0.0066 (0.0319)	0.017 (0.113) 0.0102 (0.0645)	0.010 (0.070) 0.0059 (0.0401)	0.002 (0.024) 0.0015 (0.0138)
Sei whale	--- ---	--- ---	--- ---	--- ---
Humpback whale	--- ---	--- ---	--- ---	--- ---
Right whale	--- ---	--- ---	--- ---	--- ---
Unidentified Beaked-whale	--- ---	--- ---	--- ---	--- ---
All Large whales (Balaenopteridae and Sperm whale)	0.011 (0.056) 0.0066 (0.0319)	0.073 (0.252) 0.0102 (0.0645)	0.137 (0.393) 0.0165 (0.0826)	0.152 (0.607) 0.0038 (0.0240)

Table 68. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X}$ +SD) (lower number), by species and species groups for Georges Bank Shelf Edge, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
LARGE WHALES				
Sperm whale	--- ---	--- ---	0.005 (0.036) 0.0032 (0.0205)	--- ---
Minke whale	--- ---	--- ---	0.005 (0.065) 0.0135 (0.1485)	0.003 (0.041) 0.0089 (0.0939)
Fin whale	--- ---	0.042 (0.134) 0.0243 (0.0764)	0.001 (0.021) 0.0011 (0.0123)	0.087 (0.224) 0.0493 (0.1276)
Sei whale	--- ---	--- ---	--- ---	--- ---
Humpback whale	--- ---	--- ---	--- ---	--- ---
Right whale	--- ---	--- ---	--- ---	--- ---
Unidentified Beaked-whale	--- ---	--- ---	--- ---	0.005 (0.062) ---
All Large whales (Balaenopteridae and Sperm whale)	--- ---	0.042 (0.134) 0.0243 (0.0764)	0.014 (0.080) 0.0189 (0.1508)	0.095 (0.230) 0.0614 (0.1593)

Table 69. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X}$ $\underline{+}$SD) (lower number), by species and species groups for Georges Bank Shoals, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
LARGE WHALES				
Sperm whale	--- ---	--- ---	--- ---	--- ---
Minke whale	--- ---	--- ---	0.001 (0.018) 0.0030 (0.0410)	--- ---
Fin whale	--- ---	--- ---	0.001 (0.018) 0.0007 (0.0102)	0.002 (0.033) 0.0014 (0.0190)
Sei whale	--- ---	--- ---	--- ---	--- ---
Humpback whale	--- ---	--- ---	--- ---	--- ---
Right whale	--- ---	--- ---	--- ---	--- ---
Unidentified Beaked-whale	--- ---	--- ---	--- ---	--- ---
All Large whales (Balaenopteridae and Sperm whale)	--- ---	0.001 (0.016) 0.0007 (0.0093)	0.002 (0.018) 0.0037 (0.0422)	0.002 (0.033) 0.0014 (0.0190)

Table 70. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X}$ $\pm$SD) (lower number), by species and species groups for Georges Bank Central Bank, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
LARGE WHALES				
Sperm whale	--- ---	--- ---	--- ---	--- ---
Minke whale	--- ---	--- ---	0.005 (0.047) 0.0129 (0.1077)	--- ---
Fin whale	0.001 (0.021) 0.0008 (0.0124)	0.004 (0.063) 0.0028 (0.0360)	<0.001 (0.013) 0.0004 (0.0077)	0.027 (0.168) 0.0154 (0.0956)
Sei whale	--- ---	--- ---	--- ---	--- ---
Humpback whale	0.001 (0.017) 0.0006 (0.0096)	--- ---	--- ---	--- ---
Right whale	--- ---	--- ---	--- ---	--- ---
Unidentified Beaked-whale	--- ---	--- ---	--- ---	--- ---
All Large whales (Balaenopteridae and Sperm whale)	0.002 (0.027) 0.0015 (0.0157)	0.005 (0.065) 0.0033 (0.0370)	0.006 (0.051) 0.0137 (0.1083)	0.027 (0.168) 0.0154 (0.0965)

Table 71. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\overline{X}$ $\pm$SD) (lower number), by species and species groups for Southern New England Near Shelf, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
LARGE WHALES				
Sperm whale	0.006 (0.065) 0.0039 (0.0369)	--- ---	--- ---	0.002 (0.021) 0.0011 (0.0124)
Minke whale	--- ---	--- ---	0.001 (0.021) 0.0028 (0.0483)	--- ---
Fin whale	0.001 (0.018) 0.0008 (0.0105)	0.001 (0.018) 0.0007 (0.0102)	0.019 (0.126) 0.0110 (0.0717)	0.002 (0.023) 0.0012 (0.0132)
Sei whale	--- ---	--- ---	--- ---	--- ---
Humpback whale	0.003 (0.050) 0.0022 (0.0286)	--- ---	--- ---	--- ---
Right whale	--- ---	--- ---	--- ---	--- ---
Unidentified Beaked-whale	--- ---	--- ---	--- ---	--- ---
All Large whales (Balaenopteridae and Sperm whale)	0.012 (0.083) 0.0070 (0.0476)	0.001 (0.018) 0.0007 (0.0102)	0.021 (0.129) 0.0143 (0.0868)	0.004 (0.031) 0.0023 (0.0181)

Table 72. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X}$ $\pm$SD) (lower number), by species and species groups for Southern New England Mid-Shelf, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
LARGE WHALES				
Sperm whale	0.006 (0.098) 0.0038 (0.0561)	--- ---	<0.001 (0.014) 0.0004 (0.0080)	--- ---
Minke whale	--- ---	0.002 (0.024) 0.0065 (0.0547)	--- ---	--- ---
Fin whale	--- ---	0.003 (0.039) 0.0019 (0.0224)	0.010 (0.089) 0.0061 (0.0505)	0.002 (0.031) 0.0012 (0.0178)
Sei whale	--- ---	--- ---	--- ---	--- ---
Humpback whale	--- ---	--- ---	--- ---	--- ---
Right whale	--- ---	--- ---	--- ---	--- ---
Unidentified Beaked-whale	--- ---	--- ---	--- ---	--- ---
All Large whales (Balaenopteridae and Sperm whale)	0.006 (0.098) 0.0038 (0.0561)	0.013 (0.097) 0.0129 (0.0764)	0.013 (0.094) 0.0078 (0.0534)	0.004 (0.034) 0.0027 (0.0226)

Table 73. Estimates of abundance, animals/linear km (upper number), and density, animals/km² ($\bar{X}$ ±SD) (lower number), by species and species groups for Southern New England Outer Shelf, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
LARGE WHALES				
Sperm whale	---	0.013 (0.071)	0.001 (0.019)	---
	---	0.0074 (0.0407)	0.0008 (0.0107)	---
Minke whale	---	0.001 (0.021)	---	0.001 (0.017)
	---	0.0037 (0.0477)	---	0.0029 (0.0401)
Fin whale	---	0.022 (0.105)	0.021 (0.117)	0.006 (0.039)
	---	0.0126 (0.0599)	0.0121 (0.0666)	0.0037 (0.0223)
Sei whale	---	0.009 (0.093)	---	---
	---	---	---	---
Humpback whale	---	0.003 (0.028)	---	---
	---	0.0017 (0.0158)	---	---
Right whale	---	---	---	---
	---	---	---	---
Unidentified	---	---	---	---
Beaked-whale	---	---	---	---
All Large whales	---	0.056 (0.166)	0.025 (0.124)	0.007 (0.043)
(Balaenopteridae	---	0.0350 (0.1055)	0.0147 (0.0703)	0.0066 (0.0459)
and Sperm whale)				

Table 74. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\overline{X}$ $\underline{+}$SD) (lower number), by species and species groups for the Mid-Atlantic Near Shelf, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
LARGE WHALES				
Sperm whale	--- ---	--- ---	--- ---	--- ---
Minke whale	0.001 (0.019) 0.0038 (0.0433)	--- ---	--- ---	--- ---
Fin whale	--- ---	0.004 (0.036) 0.0023 (0.0204)	0.014 (0.145) 0.0080 (0.0828)	--- ---
Sei whale	--- ---	<0.001 (0.014) ---	--- ---	--- ---
Humpback whale	--- ---	--- ---	--- ---	<0.001 (0.013) 0.0005 (0.0076)
Right whale	--- ---	--- ---	--- ---	--- ---
Unidentified Beaked-whale	--- ---	--- ---	--- ---	--- ---
All Large whales (Balaenopteridae and Sperm whale)	0.001 (0.019) 0.0038 (0.0433)	0.005 (0.045) 0.0028 (0.0257)	0.014 (0.145) 0.0080 (0.0828)	<0.001 (0.013) 0.0005 (0.0076)

Table 75. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\overline{X}$ $\pm$SD) (lower number), by species and species groups for the Mid-Atlantic Mid-Shelf, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
LARGE WHALES				
Sperm whale	--- ---	--- ---	--- ---	--- ---
Minke whale	0.001 (0.019) 0.0068 (0.0612)	--- ---	--- ---	--- ---
Fin whale	0.002 (0.024) 0.0015 (0.0137)	0.002 (0.026) 0.0017 (0.0151)	0.021 (0.148) 0.0123 (0.0840)	0.014 (0.118) 0.0084 (0.0670)
Sei whale	--- ---	--- ---	--- ---	--- ---
Humpback whale	--- ---	--- ---	--- ---	--- ---
Right whale	--- ---	--- ---	--- ---	--- ---
Unidentified Beaked-whale	--- ---	--- ---	--- ---	--- ---
All Large whales (Balaenopteridae and Sperm whale)	0.005 (0.035) 0.0083 (0.0627)	0.007 (0.041) 0.0042 (0.0237)	0.022 (0.150) 0.0129 (0.0855)	0.016 (0.119) 0.0093 (0.0678)

Table 76. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X}$ $\pm$SD) (lower number), by species and species groups for the Mid-Atlantic Outer Shelf, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
LARGE WHALES				
Sperm whale	0.021 (0.105) 0.0121 (0.0598)	--- ---	--- ---	--- ---
Minke whale	--- ---	--- ---	--- ---	0.002 (0.023) 0.0051 (0.0531)
Fin whale	0.003 (0.026) 0.0020 (0.0151)	0.025 (0.091) 0.0146 (0.0520)	--- ---	--- ---
Sei whale	--- ---	--- ---	--- ---	--- ---
Humpback whale	--- ---	--- ---	--- ---	--- ---
Right whale	--- ---	--- ---	--- ---	--- ---
Unidentified Beaked-whale	--- ---	--- ---	--- ---	--- ---
All Large whales (Balaenopteridae and Sperm whale)	0.025 (0.108) 0.0142 (0.0613)	0.025 (0.091) 0.0146 (0.0520)	--- ---	0.002 (0.023) 0.0051 (0.0531)

Table 77. Estimates of abundance, animals/linear km (upper number), and density, animals/km^2 ($\bar{X}$ $\pm$SD) (lower number), by species and species groups for Slope, June 1980 to December 1983.

SPECIES	Winter	Spring	Summer	Fall
LARGE WHALES				
Sperm whale	---	0.022 (0.125)	0.021 (0.127)	---
	---	0.0126 (0.0711)	0.0120 (0.0721)	---
Minke whale	---	---	---	---
	---	---	---	---
Fin whale	---	---	0.001 (0.029)	---
	---	---	0.0010 (0.0165)	---
Sei whale	---	---	---	---
	---	---	---	---
Humpback whale	---	---	<0.001 (0.014)	---
	---	---	0.0005 (0.0082)	---
Right whale	---	---	---	---
	---	---	---	---
Unidentified	---	---	---	---
Beaked-whale	---	---	---	---
All Large whales	---	0.028 (0.133)	0.026 (0.148)	---
(Balaenopteridae	---	0.0160 (0.0757)	0.0151 (0.0842)	---
and Sperm whale)				

MARINE TURTLES

Marine turtles have been known off the northestern United States primarily from strandings or opportunistic reports of sightings at sea (Babcock 1919, Bleakney 1965, Lazell 1976). The first comprehensive study of the spatial and temporal distribution and abundance of sea turtles in this area was conducted by CeTAP (Shoop et al. 1981). There are four members of the family Cheloniidae that are present in our study area: Loggerhead (Caretta caretta), Atlantic Ridley (Lepidochelys kempi), Hawksbill (Eretmochelys imbricata), and Green Turtle (Chelonia mydas). The Leatherback Turtle (Dermochelys coriacea) (Family Dermochelyidae) is a fifth species found in our study area. Excessive predation on eggs or hatchlings, human disturbance on nesting beaches (McFarlane 1963), excessive demand for turtle products, trawl entanglement, and consumption by local fishermen are all reasons for their current threatened or endangered status (Nat'l. Fish and Wildl. Laboratory 1980a, 1980b, 1980c, 1980d).

Marine turtles feed at several trophic levels from herbivore to tertiary carnivores. With the exception of D. coriacea, marine turtles feed mostly on the bottom and forage close to shores and reefs, generally in waters less than 60 m deep (Shoop et al. 1981). C. mydas is mostly herbivorous feeding on marine algae and marine grasses (Carr 1952, Nat'l. Fish and Wildl. Laboratory 1980a), although small invertebrates are also consumed (Nat'l. Fish and Wildl. Laboratory 1980a). L. kempi, E. imbricata and C. caretta are omnivorous and feed on a wide variety of invertebrates, algae and fish scraps discarded by fishing vessels. The Hawksbill Turtle prefers the sponge Geodia gibberosa (Nat'l. Fish and Wildl. Laboratory 1980b), whereas the Atlantic Ridley Turtle's diet consists mostly of crabs Arenaeus, Callinectes, Calappa, and Hepatus (Nat'l. Fish and Wildl. Laboratory 1980c). Leatherback Turtles are open water or pelagic carnivores feeding principally on jellyfish (Carr 1952, Nat'l. Fish and Wildl. Laboratory 1980d) and favor Cyanea in the Gulf of Maine (Lazell 1976).

The Loggerhead Turtle is the most numerous species in our study area. Their range during the winter and early spring is south of 37°00'N on the continental shelf. From May to October, they occur throughout the shelf waters and on Georges Bank south of 41°00'N latitude (Shoop et al. 1981). Winter observations were limited to the southern Mid-Atlantic Bight (CeTAP 1982). Green Turtles are found worldwide in waters warmer than 20°C in the coldest month, although juveniles are sometimes found in colder waters (Nat'l. Fish and Wildl. Laboratory 1980a). Green Turtles are infrequent to rare summer stragglers to our study area from Cape Cod southward (CeTAP 1982). The Hawksbill Turtle is scattered throughout the world's tropical oceans, although records are known from Massachusetts (Lazell 1976). This species was not seen during CeTAP surveys (Shoop et al. 1981) and is considered rare in our study area. Adult Ridley Turtles are restricted to the Gulf of Mexico (Nat'l. Fish and Wildl. Laboratory 1980c); however stranded immature Ridleys are regularly found from Massachusetts and North Carolina waters (Lazell 19767; Shoop 1980; Shoop et al. 1981). Partly because of the high numbers of strandings of L. kempi, in view of their very reduced worldwide number, Lazell (1980) requested that New England waters be considered critical habitat for that species.

Leatherback Turtles are widespread in the oceans of the world (Nat'l. Fish and Wildl. Laboratory 1980d). This is the second most common turtle within our study area (Shoop et al. 1981). The leatherback's seasonal migration is reverse of that of the Loggerhead. Leatherback Turtles move northward beyond the shelf-break, possibly within the Gulf Stream; therefore there were few sightings in the spring months (CeTAP 1982). They first appear in the Gulf of Maine (north of 42°00'N latitude) in late May to June, and from 42°00'N to approximately 38°00'N in shelf waters from June through October (Shoop et al. 1981). Leatherback sightings peak during the summer, most in SNE coastal regions (CeTAP 1982). They are not seen in winter.

Seasonal plots of relative abundance (Fig. 80) of all our turtle sightings indicate a widespread summer distribution south of 41°00'N throughout the shelf waters. Turtle sighting frequencies were greatest in the Mid-Atlantic/near-shelf subregion (0.03 individuals/count) and the Carolina Capes/coastal subregion (0.05 individuals/count) (Tables 78-79). Fall sightings occurred in the shelf waters of Southern New England and the MA Bight (Tables 78-79) and throughout the Mid-Atlantic region (Fig. 80; Tables 78-79).

All but five sightings were *C. caretta* or probable Loggerhead. Two sightings of the Ridley Turtle occurred south of Block Island. The very small size and light color make these turtles difficult to observe from any platform. There were no sightings of Ridleys during 1979 aerial surveys by CeTAP (Shoop et al. 1981). A possible Green Turtle was seen in coastal waters near Cape Hatteras. Two sightings (three individuals) of the Leatherback Turtle occurred in near-shelf waters off New Jersey and Delaware.

Although nesting records of any sea turtle are extremely rare within our study area, the shelf waters south of 42°00'N appeared to be important waters and possibly critical habitat for seasonal feeding of the Loggerhead Turtle. Likewise the shelf waters north of 38°00'N to the Gulf of Maine may be important feeding areas for Leatherback Turtles (Shoop et al. 1981).

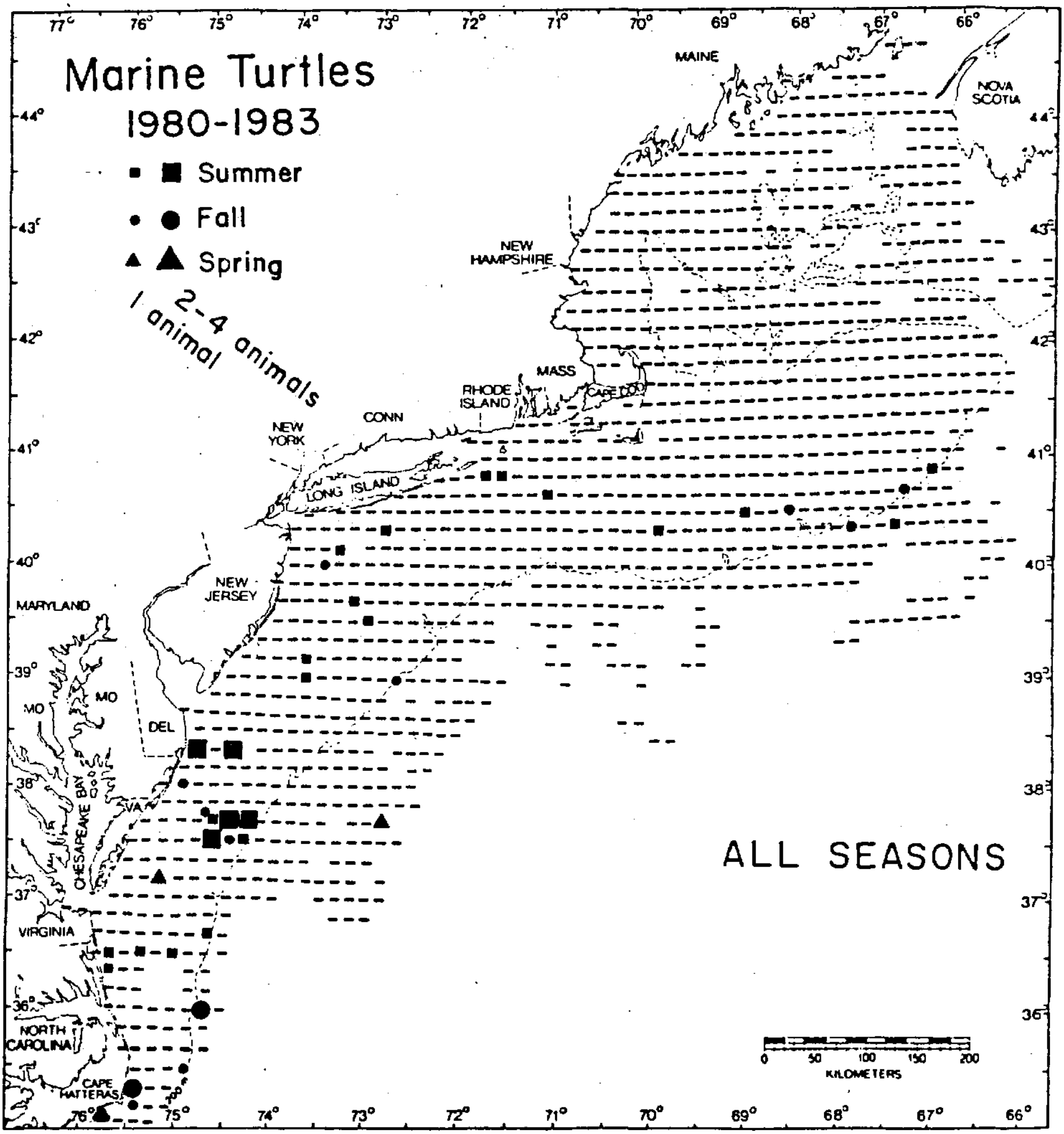

Figure 80. Relative distribution and abundance of marine turtles for all seasons.

Table 78. Seasonal estimates of all Turtle abundance, animals/linear km ($\bar{X} \pm SD$), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	---	---	---	---
South	---	---	---	---
Southwest	---	---	---	---
Total	---	---	---	---
GEORGES BANK				
Northern edge	---	---	---	---
Shelf edge	---	---	---	---
Shoals	---	---	---	---
Central bank	---	---	<0.001 (0.013)	0.002 (0.027)
Total	---	---	<0.001 (0.009)	0.001 (0.029)
S. NEW ENGLAND				
Inner shelf	---	---	0.002 (0.019)	---
Mid shelf	---	---	0.008 (0.121)	---
Outer shelf	---	---	---	---
Total	---	---	0.005 (0.060)	---
MID-ATLANTIC				
Inner shelf	---	0.001 (0.018)	0.004 (0.037)	---
Mid shelf	---	---	0.002 (0.037)	0.001 (0.017)
Outer shelf	---	---	---	0.002 (0.021)
Total	---	<0.001 (0.013)	0.003 (0.024)	0.001 (0.007)
SLOPE	---	---	0.002 (0.023)	---

Table 79. Seasonal estimates of all Turtle densities, animals/km^2 ($\bar{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central Gulf	---	---	---	---
South	---	---	---	---
Southwest	---	---	---	---
Total	---	---	---	---
GEORGES BANK				
Northern edge	---	---	---	---
Shelf edge	---	---	---	---
Shoals	---	---	---	---
Central bank	---	---	0.0046 (0.0821)	0.0168 (0.1653)
Total	---	---	0.0022 (0.0564)	0.0059 (0.0647)
S. NEW ENGLAND				
Inner shelf	---	---	0.0106 (0.1208)	---
Mid shelf	---	---	0.0082 (0.1043)	---
Outer shelf	---	---	---	---
Total	---	---	0.0081 (0.0695)	---
MID-ATLANTIC				
Inner shelf	---	0.0090 (0.1081)	0.0278 (0.2263)	---
Mid shelf	---	---	0.0178 (0.1513)	0.0086 (0.1058)
Outer shelf	---	---	---	0.0123 (0.1264)
Total	---	0.0048 (0.0789)	0.0227 (0.1495)	0.0055 (0.0441)
SLOPE	---	---	0.0121 (0.1424)	---

SEABIRDS

Seabird densities were generally greatest on GB and in the GOM (maximum 58.62 birds/km^2, GOM-southwest in fall) (Table 80). Densities were the lowest in the mid-Atlantic regions (maximum 136.74 birds/km^2, GB-northern edge in winter). The highest total density for a region occurred in SNE (38.24 birds/km^2) in spring. Peak densities in this region corresponded with the northward migration of Red Phalarope along the outer edge of the shelf (60-200 m) in late April (Powers 1983). In addition, large numbers of Herring and Great Black-backed Gulls, and Northern Gannets occurred in this subregion in spring. The gulls may have been attracted to the shelf break by the foreign fleets fishing the continental slope from Hudson Canyon east to Lydonia Canyon.

Seasonally, bird densities were high throughout the year on GB and in the GOM, although species composition changed by season. The dominant species were fulmars and Red Phalaropes in spring; Greater Shearwaters and Wilson's Storm-Petrels in summer; Greater Shearwaters and kittiwakes in fall, and fulmars and kittiwakes in winter (Powers et al. 1982). Great Black-backed and Herring Gulls were abundant in all seasons. Heavy concentrations of birds occurred locally in an area from Jeffreys Ledge south to Stellwagen Bank (Gulf of Maine-southwest), southeast through the Great South Channel, and eastward along the GB-NE. Peak densities consisting principally of Greater Shearwater, Wilson's Storm-Petrels and kittiwakes occurred in the GOM subareas in summer and fall. Along GB-NE, densities were high summer through winter . The species composition was primarily Greater Shearwaters, Wilson's and Leach's Storm-Peterls, kittiwakes, and fulmars. Northern Fulmars and Black-legged Kitiwakes were consistently found densely aggregated on the northern edge of GB in the winter. These aggregations resulted in the highest density per subregion recorded in any season (13.67 birds/km^2) (Table 80). The SNE-shelf edge was ranked second in abundance principally due to the tremendous flocks of red phalarope present along the shelf edge in spring.

The review of species and species groups adapted from Powers et al. (1982) and Powers (1983).

Table 80. Seasonal estimates of all seabird densities, birds/km^2 ($\bar{X}$ +SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	20.964 (78.975)	5.880 (12.164)	19.367 (38.461)	15.675 (54.691)
South	13.178 (17.623)	3.746 (4.046)	21.427 (37.945)	18.959 (40.555)
Southwest	17.001 (39.598)	14.758 (30.929)	31.945 (75.730)	58.627(212.860)
Total	18.774 (65.951)	8.482 (20.355)	23.681 (53.586)	27.245(117.532)
GEORGES BANK				
Northern edge	136.740(529.033)	25.510 (70.274)	67.546 (90.730)	48.594(212.353)
Shelf edge	4.403 (4.469)	7.875 (14.975)	7.345 (9.700)	10.927 (22.568)
Shoals	8.744 (9.241)	6.906 (10.312)	23.647(205.787)	11.314 (14.816)
Central bank	7.713 (15.621)	41.699(294.309)	10.420 (22.673)	14.840 (50.724)
Total	15.950(134.808)	26.057(211.537)	17.644(114.370)	16.906 (80.520)
S. NEW ENGLAND				
Inner shelf	5.899 (14.528)	5.534 (15.637)	10.089 (65.442)	9.986 (19.014)
Mid shelf	4.828 (9.359)	30.417(123.578)	7.764 (23.384)	8.424 (18.573)
Outer shelf	3.211 (3.148)	86.758(421.462)	8.405 (26.622)	3.170 (6.949)
Total	5.204 (11.711)	38.244(238.384)	8.751 (44.890)	7.622 (16.813)
MID-ATLANTIC				
Inner shelf	5.548 (13.482)	4.937 (9.464)	3.543 (15.248)	3.021 (5.745)
Mid shelf	16.983 (65.078)	10.159 (18.201)	4.914 (22.691)	1.403 (3.694)
Outer shelf	24.403 (98.089)	17.314 (62.756)	5.223 (11.093)	1.458 (2.667)
Total	12.960 (58.336)	8.564 (28.920)	4.080 (17.522)	2.149 (4.630)
SLOPE	10.079 (4.072)	3.561 (6.687)	5.739 (13.576)	3.613 (15.576)

Northern Fulmar (*Fulmarus glacialis*)

Dietary opportunists, fulmars feed at the surface as secondary and tertiary carnivores and as scavengers on zooplankton, fish, squid, and offal from fishing vessels (Fisher 1952; Palmer 1962; Ainley and Sanger 1979; Hunt et al. 1981; Powers 1983). Fulmars were found in every subregion throughout the year, although greatest densities occurred on GB in winter and spring and in the GOM in winter. Flocks of several thousand fulmars were noted each winter in these regions, often associated with fishing vessels (Powers 1983). Local concentrations of fulmars along the GB-NE in winter (Table 81), yielded a mean density greater than any other species in any subregion. Densities of fulmars on the SNE and MA regions never exceeded 1 bird/km^2 in any season.

Table 81. Seasonal estimates of Northern Fulmar densities, birds/km^2 ($\bar{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	8.893 (65.998)	0.756 (3.815)	0.399 (2.162)	0.246 (0.639)
South	3.064 (7.710)	0.580 (0.980)	0.818 (2.344)	0.172 (0.369)
Southwest	0.673 (4.003)	1.176 (3.827)	0.152 (0.985)	0.241 (0.785)
Total	6.256 (52.830)	0.867 (3.503)	0.372 (1.901)	0.231 (0.641)
GEORGES BANK				
Northern edge	126.421 (530.322)	23.477 (70.748)	0.537 (1.577)	0.683 (1.928)
Shelf edge	1.478 (3.314)	1.812 (6.230)	0.007 (0.079)	0.255 (0.881)
Shoals	2.680 (5.081)	2.852 (4.869)	0.137 (0.509)	0.212 (0.647)
Central bank	1.809 (3.707)	2.151 (5.553)	0.099 (0.396)	0.122 (0.361)
Total	9.963 (134.303)	3.789 (19.875)	0.124 (0.576)	0.244 (0.894)
S. NEW ENGLAND				
Inner shelf	0.332 (0.152)	0.068 (0.313)	0.191 (1.054)	0.010 (0.092)
Mid shelf	0.527 (2.034)	0.825 (2.283)	0.118 (0.901)	0.029 (0.176)
Outer shelf	0.068 (0.314)	0.441 (1.235)	0.084 (0.439)	0.028 (0.178)
Total	0.248 (1.470)	0.473 (1.620)	0.142 (0.919)	0.022 (0.154)
MID-ATLANTIC				
Inner shelf	0.013 (0.102)	0.054 (0.530)	0.049 (0.583)	0.004 (0.057)
Mid shelf	0.027 (0.137)	0.204 (0.725)	0.020 (0.190)	---
Outer shelf	0.239 (0.603)	0.114 (0.350)	---	0.007 (0.079)
Total	0.065 (0.306)	0.107 (0.572)	0.037 (0.472)	0.003 (0.054)
SLOPE	---	0.311 (1.154)	---	---

Shearwaters

Five species of shearwaters were recorded from late spring to early winter, though patterns of distribution varied bewteen species. All species feed at or in near-surface waters as secondary and tertiary carnivores on fish, squid and crustaceans (Palmer 1962; Cramp et al. 1977; Brown et al. 1981; Powers 1983); Greater (Puffinus gravis) and Manx (P. puffinus) Shearwaters also scavenge offal from fishing vessels (Bent 1922; Brown et al. 1981).

Cory's Shearwaters (Calonectris diomedea) were found in shelf and slope waters throughout summer and fall (Table 82), though they generally remained south of the GOM, from GB to Cape Hatteras. Greatest numbers of birds resided in the SNE-shelf edge, from the Great South Channel west to Cox Ledge, where local concentrations of 30-100 birds/km^2 were recorded; however, mean densities rarely exceeded 1 bird/km^2. Densities in all subregions appeared relatively uniform. Greater Shearwaters were the dominant shearwaters in shelf waters in the GOM, GB and SNE regions from late May to early December (Table 83). Greatest densities were found on GB and in the GOM in summer and fall where densities were greater than 5 birds/km^2. Flocks of more than 10,000 birds were observed in these areas, often in association with fishing vessels (Powers 1983). Locally, densities were highest from Stellwagen Bank south to the Great South Channel and west to Cox Ledge. With the exception of areas of intense fishing effort along the shelf break, densities in the SNE and MA regions were generally less than 5 birds/km^2 in all seasons. Sooty Shearwaters (P. griseus) were recorded from April to November although peak densities occurred in summer on GB and in the southwest GOM (Table 84). Locally, greatest numbers were found on the Great South Channel and the northern edge of GB, however mean densities generally did not exceed 1 bird/km^2 in any subregion. Manx Shearwaters were recorded regularly in the SNE, GB and GOM regions in summer and fall, specifically along the southwest edge of GB into the Great South Channel and on Stellwagen Bank and Cox Ledge. Mean densities never exceeded 0.1 birds/km^2 in any subregion. Audubon's Shearwaters (P. lherminieri) occurred in slope/outer shelf waters on Georges Bank and in the SNE region in spring and throughout the mid-Atlantic shelf in fall, however mean densities never exceeded 0.1 birds/km^2 in any subregion.

Table 82. Seasonal estimates of Cory's Shearwater, birds/km^2 ($\bar{X} \pm SD$), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring		Summer		Fall	
GULF OF MAINE							
Central gulf	---	---		0.187	(1.121)	0.053	(0.341)
South	---	---		0.214	(0.690)	0.246	(1.428)
Southwest	---	---		0.024	(0.170)	0.218	(0.733)
Total	---	---		0.138	(0.876)	0.131	(0.764)
GEORGES BANK							
Northern edge	---	---		0.333	(1.233)	0.175	(0.810)
Shelf edge	---	---		0.121	(0.473)	0.031	(0.202)
Shoals	---	---		0.483	(2.710)	0.348	(1.402)
Central bank	---	0.002	(0.042)	0.703	(1.223)	0.323	(1.449)
Total	---	0.001	(0.030)	0.510	(1.999)	0.254	(1.213)
S. NEW ENGLAND							
Inner shelf	---	---		2.768	(32.419)	0.554	(2.631)
Mid shelf	---	---		0.682	(2.123)	0.255	(1.523)
Outer shelf	---	---		0.408	(4.078)	0.118	(0.841)
Total	---	---		1.454	(20.308)	0.319	(1.854)
MID-ATLANTIC							
Inner shelf	---	0.002	(0.047)	0.840	(10.960)	0.028	(0.196)
Mid shelf	---	---		0.199	(0.849)	0.075	(0.263)
Outer shelf	---	---		0.049	(0.191)	0.242	(1.292)
Total	---	0.001	(0.034)	0.589	(8.687)	0.105	(0.664)
SLOPE	—	---		0.099	(0.704)	0.015	(0.105)

Table 83. Seasonal estimates of Greater Shearwater, birds/km^2 ($\bar{X}$ +SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	0.024 (0.210)	---	4.860 (13.380)	5.205 (22.123)
South	0.355 (1.408)	---	4.486 (8.770)	5.932 (14.035)
Southwest	0.201 (0.942)	0.014 (0.126)	7.470 (31.307)	27.750(102.809)
Total	0.112 (0.726)	0.004 (0.073)	5.654 (20.614)	11.093 (55.568)
GEORGES BANK				
Northern edge	0.685 (1.664)	0.018 (0.115)	22.010 (41.114)	31.164(142.468)
Shelf edge	0.129 (0.317)	0.010 (0.093)	0.494 (0.944)	5.704 (13.124)
Shoals	0.138 (0.587)	0.079 (0.412)	10.166 (68.522)	4.645 (6.918)
Central bank	0.210 (1.292)	0.139 (0.800)	5.760 (16.184)	5.007 (21.795)
Total	0.213 (1.111)	0.097 (0.616)	7.210 (39.980)	8.132 (51.544)
S. NEW ENGLAND				
Inner shelf	0.022 (0.234)	---	4.011 (28.477)	1.462 (8.676)
Mid shelf	---	0.018 (0.129)	1.508 (6.024)	2.461 (10.058)
Outer shelf	---	0.004 (0.059)	0.881 (2.263)	1.485 (5.771)
Total	0.009 (0.155)	0.008 (0.087)	2.394 (18.267)	1.892 (8.708)
MID-ATLANTIC				
Inner shelf	---	---	0.209 (2.184)	0.042 (0.225)
Mid shelf	---	---	0.717 (3.273)	0.084 (0.523)
Outer shelf	---	---	0.097 (0.351)	0.040 (0.220)
Total	---	---	0.350 (2.491)	0.054 (0.345)
SLOPE	---	---	0.316 (1.033)	0.078 (0.293)

Table 84. Seasonal estimates of Sooty Shearwater, birds/km^2 ($\bar{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter		Spring		Summer		Fall	
GULF OF MAINE								
Central gulf	---		---		0.351	(1.752)	0.004	(0.076)
South	---		0.045	(0.300)	0.635	(2.555)	0.070	(0.345)
Southwest	0.003	(0.046)	0.324	(1.889)	1.822	(8.565)	0.048	(0.238)
Total	50.001	(0.021)	0.116	(1.106)	0.861	(5.151)	0.027	(0.200)
GEORGES BANK								
Northern edge	---		0.143	(0.546)	0.960	(2.370)	0.013	(0.105)
Shelf edge	---		0.033	(0.205)	0.038	(0.198)	---	
Shoals	---		0.087	(0.370)	0.474	(2.177)	0.004	(0.057)
Central bank	---		0.189	(0.836)	0.512	(2.204)	---	
Total	---		0.136	(0.651)	0.448	(2.011)	0.003	(0.048)
S. NEW ENGLAND								
Inner shelf	---		0.004	(0.062)	0.386	(2.852)	0.003	(0.047)
Mid shelf	---		0.114	(0.507)	0.212	(1.027)	---	
Outer shelf	---		0.038	(0.188)	0.140	(0.498)	0.004	(0.060)
Total	---		0.057	(0.330)	0.270	(1.922)	0.002	(0.040)
MID-ATLANTIC								
Inner shelf	---		0.038	(0.303)	0.018	(0.137)	---	
Mid shelf	---		0.109	(0.522)	0.009	(0.086)	---	
Outer shelf	---		0.113	(0.453)	---		---	
Total	---		0.071	(0.404)	0.014	(0.118)	---	
SLOPE	---		0.019	(0.119)	0.006	(0.073)	---	

Storm-Petrels

Two species of storm-petrels were recorded throughout the study area from April to November. Both feed principally at the surface as secondary carnivores on zooplankton, and to a lesser extent as tertiary carnivores on small fish and cephalopods (Cramp 1977; Ainley and Sanger 1979; Powers 1983). Wilson's Storm-Petrels (Oceanites oceanicus) also scavenge offal from fishing and whaling vessels (Cramp 1977) and carrion (Payne et al. 1983). Greatest densities of Wilson's Storm-Petrels occurred in summer along the GB-NE and in the western GOM through the Great South Channel (Table 85). Mean densities within the GOM were fairly stable (10 to 13 birds/km^2) indicating relatively uniform distribution across that region. Peak densities were found along the NE of GB (39 birds/km^2). Powers and Backus (1981) also found heavy concentrations of Wilson's Storm-Petrels in this subregion, and suggested that the greater densities found along frontal regions than in adjacent shelf and slope waters may be related to the concentration of preferred prey items in those areas of significant mixing and upwelling. Leach's Storm-Petrels (Oceanodroma leucorhoa) were found from April to November, but were more common on the Southern Scotian Shelf and in slope water seaward of the shelf break from 65° to 72°W in summer (Powers 1983; Table 86). South of the Scotian Shelf, Leach's Storm-Petrels were most abundant (4 birds/km^2) on GB-NE and in shelf waters along the New England coast in summer (Table 86).

Table 85. Seasonal estimates of Wilson's Storm-Petrel, birds/km^2 ($\bar{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	---	0.015 (0.167)	10.605 (32.198)	0.179 (1.380)
South	---	0.663 (2.687)	12.904 (33.313)	2.656 (15.778)
Southwest	---	0.478 (2.807)	13.731 (47.770)	0.165 (0.898)
Total	---	0.280 (1.981)	11.902 (38.019)	0.633 (6.914)
GEORGES BANK				
Northern edge	---	0.441 (1.253)	38.850 (74.089)	0.081 (0.439)
Shelf edge	---	1.254 (3.198)	5.896 (9.373)	0.087 (0.364)
Shoals	---	1.458 (5.975)	11.590(142.718)	---
Central bank	0.008 (0.116)	1.173 (3.765)	2.659 (10.334)	---
Total	0.004 (0.008)	1.216 (4.364)	8.324 (79.454)	0.027 (0.226)
S. NEW ENGLAND				
Inner shelf	---	0.008 (0.078)	1.152 (5.441)	0.007 (0.118)
Mid shelf	---	0.345 (1.310)	4.749 (20.179)	0.023 (0.185)
Outer shelf	---	1.003 (6.344)	6.731 (24.950)	0.003 (0.049)
Total	---	0.421 (3.476)	3.621 (17.126)	0.013 (0.141)
MID-ATLANTIC				
Inner shelf	---	0.139 (0.613)	1.887 (8.556)	0.012 (0.172)
Mid shelf	---	1.009 (5.190)	3.610 (20.994)	0.055 (0.267)
Outer shelf	---	3.030 (15.725)	5.045 (10.988)	0.387 (1.724)
Total	---	0.886 (7.155)	2.643 (13.636)	0.114 (0.869)
SLOPE	---	0.362 (1.941)	4.959 (13.061)	2.406 (15.612)

Table 86. Seasonal estimates of Leach's Storm-Petrel, birds/km^2 ($\overline{X}$ $\underline{+}$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	---	0.078 (0.469)	0.885 (3.637)	0.007 (0.125)
South	---	---	0.117 (0.461)	---
Southwest	---	---	0.086 (0.705)	0.005 (0.069)
Total	---	0.038 (0.332)	0.531 (2.763)	0.005 (0.100)
GEORGES BANK				
Northern edge	---	0.094 (0.310)	4.324 (10.263)	0.013 (0.105)
Shelf edge	---	0.025 (0.151)	0.413 (1.783)	---
Shoals	---	0.026 (0.237)	0.438 (2.710)	---
Central bank	---	0.007 (0.074)	0.326 (1.871)	0.004 (0.054)
Total	---	0.021 (0.170)	0.654 (3.397)	0.003 (0.048)
S. NEW ENGLAND				
Inner shelf	---	---	0.010 (0.090)	---
Mid shelf	---	0.078 (1.117)	0.021 (0.163)	---
Outer shelf	---	---	0.011 (0.132)	0.010 (0.135)
Total	--	0.031 (0.704)	0.015 (0.135)	0.002 (0.067)
MID-ATLANTIC				
Inner shelf	---	0.013 (0.115)	0.002 (0.041)	---
Mid shelf	---	0.005 (0.065)	---	---
Outer shelf	---	0.273 (1.554)	---	0.024 (0.144)
Total	---	0.055 (0.656)	0.001 (0.032)	0.005 (0.070)
SLOPE	---	0.130 (0.606)	0.150 (1.021)	0.056 (0.100)

Northern Gannet (<u>Sula bassanus</u>)

Gannets feed as tertiary carnivores principally on schooling fish (Palmer 1962) and to a lesser extent on squid (Palmer 1962; Powers 1983). They will also scavenge offal from fishing vessels (Palmer 1962) and take fish from near surface fishing nets (Cramp et al. 1977).

Gannets were recorded throughout shelf waters in all seasons, being uncommon only north and east of Cape Cod in summer. In fall, highest densities were found from Stellwagen Bank south through the Great South Channel. By mid-winter, Gannets were abundant in the Mid-Atlantic region with densities exceeding 1 bird/km^2 in every subregion (Table 87). The majority of adult birds overwintered in this region while the subadults generally moved south of Cape Hatteras. In early spring, large numbers of gannets were found along the shelf break between the Chesapeake Bight and Hydrographer Canyon yielding mean densities greater than 5 birds/km^2. These birds often aggregated in large flocks (several hundred to a thousand) around trawlers fishing the shelf break (Powers 1983).

Table 87. Seasonal estimates of Gannet, birds/km^2 ($\overline{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter		Spring		Summer		Fall	
GULF OF MAINE								
Central gulf	0.064	(0.268)	0.381	(0.874)	0.033	(0.190)	0.677	(1.522)
South	1.569	(6.712)	0.255	(0.713)	---		1.110	(2.244)
Southwest	0.746	(1.571)	0.747	(1.354)	0.022	(0.138)	2.190	(4.068)
Total	0.436	(2.753)	0.482	(1.054)	0.025	(0.161)	1.143	(2.612)
GEORGES BANK								
Northern edge	0.148	(0.314)	0.041	(0.178)	---		0.407	(0.946)
Shelf edge	---		0.304	(0.783)	---		0.064	(0.323)
Shoals	0.157	(0.634)	0.149	(0.476)	0.041	(0.271)	0.655	(1.144)
Central bank	0.142	(0.668)	0.238	(0.696)	0.021	(0.203)	0.252	(0.728)
Total	0.135	(0.612)	0.207	(0.630)	0.021	(0.200)	0.360	(0.883)
S. NEW ENGLAND								
Inner shelf	1.463	(4.851)	0.995	(3.299)	0.006	(0.084)	0.781	(3.202)
Mid shelf	0.848	(2.475)	1.305	(2.369)	0.003	(0.053)	0.699	(2.915)
Outer shelf	0.373	(0.923)	7.017	(32.134)	---		0.045	(0.240)
Total	1.090	(3.675)	2.811	(17.360)	0.004	(0.064)	0.563	(2.653)
MID-ATLANTIC								
Inner shelf	1.507	(2.225)	1.354	(3.620)	0.009	(0.123)	0.188	(0.585)
Mid shelf	4.423	(13.723)	2.948	(6.423)	---		0.115	(0.471)
Outer shelf	1.819	(4.135)	7.953	(45.677)	---		0.015	(0.159)
Total	2.454	(8.003)	2.947	(19.515)	0.005	(0.098)	0.125	(0.484)
SLOPE	1.799	(2.545)	0.223	(0.560)	---		---	

Phalaropes

Both species of phalaropes found in shelf waters feed at the surface as secondary carnivores on planktonic crustaceans, and the eggs and larvae of fish and squid (Ainley and Sanger 1979). Red Phalarope (*Phalaropus fulicaria*) were recorded predominantly in spring and fall, seasons which correspond to their north and south migrations (Table 88). The spring northward movement of phalaropes occurs primarily along the outer edge of the shelf (60-200 m), where hydrographic features may lead to increased concentrations of zooplankton (Powers and Backus 1981; Powers 1983). In this season, they are the most abundant species on Georges Bank and in the southern New England regions where mean densities exceeded 20 birds/km^2. Densities in the GOM in spring were less than 0.1 birds/km^2. In fall, densities never exceeded 0.5 birds/km^2 in any subregion. Northern Phalaropes (*P. lobatus*) were found in highest densities in the MAB region in spring, although mean densities in any season never exceeded 0.5 birds/km^2.

Table 88. Seasonal estimates of Red Phalarope densities, birds/km^2 ($\bar{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	0.119 (1.872)	0.005 (0.075)	0.014 (0.132)	0.265 (1.837)
South	---	---	---	0.156 (0.906)
Southwest	---	---	---	0.011 (0.138)
Total	0.075 (1.493)	0.002 (0.052)	0.007 (0.098)	0.180 (1.433)
GEORGES BANK				
Northern edge	0.152 (0.698)	0.041 (0.256)	---	---
Shelf edge	---	2.391 (12.650)	---	0.226 (1.157)
Shoals	---	0.243 (1.920)	0.004 (0.057)	0.009 (0.115)
Central bank	---	36.013(293.748)	0.009 (0.110)	0.042 (0.278)
Total	0.009 (0.176)	18.742(210.343)	0.005 (0.081)	0.064 (0.559)
S. NEW ENGLAND				
Inner shelf	---	---	---	0.054 (0.830)
Mid shelf	---	22.667(123.025)	0.001 (0.035)	0.343 (5.332)
Outer shelf	---	49.367(374.772)	---	0.228 (2.605)
Total	---	22.877(213.621)	<0.001 (0.024)	0.220 (3.737)
MID-ATLANTIC				
Inner shelf	---	0.024 (0.352)	---	0.132 (1.390)
Mid shelf	---	0.065 (0.748)	---	0.018 (0.208)
Outer shelf	---	0.136 (0.996)	---	---
Total	---	0.055 (0.648)	---	0.065 (0.944)
SLOPE	---	0.212 (2.020)	---	---

Jaegers and Skuas

Three species of jaegers and two species of skuas were recorded. Jaegers and skuas feed as secondary and tertiary carnivores on crustaceans, fish and cephalopods and offal from fishing vessels (Ainley and Sanger 1979; Powers 1983). Skuas also feed as upper-level carnivores on terrestrial mammals, eggs and birds as well as carrion (Furness 1979; Powers 1983). At sea, jaegers and skuas feed at the surface or by pirating other birds. Pomarine Jaeger (Stercorarius pomarinus) was the most commonly observed jaeger in all seasons, and was recorded on GB throughout the year. Greatest densities occurred in summer and fall on the northern and shelf edges of GB, in the Great South Channel and along the shelf break in the Southern New England region. The majority of Pomarine Jaegers identified to age in fall were subadults and juveniles, while adults were most common in spring (Powers 1983). Although groups of up to 20 individuals were observed following fishing vessels, mean densities never exceeded 0.5 birds/km^2 in any subregion. Parasitic Jaegers (S. parasiticus) were present but uncommon throughout shelf waters with greatest densities found in fall along the NE of GB, through the Great South Channel to the inner-shelf waters of the SNE region. Densities never exceeded 0.1 birds/km^2 in any subregion. One sighting of an adult Long-tailed Jaeger (S. longicaudus) was recorded in May 1981 on GB.

Great Skuas (Catharacta skua) accounted for 29 percent (30 individuals) of the total number of skuas seen. The majority of sightings occurred on GB and in the GOM in fall and winter, although Great Skuas were recorded across the shelf in all seasons. Evidence from banding recoveries suggests that a large component of the Great Skuas in the western North Atlantic are 2nd-year subadults from colonies in the eastern North Atlantic (Furness 1979; Powers 1983). South Polar Skuas (C. maccormickii) were predominantly recorded in spring and fall, both on Georges Bank and the SNE mid- and outer shelf subareas, and accounted for 14 percent (15 individuals) of the total number of skuas seen. The remaining 57 percent (60 individuals) of skua sightings were not positively identified to species as the two species are difficult to separate at sea. These birds were recorded throughout shelf waters in every season.

Gulls

Eight species of gulls were recorded. All feed as secondary and tertiary carnivores on crustaceans, fish, and as scavengers of offal (Ainley and Sanger 1979; Powers 1983); the large gulls also feed as upper level carnivores on birds, eggs and carrion (Bent 1921; Ainley and Sanger 1979; Powers 1983). Glaucous (Larus hyperboreus) and Iceland (L. glaucoides) Gulls were recorded fall through spring in the SNE, GB and GOM regions often attending fishing vessels with large flocks of Herring (L. argentatus) and Great Black-backed (L. marinus) Gulls, but densities never exceeded 0.1 birds/km^2 in any subregion. Great Black-backed Gulls and Herring Gulls were observed across the shelf throughout the year and were the dominant gull species in every subregion (Tables 89-90) except the Inner Shelf subarea of the mid-Atlantic region in summer when Laughing Gulls (L. artricilla) were more abundant. Great Black-backed and Herring Gull distributions were greatly influenced by fishing activity; the highest densities in any subregion were found among fishing fleets from Jeffreys Ledge south to the Great South Channel and east along the Northern Edge of Georges Bank, and over Cox Ledge (Powers 1983). Seasonally, mean densities of both species were greatest in fall and winter (11 to 12 birds/km^2) primarily in areas supporting active fishing vessels, and in spring (3 to 5 birds/km^2) along the continental slope from Hudson Canyon east to Lydonia Canyon when foreign trawlers are present (Powers 1983; Table 91). In summer, a large component of both species moved inshore in the GOM and SNE regions, possibly in response to the increased inshore fishing effort during that time. In summer, areas of greatest concentration were from Massachusetts Bay south to the Great South Channel and west across Nantucket Shoals to Cox Ledge (Powers et al. 1982). South to the mid-Atlantic region, both species were abundant throughout the year. Ring-billed Gulls (L. delawarensis) were observed throughout shelf waters in fall and coastally in winter and spring, however, mean densities never exceeded 0.1 birds/km^2 in any subregion. Laughing Gulls were recorded throughout the shelf in summer and fall except for Georges Bank. Greatest numbers were found in coastal and inner shelf waters from the mid-Atlantic region south to the Carolinas. Densities in any subregion never exceeded 0.5 birds/km^2. Bonaparte's Gulls (L. philadelphia) were recorded predominantly in coastal waters in fall and winter, with heaviest concentrations occurring in the MAB region. Densities never exceeded 0.1 birds/km^2 in any subregion. Black-legged Kittiwakes (Rissa tridactyla) were common in all subareas from September to May with greatest numbers occurring in the GOM and GB regions (Table 92). Peak densities (9 to 12 birds/km^2) occurred locally on Jeffreys Ledge and Stellwagen Bank, south to the Great South Channel and west across Nantucket Shoals to Cox Ledge. Densities of 500-600 birds/km^2 were found on Stellwagen Bank in fall (1981) and in the Great South Channel in winter (1982), where as many as 10,000 to 20,000 kittiwakes were present with large numbers of Greater Shearwaters and Herring Gulls (Powers et al. 1982).

Table 89. Seasonal estimates of Herring Gull densities, birds/km^2 ($\overline{X}$ +SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	1.202 (5.608)	1.081 (2.125)	0.498 (2.029)	1.582 (4.407)
South	0.602 (1.408)	1.159 (1.835)	0.962 (4.790)	3.455 (20.306)
Southwest	1.581 (2.645)	5.019 (15.592)	3.742 (14.969)	11.360 (55.026)
Total	1.193 (4.674)	2.410 (9.331)	1.603 (8.909)	4.424 (29.528)
GEORGES BANK				
Northern edge	0.252 (0.625)	0.360 (1.337)	---	11.653 (70.830)
Shelf edge	0.344 (0.583)	0.896 (2.083)	---	1.057 (3.592)
Shoals	0.127 (0.443)	0.808 (2.351)	0.022 (0.173)	2.146 (5.156)
Central bank	0.608 (2.130)	0.533 (1.469)	0.049 (0.589)	2.477 (8.653)
Total	0.425 (1.649)	0.648 (1.845)	0.029 (0.412)	3.165 (25.149)
S. NEW ENGLAND				
Inner shelf	1.366 (4.793)	2.992 (8.946)	0.838 (4.102)	3.305 (7.868)
Mid shelf	0.598 (1.260)	2.283 (6.491)	0.150 (1.356)	1.722 (4.338)
Outer shelf	0.933 (1.279)	2.288 (6.838)	0.017 (0.163)	0.348 (1.072)
Total	0.953 (3.322)	2.512 (7.451)	0.399 (2.742)	1.895 (5.445)
MID-ATLANTIC				
Inner shelf	1.479 (6.206)	1.869 (5.798)	0.004 (0.067)	1.007 (2.818)
Mid shelf	9.051 (60.114)	4.567 (14.761)	---	0.245 (0.703)
Outer shelf	7.257 (34.889)	2.285 (5.619)	---	0.236 (0.841)
Total	4.981 (36.943)	2.712 (9.327)	0.003 (0.053)	0.591 (2.013)
SLOPE	5.399 (7.636)	1.220 (1.943)	---	0.684 (1.613)

Table 90. Seasonal estimates of Great Black-backed Gull densities, birds/km^2 ($\bar{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	1.986 (7.359)	1.244 (3.685)	1.106 (3.211)	3.489 (30.464)
South	1.457 (4.098)	0.544 (1.044)	0.986 (2.104)	2.293 (4.539)
Southwest	2.334 (5.613)	3.161 (11.354)	2.357 (7.804)	3.504 (9.992)
Total	1.981 (6.609)	1.765 (7.127)	1.495 (5.116)	3.272 (23.415)
GEORGES BANK				
Northern edge	0.969 (1.295)	0.502 (1.123)	0.411 (1.070)	0.808 (1.960)
Shelf edge	0.363 (0.608)	0.779 (2.264)	---	0.544 (1.543)
Shoals	0.615 (1.157)	0.596 (1.244)	0.167 (0.625)	0.903 (2.278)
Central bank	0.973 (4.189)	0.620 (1.606)	0.045 (0.254)	1.765 (15.559)
Total	0.820 (3.237)	0.626 (1.584)	0.097 (0.480)	1.126 (9.432)
S. NEW ENGLAND				
Inner shelf	0.811 (2.845)	0.617 (4.151)	0.219 (1.725)	1.590 (4.861)
Mid shelf	0.568 (1.128)	1.085 (5.763)	0.158 (0.805)	1.308 (7.179)
Outer shelf	0.445 (0.754)	1.841 (6.317)	0.052 (0.377)	0.323 (1.248)
Total	0.667 (2.053)	1.147 (5.483)	0.167 (1.218)	1.154 (5.489)
MID-ATLANTIC				
Inner shelf	0.713 (5.536)	0.096 (0.541)	0.025 (0.381)	0.314 (0.929)
Mid shelf	0.848 (2.266)	0.170 (0.581)	0.171 (1.686)	0.064 (0.366)
Outer shelf	12.040 (57.419)	0.212 (0.514)	---	0.060 (0.383)
Total	3.129 (26.802)	0.137 (0.549)	0.066 (0.966)	0.177 (0.694)
SLOPE	0.719 (1.018)	0.107 (0.417)	---	0.026 (0.148)

Table 91. Seasonal estimates of Larid Gull densities, birds/km^2 ($\bar{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	3.473 (13.076)	2.705 (6.146)	1.686 (4.775)	5.119 (34.157)
South	2.119 (4.440)	1.717 (2.255)	1.995 (5.340)	5.798 (24.354)
Southwest	4.790 (9.205)	9.577 (27.912)	7.414 (23.990)	14.938 (56.550)
Total	3.553 (11.413)	4.833 (17.030)	3.572 (14.428)	7.751 (39.881)
GEORGES BANK				
Northern edge	1.397 (1.825)	0.903 (2.359)	0.411 (1.070)	12.476 (70.760)
Shelf edge	0.708 (0.977)	1.732 (3.708)	---	1.611 (4.407)
Shoals	0.784 (1.304)	1.480 (3.048)	0.189 (0.703)	3.800 (10.030)
Central bank	1.611 (5.789)	1.154 (2.341)	0.102 (0.654)	4.468 (23.861)
Total	1.286 (4.458)	1.307 (2.770)	0.130 (0.654)	4.616 (28.861)
S. NEW ENGLAND				
Inner shelf	2.745 (9.769)	3.616 (12.673)	1.117 (4.753)	5.444 (12.450)
Mid shelf	1.233 (2.118)	3.710 (10.871)	0.358 (1.824)	3.150 (10.678)
Outer shelf	1.378 (1.720)	22.997(194.938)	0.070 (0.408)	0.715 (1.833)
Total	1.902 (6.674)	9.100(103.920)	0.613 (3.244)	3.290 (10.134)
MID-ATLANTIC				
Inner shelf	2.289 (12.007)	2.040 (6.005)	0.370 (1.580)	1.561 (3.627)
Mid shelf	9.931 (61.906)	5.035 (15.097)	0.179 (1.688)	0.340 (0.939)
Outer shelf	19.297 (92.294)	4.685 (18.153)	---	0.383 (1.063)
Total	8.166 (54.963)	3.352 (11.946)	0.284 (1.554)	0.904 (2.616)
SLOPE	6.119 (8.654)	1.341 (2.154)	---	0.816 (1.752)

Table 92. Seasonal estimates of Black-legged Kittiwake densities, birds/km^2 ($\bar{X}$ $\pm$SD), from each region and subregion sampled, June 1980 to December 1983.

REGION/subregion	Winter	Spring	Summer	Fall
GULF OF MAINE				
Central gulf	6.536 (22.833)	0.094 (0.477)	0.006 (0.071)	1.742 (4.186)
South	5.398 (9.237)	0.091 (0.279)	---	2.182 (6.182)
Southwest	9.075 (32.228)	0.375 (1.246)	0.003 (0.052)	12.221 (69.529)
Total	6.910 (23.810)	0.187 (0.812)	0.004 (0.060)	4.498 (35.557)
GEORGES BANK				
Northern edge	7.171 (7.805)	0.051 (0.228)	---	2.978 (9.093)
Shelf edge	1.646 (2.137)	0.136 (0.535)	---	0.404 (1.111)
Shoals	4.633 (5.895)	0.166 (0.809)	---	1.308 (2.788)
Central bank	3.621 (9.612)	0.234 (1.130)	0.016 (0.268)	0.684 (1.956)
Total	3.976 (8.217)	0.189 (0.939)	0.007 (0.183)	1.097 (3.783)
S. NEW ENGLAND				
Inner shelf	1.201 (2.496)	0.288 (1.062)	---	0.569 (2.614)
Mid shelf	1.992 (6.366)	0.712 (2.409)	0.002 (0.047)	0.703 (1.975)
Outer shelf	0.518 (0.800)	0.445 (2.500)	---	0.143 (0.665)
Total	1.562 (4.837)	0.501 (2.107)	0.001 (0.032)	0.520 (2.008)
MID-ATLANTIC				
Inner shelf	1.311 (2.782)	0.330 (1.933)	---	0.815 (3.485)
Mid shelf	1.895 (3.751)	0.206 (0.804)	---	0.231 (1.528)
Outer shelf	1.011 (1.480)	0.108 (0.419)	---	0.055 (0.362)
Total	1.424 (2.922)	0.256 (1.497)	---	0.454 (2.521)
SLOPE	---	0.069 (0.375)	---	0.053 (0.237)

Terns (Sterna spp.)

Five species of terns were recorded in coastal and shelf waters. Terns feed as tertiary carnivores on small fish in surface and near-surface waters (Powers et al. 1982). Common Terns (Sterna hirundo) were sighted regularly in coastal and inner shelf waters of the study areas in spring, summer and fall. Arctic Terns (S. paradisaea), difficult to separate from Common Terns at sea, were positively identified only on GB in spring. Royal Terns (S. maxima) were sighted in coastal and inner shelf waters in the SNE and MAB regions in summer and fall, and in the southwest GOM in summer. Sightings of Sandwich Terns (S. sandvicensis) were limited to nearshore waters around Cape Hatteras in summer and early fall (Powers 1983). Least Terns (S. minimus) were infrequently observed coastally from Cape Cod south to Chesapeake Bay in summer.

Alcids

Five species of alcids were recorded in coastal and offshore waters of the shelf from November through May; another species (Black Guillemot) was found only in coastal waters in the Gulf of Maine in winter. Alcids are pursuit-divers which feed as secondary and tertiary carnivores on macroplankton, cephalopods and fish (Ainley and Sanger 1979; Powers 1983). Puffins feed almost exclusively on fish (Nettleship 1972) including species of the genera Ammodytes, Clupea, Gadus, and Mallotus (Powers 1983).

Razorbills (Alca torda) were present off the northeastern United States from late November to May, and were most common in shoal areas around Cape Cod, into the Great South Channel, and along the NE of GB (Powers 1983). Murres (Thick-billed, Uria lomvia, and Common, U. aalge) were uncommonly recorded in winter across the shelf from Long Island east and north to the southern GOM and in spring on northeast-GB and in the Northeast Channel (Powers 1983). Dovekies (Alle alle) were recorded from December to May on the north and east parts of Georges Bank and across Nantucket Shoals. Black Guillemots (Cepphus grylle) are strictly coastal inhabitants and were recorded only seldomly in winter along the coastal subregions in the GOM. Puffins (Fratercula arctica) were recorded primarily on GB in winter and spring, although sightings in the GOM extended to early summer (Powers 1983).

Seabirds

Seasonal Estimates by Regions (Tables only)

Following are seasonal densities of the dominant seabird species by region. This section (Tables 93-106) tabularizes seabird densities relative to subregions (Table 2). Regions are based on NMFS/NEFC groundfish strata (Fig. 4).

Table 93. Estimates of bird densities (birds/km^2, $\bar{X}$ $\pm$SD), for the Gulf of Maine/ Central Gulf by species and season, June 1980 to December 1983.

Species	Winter	Spring	Summer	Fall
Northern Fulmar	8.893 (65.998)	0.756 (3.815)	0.399 (2.162)	0.246 (0.639)
Cory's Shearwater	---	---	0.187 (1.121)	0.053 (0.341)
Greater Shearwater	0.024 (0.210)	---	4.860 (13.380)	5.205 (22.123)
Sooty Shearwater	---	---	0.351 (1.752)	0.004 (0.076)
Wilson's Storm-Petrel	---	0.015 (0.167)	10.605 (32.198)	0.179 (1.380)
Leach's Storm-Petrel	---	0.078 (0.469)	0.885 (3.637)	0.007 (0.125)
Gannet	0.064 (0.268)	0.381 (0.874)	0.033 (0.190)	0.677 (1.522)
Red Phalarope	0.119 (1.872)	0.005 (0.075)	0.014 (0.132)	0.265 (1.837)
Herring Gull	1.202 (5.608)	1.081 (2.125)	0.498 (2.029)	1.582 (4.407)
Great Black-backed Gull	1.986 (7.359)	1.244 (3.685)	1.106 (3.211)	3.489 (30.464)
Black-legged Kittiwake	6.536 (22.833)	0.094 (0.477)	0.006 (0.071)	1.742 (4.186)
TOTAL	18.824 (70.087)	3.654 (11.030)	18.944 (35.390)	13.449 (38.244)

Table 94. Estimates of bird densities (birds/km^2, $\bar{X}$ $\pm$SD), for the Gulf of Maine/South by species and season, June 1980 to December 1983.

Species	Winter	Spring	Summer	Fall
Northern Fulmar	3.064 (7.710)	0.580 0.980)	0.818 (2.344)	0.172 (0.369)
Cory's Shearwater	---	---	0.214 (0.690)	0.246 (1.428)
Greater Shearwater	0.355 (1.408)	---	4.486 (8.770)	5.932 (14.033)
Sooty Shearwater	---	0.045 (0.300)	0.635 (2.555)	0.070 (0.345)
Wilson's Storm-Petrel	---	0.663 (2.687)	12.904 (33.313)	2.656 (15.778)
Leach's Storm-Petrel	---	---	0.117 (0.461)	---
Gannet	1.569 (6.712)	0.255 (0.713)	---	1.110 (2.244)
Red Phalarope	---	---	---	0.156 (0.906)
Herring Gull	0.602 (1.408)	1.159 (1.835)	0.962 (4.790)	3.455 (20.306)
Great Black-backed Gull	1.457 (4.098)	0.544 (1.044)	0.986 (2.104)	2.293 (4.539)
Black-legged Kittiwake	5.398 (9.237)	0.091 (0.279)	---	2.182 (6.182)
TOTAL	12.445 (14.511)	3.337 (3.649)	21.122 (49.443)	18.272 (30.417)

Table 95. Estimates of bird densities (birds/km^2, $\bar{X}$ $\pm$SD), for the Gulf of Maine/ Southwest by species and season, June 1980 to December 1983.

Species	Winter	Spring	Summer	Fall
Northern Fulmar	0.673 (4.003)	1.176 (3.827)	0.152 (0.985)	0.241 (0.785)
Cory's Shearwater	---	---	0.024 (0.170)	0.218 (0.733)
Greater Shearwater	0.201 (9.042)	0.014 (0.126)	7.470 (31.307)	27.750(102.809)
Sooty Shearwater	0.003 0.046)	0.324 (1.889)	1.822 (8.565)	0.048 (0.238)
Wilson's Storm-Petrel	---	0.478 (2.807)	13.731 (47.770)	0.165 (0.898)
Leach's Storm-Petrel	---	---	0.086 (0.705)	0.005 (0.069)
Gannet	0.746 (1.571)	0.747 (1.354)	0.022 (0.138)	2.190 (4.068)
Red Phalarope	---	---	---	0.011 (0.138)
Herring Gull	1.581 (2.645)	5.019 (15.592)	3.742 (14.969)	11.360 (55.026)
Great Black-backed Gull	2.334 (5.613)	3.161 (11.354)	2.357 (7.804)	3.504 (9.992)
Black-legged Kittiwake	9.075 (32.228)	0.375 (1.246)	0.003 (0.052)	12.221 (69.529)
TOTAL	14.613 (33.112)	11.294 (28.283)	29.409 (60.183)	57.713(136.200)

Table 96. Estimates of bird densities (birds/km^2, $\bar{X}$ $\underline{+}$SD), for the Georges Bank/ Northern Edge by species and season, June 1980 to December 1983.

Species	Winter	Spring	Summer	Fall
Northern Fulmar	126.421(530.322)	23.477 (70.748)	0.537 (1.577)	0.683 (1.928)
Cory's Shearwater	---	---	0.333 (1.233)	0.175 (0.810)
Greater Shearwater	0.685 (1.664)	0.018 (0.115)	22.010 (41.114)	31.164(142.468)
Sooty Shearwater	---	0.143 (0.546)	0.960 (2.370)	0.013 (0.105)
Wilson's Storm-Petrel	---	0.441 (1.253)	38.850 (74.089)	0.081 (0.439)
Leach's Storm-Petrel	---	0.094 (0.310)	4.324 (10.263)	0.013 (0.105)
Gannet	0.148 (0.314)	0.041 (0.178)	---	0.407 (0.946)
Red Phalarope	0.152 (0.698)	0.041 (0.256)	---	---
Herring Gull	0.252 (0.625)	0.360 (1.337)	---	11.653 (70.830)
Great Black-backed Gull	0.969 (1.295)	0.502 (1.123)	0.411 (1.070)	0.808 (1.960)
Black-legged Kittiwake	7.171 (7.805)	0.051 (0.228)	---	2.978 (9.093)
TOTAL	135.798(530.385)	25.168 (70.785)	67.425 (85.415)	47.975(159.393)

Table 97. Estimates of bird densities (birds/km^2, $\bar{X}$ $\underline{+}$SD), for the Georges Bank/ Shelf Edge by species and season, June 1980 to December 1983.

Species	Winter	Spring	Summer	Fall
Northern Fulmar	1.478 (3.314)	1.812 (6.230)	(0.007) (0.079)	0.255 (0.881)
Cory's Shearwater	---	---	0.121 (0.473)	0.031 (0.202)
Greater Shearwater	0.129 (0.317)	0.010 (0.093)	0.494 (0.944)	5.704 (13.124)
Sooty Shearwater	---	0.033 (0.205)	0.038 (0.198)	---
Wilson's Storm-Petrel	---	1.254 (3.198)	5.896 (9.373)	0.087 (0.364)
Leach's Storm-Petrel	---	0.025 (0.151)	0.413 (1.783)	---
Gannet	---	0.304 (0.783)	---	0.064 (0.323)
Red Phalarope	---	2.391 (12.650)	---	0.226 (1.157)
Herring Gull	0.344 (0.583)	0.896 (2.083)	---	1.057 (3.592)
Great Black-backed Gull	0.363 (0.608)	0.779 (2.264)	---	0.544 (1.543)
Black-legged Kittiwake	1.646 (2.137)	0.136 (0.535)	---	0.404 (1.111)
TOTAL	3.960 (4.045)	7.640 (14.816)	6.969 (9.602)	8.372 (19.399)

Table 98. Estimates of bird densities (birds/km², $\bar{X}$ +SD), for the Georges Bank/ Shoals by species and season, June 1980 to December 1983.

Species	Winter		Spring		Summer		Fall	
Northern Fulmar	2.680	(5.081)	2.852	(4.869)	0.137	(0.509)	0.212	(0.647)
Cory's Shearwater	---		---		0.483	(2.710)	0.348	(1.402)
Greater Shearwater	0.138	(0.587)	0.079	(0.412)	10.166	(68.522)	4.645	(6.918)
Sooty Shearwater	---		0.087	(0.370)	0.474	(2.177)	0.004	(0.057)
Wilson's Storm-Petrel	---		1.458	(5.975)	11.590	(142.718)	---	
Leach's Storm-Petrel	---		0.026	(0.237)	0.438	(2.710)	---	
Gannet	0.157	(0.634)	0.149	(0.476)	0.041	(0.271)	0.655	(1.144)
Red Phalarope	---		0.243	(1.920)	0.004	(0.057)	0.009	(0.115)
Herring Gull	0.127	(0.443)	0.808	(2.351)	0.022	(0.173)	2.146	(5.156)
Great Black-backed Gull	0.615	(1.157)	0.596	(1.244)	0.167	(0.625)	0.903	(2.278)
Black-legged Kittiwake	4.633	(5.895)	0.166	(0.809)	---		1.308	(2.788)
TOTAL	8.350	(7.928)	6.315	(8.447)	23.522	(158.379)	10.230	(9.545)

Table 99. Estimates of bird densities (birds/km^2, $\bar{X}$ $\pm$SD), for the Georges Bank Central Bank by species and season, June 1980 to December 1983.

Species	Winter	Spring	Summer	Fall
Northern Fulmar	1.809 (3.707)	2.151 (5.553)	0.099 (0.396)	0.122 (0.361)
Cory's Shearwater	---	0.002 (0.042)	0.703 (1.223)	0.323 (1.449)
Greater Shearwater	0.210 (1.292)	0.139 (0.800)	5.760 (16.184)	5.007 (21.795)
Sooty Shearwater	---	0.189 (0.836)	0.512 (2.204)	---
Wilson's Storm-Petrel	0.008 (0.116)	1.173 (3.765)	2.659 (10.334)	---
Leach's Storm-Petrel	---	0.007 (0.074)	0.326 (1.871)	0.004 (0.054)
Gannet	0.142 (0.668)	0.238 (0.696)	0.021 (0.203)	0.252 (0.728)
Red Phalarope	---	36.013(293.748)	0.009 (0.110)	0.042 (0.278
Herring Gull	0.608 (2.130)	0.533 (1.469)	0.049 (0.589)	2.477 (8.653)
Great Black-backed Gull	0.973 (4.189)	0.620 (1.606)	0.045 (0.254)	1.765 (15.559)
Black-legged Kittiwake	3.621 (9.612)	0.234 (1.130)	0.016 (0.268)	0.684 (1.956)
TOTAL	7.371 (11.417)	41.299(293.838)	10.199 (19.475)	10.676 (28.260)

Table100. Estimates of bird densities (birds/km^2, $\bar{X}$ ±SD), for the Southern New England/Inner Shelf by species and season, June 1980 to December 1983.

Species	Winter	Spring	Summer	Fall
Northern Fulmar	0.332 (0.152)	0.068 (0.313)	0.191 (1.054)	0.010 (0.092)
Cory's Shearwater	---	---	2.768 (32.419)	0.554 (2.631)
Greater Shearwater	0.022 (0.234)	---	4.011 (28.477)	1.462 (8.676)
Sooty Shearwater	---	0.004 (0.062)	0.386 (2.852)	0.003 (0.047)
Wilson's Storm-Petrel	---	0.008 (0.078)	1.152 (5.441)	0.007 (0.118)
Leach's Storm-Petrel	---	---	0.010 (0.090)	---
Gannet	1.463 (4.851)	0.995 (3.299)	0.086 (0.084)	0.781 (3.202)
Red Phalarope	---	---	---	0.054 (0.830)
Herring Gull	1.366 (4.793)	2.992 (8.946)	0.838 (4.102)	3.305 (7.868)
Great Black-backed Gull	0.811 (2.845)	0.617 (4.151)	0.219 (1.725)	1.590 (4.861)
Black-legged Kittiwake	1.201 (2.496)	0.288 (1.062)	---	0.569 (2.614)
TOTAL	5.195 (7.804)	4.972 (10.459)	9.581 (43.825)	8.335 (13.621)

Table 101. Estimates of bird densities (birds/km^2, $\bar{X}$ $\pm$SD), for the South New England/Mid-Shelf by species and season, June 1980 to December 1983.

Species	Winter	Spring	Summer	Fall
Northern Fulmar	0.527 (2.034)	0.825 (2.283)	0.118 (0.901)	0.029 (0.176)
Cory's Shearwater	---	---	0.682 (2.123)	0.255 (1.523)
Greater Shearwater	---	0.018 (0.129)	1.508 (6.024)	2.461 (10.058)
Sooty Shearwater	---	0.114 (0.507)	0.212 (1.027)	---
Wilson's Storm-Petrel	---	0.345 (1.310)	4.749 (20.179)	0.023 (0.185)
Leach's Storm-Petrel	---	0.078 (1.117)	0.021 (0.163)	---
Gannet	0.848 (2.475)	1.305 (2.369)	0.003 (0.053)	0.699 (2.915)
Red Phalarope	---	22.667(123.025)	0.001 (0.035)	0.343 (5.332)
Herring Gull	0.598 (12.60)	2.283 (6.491)	0.150 (1.356)	1.722 (4.338)
Great Black-backed Gull	0.568 (1.128)	1.085 (5.763)	0.158 (0.805)	1.308 (7.179)
Black-legged Kittiwake	1.992 (6.366)	0.712 (2.409)	0.002 (0.047)	0.703 (1.975)
TOTAL	4.533 (7.324)	29.432(123.411)	7.604 (21.269)	7.543 (14.654)

Table 102. Estimates of bird densities (birds/km^2, $\bar{X}$ $\underline{+}$SD), for the Southern New England/Outer Shelf by species and season, June 1980 to December 1983.

Species	Winter	Spring	Summer	Fall
Northern Fulmar	0.068 (0.314)	0.441 (1.235)	0.084 (0.439)	0.028 (0.178)
Cory's Shearwater	---	---	0.408 (4.078)	0.118 (0.841)
Greater Shearwater	---	0.004 (0.059)	0.881 (2.263)	1.485 (5.771)
Sooty Shearwater	---	0.038 (0.188)	0.140 (0.498)	0.004 (0.060)
Wilson's Storm-Petrel	---	1.003 (6.344)	6.731 (24.950)	0.003 (0.049)
Leach's Storm-Petrel	---	---	0.011 (0.132)	---
Gannet	0.373 (0.923)	7.017 (32.134)	---	0.045 (0.240)
Red Phalarope	---	49.367(374.772)	---	0.228 (2.605)
Herring Gull	0.933 (1.279)	2.288 (6.838)	0.017 (0.163)	0.348 (1.072)
Great Black-backed Gull	0.445 (0.754)	1.841 (6.317)	0.052 (0.377)	0.323 (1.248)
Black-legged Kittiwake	0.518 (0.800)	0.445 (2.500)	---	0.143 (0.665)
TOTAL	2.337 (1.331)	62.444(376.326)	8.324 (25.394	2.725 (6.636)

Table 103. Estimates of bird densities (birds/km^2, $\bar{X}$ $\pm$SD), for the Mid-Atlantic Near Shelf by species and season, June 1980 to December 1983.

Species	Winter	Spring	Summer	Fall
Northern Fulmar	0.013 (0.102)	0.054 (0.530)	0.049 (0.583)	0.004 (0.057)
Cory's Shearwater	---	0.002 (0.047)	0.840 (10.960)	0.028 (0.196)
Greater Shearwater	---	---	0.209 (2.184)	0.042 (0.225)
Sooty Shearwater	---	0.038 (0.303)	0.018 (0.137)	---
Wilson's Storm-Petrel	---	0.139 (0.613)	1.887 (8.556)	0.012 (0.172)
Leach's Storm-Petrel	---	0.013 (0.115)	0.002 (0.041)	---
Gannet	1.507 (2.225)	1.354 (3.620)	0.009 (0.123)	0.188 (0.585)
Red Phalarope	---	0.024 (0.352)	---	0.132 (1.390)
Herring Gull	1.479 (6.206)	1.869 (5.798)	0.004 (0.067)	1.007 (2.818)
Great Black-backed Gull	0.713 (5.536)	0.096 (0.541)	0.025 (0.381)	0.314 (0.929)
Black-legged Kittiwake	1.311 (2.782)	0.330 (1.933)	---	0.815 (3.485)
TOTAL	5.023 (9.047)	3.919 (7.186)	3.043 (14.093)	2.542 (4.831)

Table 104. Estimates of bird densities (birds/km^2, $\bar{X}$ $\pm$SD), for the Mid-Atlantic Mid-Shelf by species and season, June 1980 to December 1983.

Species	Winter	Spring	Summer	Fall
Northern Fulmar	0.027 (0.137)	0.204 (0.725)	0.020 (0.190)	---
Cory's Shearwater	---	---	0.199 (849))	0.075 (0.263)
Greater Shearwater	---	---	0.717 (0.084)	0.094 (0.532)
Sooty Shearwater	---	0.109 (0.086)	0.009 (0.086)	---
Wilson's Storm-Petrel	---	1.009 (5.190)	3.610 (20.994)	0.055 (0.267)
Leach's Storm-Petrel	---	0.005 (0.065)	---	---
Gannet	4.423 (13.723)	2.948 (6.423)	---	0.115 (0.471)
Red Phalarope	---	0.065 (0.748)	---	0.018 (0.208)
Herring Gull	9.051 (60.114)	4.567 (14.761)	---	0.245 (0.703)
Great Black-backed Gull	0.848 (2.266)	0.170 (0.581)	0.171 (1.686)	0.064 (0.366)
Black-legged Kittiwake	1.895 (3.751)	0.206 (0.804)	---	0.231 (1.528)
TOTAL	16.244 (61.816)	9.283 (16.983)	4.726 (21.332)	0.887 (1.908)

Table 105. Estimates of bird densities (birds/km^2, $\bar{X}$ $\pm$SD), for the Mid-Atlantic Outer-Shelf by species and season, June 1980 to December 1983.

Species	Winter	Spring	Summer	Fall
Northern Fulmar	0.239 (0.603)	0.114 (0.350)	---	0.007 (0.079)
Cory's Shearwater	---	---	0.049 (0.191)	0.242 (1.292)
Greater Shearwater	---	---	0.097 (0.351)	0.040 (0.220)
Sooty Shearwater	---	0.113 (0.453)	---	---
Wilson's Storm-Petrel	---	3.030 (15.725)	5.045 (10.988)	0.387 (1.724)
Leach's Storm-Petrel	---	0.273 (1.554)	---	0.024 (0.144)
Gannet	1.819 (4.135)	7.953 (45.677)	---	0.015 (0.159)
Red Phalarope	---	0.136 (0.996)	---	---
Herring Gull	7.257 (34.889)	2.285 (5.619)	---	0.236 (0.841)
Great Black-backed Gull	12.040 (57.419)	0.212 (0.514)	---	0.060 (0.383)
Black-legged Kittiwake	1.011 (1.480)	0.108 (0.419)	---	0.055 (0.362)
TOTAL	22.366 (67.334)	14.224 (48.677)	5.191 (10.995)	1.066 (2.393)

Table 106. Estimates of bird densities (birds/km^2, $\overline{X}$ $\pm$SD), for Slope by species and season, June 1980 to December 1983.

Species	Winter	Spring	Summer	Fall
Northern Fulmar	---	0.311 (1.154)	---	---
Cory's Shearwater	---	---	0.099 (0.704)	0.015 (0.105)
Greater Shearwater	---	---	0.316 (1.033)	0.078 (0.293)
Sooty Shearwater	---	0.019 (0.119)	0.006 (0.073)	---
Wilson's Storm-Petrel	---	0.362 (1.941)	4.959 (13.061)	2.406 (15.612)
Leach's Storm-Petrel	---	0.130 (0.606)	0.150 (1.021)	0.056 (0.100)
Gannet	1.799 (2.545)	0.223 (0.560)	---	---
Red Phalarope	---	0.212 (2.020)	---	---
Herring Gull	5.399 (7.636)	1.220 (1.943)	---	0.684 (1.613)
Great Black-backed Gull	0.719 (1.081)	0.107 (0.417)	---	0.026 (0.148)
Black-legged Kittiwake	---	0.069 (0.375)	---	0.053 (0.237)
TOTAL	7.917 (8.113)	2.653 (3.737)	5.530 (13.161)	3.318 (15.701)

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Appendix 1. List of cetacean sightings from June 1980 to December 1983)
(* indicates a general observation)

Bottlenosed Dolphin — *Tursiops truncatus*

15 Jul 80	37°42'N 73°57'W	50 (1)*
	37°40'N 74°00'W	2 (1)*
16 Jul 80	35°50'N 75°26'W	2 (1)*
19 Jul 80	37°43'N 74°07'W	25 (1)*
20 Jul 80	37°56'N 73°55'W	6 (1)*
	38°02'N 73°53'W	13 (1)*
24 Aug 80	40°24'N 67°40'W	1*
	40°19'N 67°41'W	6(1)
	40°27'N 67°41'W	6(1)*
	40°16'N 68°30'W	1*
	40°17'N 68°32'W	8(1)*
	40°19'N 68°40'W	4(1)*
28 Sep 80	37°36'N 74°23'W	10(1)*
17 Oct 80	40°02'N 69°30'W	5(1)
20 Oct 80	41°24'N 66°58'W	4(1)*
03 Jun 81	40°19'N 67°55'W	12(1)*
	40°19'N 67°55'W	8(1)
13 Jun 81	37°56'N 74°39'W	17(1)
14 Jun 81	36°37'N 75°16'W	2(1)*
15 Jun 81	37°30'N 74°35'W	1
16 Jun 81	38°08'N 74°09'W	6(1)*
	38°08'N 74°09'W	4(1)*
25 Jun 81	39°29'N 72°57'W	1*
10 Jul 81	38°45'N 74°02'W	55(1)
12 Jul 81	40°38'N 68°50'W	12(1)*
	37°43'N 74°20'W	4(1)*
	37°42'N 74°15'W	36(1)*
14 Aug 81	39°27'N 74°09'W	20(1)*
17 Aug 81	39°37'N 71°53'W	60(1)
14 Sep 81	37°14'N 74°43'W	9(1)*
19 Sep 81	34°25'N 76°20'W	12(1)
	34°16'N 76°42'W	2(1)
20 Sep 81	34°27'N 77°28'W	30(1)
22 Sep 81	33°07'N 77°14'W	50(1)
23 Sep 81	34°20'N 75°29'W	10(1)
28 Sep 81	38°02'N 73°54'W	25(1)
01 Oct 81	39°04'N 72°42'W	6(1)*
09 Oct 81	39°26'N 72°25'W	10(1)
	39°30'N 72°22'W	52(1)
19 Mar 82	38°53'N 73°09'W	2(1)*
	38°41'N 72°25'W	15(1)
20 Apr 82	39°55'N 69°52'W	2
21 Apr 82	29°56'N 70°00'W	20(1)*
22 Apr 82	40°10'N 66°00'W	15(1)
30 Apr 82	39°32'N 69°18'W	10(1)
	39°37'N 69°19'W	1
24 Jun 82	37°12'N 73°47'W	50(1)
26 Jun 82	37°30'N 74°04'W	1
	37°14'N 74°09'W	5(1)
28 Jun 82	37°51'N 73°74'W	10(1)

14 Aug 82	40°52'N 66°46'W	3(1)
	40°50'N 66°44'W	4(1)
	40°46'N 66°41'W	2(1)
	40°46'N 66°41'W	3(1)
	40°44'N 66°40'W	50(1)
16 Aug 82	40°22'N 67°17'W	100(1)
	40°26'N 67°15'W	6(1)
	40°30'N 67°12'W	15(1)
09 Sep 82	40°18'N 67°34'W	15(1)
10 Sep 82	40°19'N 67°33'W	10(2)
15 Sep 82	37°23'N 74°32'W	20(1)
16 Sep 82	35°42'N 74°58'W	4(1)
18 Sep 82	33°36'N 77°37'W	3(1)
20 Sep 82	33°46'N 76°31'W	25(1)
22 Sep 82	34°31'N 76°05'W	8(1)
24 Sep 82	40°26'N 67°33'W	1
25 Sep 82	40°20'N 67°33'W	3(1)*
27 Sep 82	40°08'N 68°48'W	2(1)*
29 Sep 82	38°20'N 73°33'W	30(1)
06 Oct 82	39°53'N 71°59'W	6(1)
	39°57'N 72°00'W	20(1)
07 Oct 82	39°34'N 72°39'W	4(1)
	38°54'N 72°55'W	6(1)
15 Dec 82	39°24'N 72°13'W	5(1)
21 Feb 83	38°33'N 73°16'W	11(2)
	38°01'N 73°55'W	1
13 Mar 83	33°04'N 77°42'W	2
	33°16'N 77°53'W	5
14 Mar 83	33°57'N 77°27'W	3
	33°54'N 77°18'W	2
24 Mar 83	39°56'N 71°51'W	3(1)
	40°10'N 71°42'W	9(1)
26 May 83	35°51'N 74°48'W	3(1)
	35°20'N 75°11'W	3(1)
08 Jul 83	39°38'N 72°32'W	10(1)
02 Aug 83	38°20'N 73°48'W	10(1)
18 Aug 83	41°37'N 69°38'W	5(1)*
24 Aug 83	41°27'N 66°51'W	4(1)
	41°25'N 66°56'W	15(1)*
13 Sep 83	37°57'N 73°58'W	5(1)
17 Sep 83	34°10'N 77°12'W	2(1)
18 Sep 83	33°12'N 77°57'W	1*
19 Sep 83	33°28'N 76°40'W	1*
10 Oct 83	40°14'N 68°58'W	8(1)*

Spotted Dolphin — <u>Stenella sp.</u>

26 Sep 80	35°16'N 75°13'W	2(1)
14 Jun 81	36°37'N 75°16'W	1*
	36°06'N 74°56'W	12(1)*
12 Jun 81	37°42'N 74°11'W	20(1)*
13 Jun 81	38°17'N 74°16'W	4(1)*
	38°20'N 74°15'W	5(1)*
14 Sep 81	37°14'N 74°43'W	1*
19 Sep 81	34°32'N 76°08'W	2(1)*
20 Sep 81	33°13'N 78°00'W	4(1)

	33°06'N 78°06'W	8(1)
22 Sep 81	33°19'N 77°20'W	32(2)*
24 Sep 81	35°49'W 75°29'W	15(1)
02 May 82	38°31'N 69°51'W	5(1)
29 Jun 82	38°07'N 72°55'W	6(1)
01 Jul 82	39°57'N 70°02'W	6(1)
14 Aug 82	40°10'N 66°09'W	30(1)
18 Sep 82	33°29'N 77°30'W	50(1)
19 Sep 82	33°14'N 78°06'W	9(1)
22 Sep 82	35°22'N 75°21'W	25(1)
05 Oct 82	39°59'N 70°29'W	6(1)
14 Mar 83	34°02'N 77°28'W	1
	33°54'N 77°15'W	1
	34°09'N 77°07'W	5
	34°17'N 77°04'W	2
17 Mar 83	34°53'N 75°36'W	12(1)
	34°20'N 76°20'W	2(1)
	34°11'N 76°32'W	8(1)
26 May 83	35°59'N 74°40'W	115(2)
	35°30'N 75°05'W	24(1)
	35°57'N 74°42'W	125(1)
	35°25'N 75°08'W	15(1)
	35°23'N 75°10'W	25(1)
16 Sep 83	34°12'N 76°20'W	9(1)*
17 Sep 83	33°47'N 77°33'W	3(1)
18 Sep 83	33°12'N 77°57'W	9(1)

Striped Dolphin — *Stenella coeruleoalba*

25 Sep 81	38°24'N 72°02'W	5(1)*
23 Mar 82	37°00'N 74°23'W	110(1)
	37°02'N 74°21'W	2(1)
	37°06'N 74°18'W	14(1)
20 Jun 82	40°01'N 71°42'W	6(1)
24 Jun 82	36°55'N 73°04'W	150(1)
	36°56'N 73°02'W	50(1)*
	37°15'N 73°54'W	70(1)*
15 Aug 82	40°22'N 67°10'W	25(1)

Saddleback (Common) Dolphin — *Delphinus delphis*

15 Jul 80	39°30'N 72°27'W	20(1)
27 Jul 80	40°14'N 69°37'W	22(1)*
03 Aug 80	40°41'N 67°08'W	9(1)
21 Oct 80	41°51'N 66°17'W	33(1)*
	41°58'N 66°19'W	25(1)*
29 Oct 80	43°22'N 68°06'W	4(1)
19 Dec 80	40°58'N 67°08'W	10(1)*
	41°18'N 66°20'W	3(1)*
22 Dec 80	42°19'N 69°33'W	1*
05 Mar 81	40°22'N 67°40'W	1
07 Mar 81	40°24'N 67°46'W	4(1)*
22 Mar 81	39°20'N 74°06'W	3(1)
20 May 81	41°19'N 66°58'W	13(1)
	40°59'N 67°01'W	8(1)*
21 May 81	40°44'N 67°28'W	3(1)*
	40°47'N 67°30'W	1*
	40°49'N 67°31'W	2(1)*
22 May 81	40°59'N 67°01'W	10(1)*
11 Jun 81	39°43'N 72°55'W	20(1)
14 Jun 81	36°41'N 75°38'W	1
15 Jun 81	37°33'N 74°41'W	11(1)*
29 Jun 81	40°38'N 67°17'W	8(1)*
13 Oct 81	40°21'N 69°44'W	40(1)*
	40°18'N 69°38'W	14(1)*
14 Oct 81	40°03'N 69°12'W	750(1)
11 Nov 81	40°52'N 68°53'W	10(1)*
12 Nov 81	40°25'N 69°54'W	10(1)
	40°21'N 70°03'W	3(1)
01 Dec 81	40°56'N 67°43'W	5(1)
	40°54'N 67°43'W	25(2)*
	40°52'N 67°43'W	16(2)*
	40°49'N 67°43'W	35(1)*
	40°47'N 67°42'W	5(2)*
	40°44'N 67°41'W	47(4)*
	40°42'N 67°41'W	2(1)*
21 Dec 81	40°10'N 70°40'W	35(1)*
	40°09'N 71°00'W	5(1)*
02 Feb 82	40°19'N 69°00'W	2
	40°19'N 69°03'W	2
	40°18'N 69°08'W	2
	40°18'N 69°09'W	4
	40°18'N 69°12'W	2-3
	40°18'N 69°24'W	10
	40°18'N 69°27'W	3
	40°18'N 69°31'W	4
	40°17'N 70°03'W	3-8-3
	40°17'N 70°06'W	2-12
	40°17'N 70°10'W	1
	40°17'N 70°13'W	4-3-2
	40°17'N 70°24'W	6
08 Feb 82	36°36'N 74°44'W	10
	36°36'N 74°44'W	4
	36°36'N 74°44'W	4
	36°39'N 74°44'W	15
	36°42'N 74°44'W	12

	36°46'N 74°44'W	5,2,3
09 Feb 82	38°17'N 74°16'W	6,10
	38°20'N 74°15'W	30
19 Mar 82	38°53'N 73°09'W	3(1)
22 Mar 82	37°33'N 74°34'W	20(1)
23 Mar 82	37°00'N 74°23'W	50(2)
	37°00'N 74°23'W	14(3)
	37°04'N 74°20'W	10(4)
	37°06'N 74°18'W	12(2)
	37°13'N 74°13'W	15(3)
	37°15'N 74°11'W	3(1)
	37°16'N 74°10'W	25(1)
	37°18'N 74°09'W	2(1)
	37°20'N 74°07'W	7(2)
	37°21'N 74°06'W	13(2)
	37°23'N 74°04'W	50(1)
24 Mar 82	39°40'N 71°41'W	6(1)
20 Apr 82	39°57'N 71°15'W	2(1)
	39°57'N 71°15'W	5(1)
24 Apr 82	40°45'N 66°09'W	4(1)
27 Apr 82	40°27'N 67°30'W	7(1)*
30 Apr 82	39°39'N 69°25'W	10(1)
	39°37'N 69°19'W	4(1)
	39°35'N 69°15'W	5(1)
	39°32'N 69°18'W	100(1)
	39°13'N 69°20'W	20(1)*
	39°14'N 69°22'W	2(1)
03 May 82	39°21'N 71°03'W	4(1)
23 Jun 82	37°02'N 73°16'W	10(1)*
	37°08'N 73°01'W	50(1)*
27 Jun 82	37°58'N 74°22'W	20(1)
19 Jul 82	40°42'N 67°33'W	3(1)
27 Jul 82	41°12'N 67°12'W	50(1)
28 Jul 82	41°31'N 66°48'W	3(1)
	41°32'N 66°45'W	25(1)
	41°33'N 66°42'W	15(1)
	41°33'N 66°42'W	10(1)
11 Aug 82	40°32'N 67°27'W	6(1)
24 Sep 82	40°53'N 67°42'W	35(1)
	40°53'N 67°45'W	5(1)*
20 Oct 82	40°31'N 68°19'W	6(1)
	40°26'N 68°04'W	10(1)
	40°06'N 68°02'W	100(1)
	40°29'N 67°46'W	75(1)
21 Oct 82	40°38'N 66°58'W	350(1)
	40°38'N 66°58'W	500(1)
24 Oct 82	41°40'N 66°00'W	75(1)
	41°42'N 66°00'W	3000(1)
20 Nov 82	40°52'N 67°03'W	5(1)
	40°55'N 67°02'W	2(1)
	40°55'N 67°02'W	1
	40°55'N 67°02'W	2(1)
21 Nov 82	41°24'N 66°24'W	2(1)
	41°21'N 66°23'W	3(1)
	41°21'N 66°23'W	6(1)
	41°21'N 66°23'W	6(1)
	41°19'N 66°22'W	10(1)

	41°19'N 66°22'W	6(1)
	41°19'N 66°22'W	2(1)
	41°21'N 66°20'W	4(1)
	41°21'N 66°20'W	10(1)
	41°24'N 66°20'W	3(1)
	41°24'N 66°20'W	3(1)
	41°24'N 66°20'W	12(1)
	41°14'N 66°20'W	12(1)
	41°24'N 66°20'W	5(1)
	41°41'N 66°19'W	10(1)
	41°41'N 66°19'W	10(1)
	41°41'N 66°19'W	20(1)
	41°41'N 66°19'W	10(1)
	41°41'N 66°19'W	15(1)
	41°41'N 66°19'W	35(1)
	41°41'N 66°19'W	25(1)
	41°41'N 66°19'W	15(1)
	42°11'N 67°15'W	10(1)*
	42°02'N 66°50'W	25(1)*
22 Nov 82	42°27'N 66°26'W	25(1)*
30 Nov 82	40°21'N 71°36'W	24(1)
01 Dec 82	40°34'N 69°30'W	27(1)
03 Dec 82	40°40'N 68°31'W	15(1)
	40°30'N 68°01'W	35(1)
	40°32'N 67°59'W	22(2)
04 Dec 82	42°02'N 66°56'W	6(1)
	42°05'N 66°50'W	8(1)
	42°06'N 66°47'W	5(1)
	42°15'N 66°28'W	7(1)
18 Jan 83	41°11'N 68°53'W	19(1)
	41°09'N 68°55'W	43(2)
19 Jan 83	41°51'N 68°10'W	6(1)*
20 Jan 83	40°25'N 67°45'W	2(1)
	40°25'N 67°44'W	7(1)*
	40°33'N 67°57'W	3(1)
	40°33'N 67°56'W	2(1)
21 Jan 83	41°05'N 66°59'W	5(1)
	41°09'N 66°59'W	2(1)
22 Jan 83	41°14'N 66°19'W	12(3)
	41°19'N 66°19'W	4(1)
	41°37'N 66°21'W	15(1)
	41°49'N 66°20'W	6(1)
	42°04'N 66°20'W	2(1)
	42°06'N 66°20'W	8(1)
06 Feb 83	40°16'N 69°38'W	27(1)
05 Feb 83	40°11'N 69°24'W	10(1)
10 Feb 83	39°54'N 72°21'W	5(1)
23 Feb 83	39°05'N 73°16'W	15(1)
	39°07'N 73°11'W	27(4)
	39°59'N 71°40'W	9(1)*
26 Feb 83	34°28'N 76°02'W	4(1)
27 Feb 83	37°20'N 74°41'W	125(1)
28 Feb 83	37°31'N 74°38'W	1
	37°31'N 74°38'W	75(1)
08 Mar 83	40°25'N 70°17'W	25
	40°25'N 70°17'W	15
	40°25'N 70°17'W	10

	40°22'N 70°20'W	8
	40°19'N 70°23'W	12
	40°17'N 70°26'W	20
09 Mar 83	37°25'N 74°29'W	300
	37°23'N 74°30'W	8
11 Mar 83	36°04'N 74°46'W	1600
	36°02'N 74°46'W	200
	36°02'N 74°46'W	25
	36°02'N 74°46'W	20
	36°02'N 74°46'W	20
	36°00'N 74°46'W	10
	36°00'N 74°46'W	60
16 Mar 83	38°05'N 73°28'W	6(1)
	37°17'N 73°55'W	4(1)
20 Mar 83	38°04'N 74°11'W	85
	38°11'N 73°57'W	5
	38°12'N 73°54'W	1
	39°23'N 72°25'W	4
04 Apr 83	39°55'N 69°37'W	12(1)
05 Apr 83	40°32'N 68°11'W	10(1)
12 Apr 83	41°38'N 69°07'W	5(1)*
14 Apr 83	40°41'N 66°56'W	14(1)*
	40°42'N 66°53'W	16(1)
	40°51'N 66°39'W	17(1)*
10 May 83	40°13'N 68°02'W	75(1)*
25 May 83	39°09'N 71°34'W	55(2)
	39°07'N 71°36'W	15(1)
	38°14'N 72°32'W	12(1)
	38°08'N 72°38'W	50(1)
	38°05'N 72°40'W	100(1)
	37°51'N 72°53'W	192(1)
	37°30'N 73°11'W	110(2)
	37°24'N 73°17'W	170(3)
	37°19'N 73°23'W	45(1)
02 Jun 83	39°37'N 72°45'W	65(2)
	39°35'N 72°42'W	92(2)
	39°33'N 72°40'W	55(2)
	39°32'N 72°38'W	58(2)
	40°02'N 71°33'W	15(1)
24 Aug 83	41°27'N 66°51'W	1(1)
	41°27'N 66°51'W	15(1)
	41°25'N 66°56'W	35(1)*
	41°52'N 67°01'W	4(1)*
20 Oct 83	41°13'N 67°16'W	10(1)
21 Oct 83	41°19'N 66°22'W	6(1)
	41°30'N 66°24'W	4(1)
23 Oct 83	42°10'N 67°42'W	8(1)*
	42°07'N 67°42'W	150(1)
	42°09'N 67°42'W	3(1)
24 Oct 83	41°48'N 65°49'W	18(1)
	41°40'N 65°54'W	5(1)
25 Oct 83	41°58'N 66°55'W	12(1)
20 Nov 83	38°20'N 73°40'W	15(1)
30 Nov 83	39°46'N 72°22'W	150(1)
	40°02'N 72°11'W	15(1)
02 Dec 83	40°46'N 70°34'W	25(1)
	40°11'N 69°35'W	8(1)

	40°05'N 69°00'W	15(1)*
04 Dec 83	40°25'N 68°20'W	1
	40°40'N 68°18'W	19(1)
06 Dec 83	40°38'N 68°12'W	5(1)
	40°43'N 68°21'W	7(2)
16 Dec 83	42°22'N 67°37'W	3(1)

White-sided Dolphin		*Lagenorhynchus acutus*
09 Jun 80	41°01'N 67°17'W	3(1)
	41°02'N 67°18'W	10(1)*
11 Jun 80	41°32'N 69°23'W	4(1)*
30 Jun 80	41°31'N 69°25'W	7(1)
18 Aug 80	43°16'N 70°04'W	30(1)*
	43°16'N 70°08'W	6(1)*
	43°23'N 70°03'W	4(1)*
	43°22'N 70°05'W	2(1)
19 Aug 80	42°33'N 69°13'W	18(1)
27 Aug 80	42°06'N 69°49'W	22(1)*
29 Aug 80	42°57'N 69°01'W	10(1)*
	42°27'N 69°04'W	17(1)*
18 Feb 81	42°40'N 70°29'W	10(1)*
05 Mar 81	42°09'N 69°30'W	4(1)*
	42°10'N 69°24'W	3(1)*
	42°16'N 67°54'W	15(1)*
09 Mar 81	40°33'N 68°38'W	8(1)*
11 Mar 81	41°26'N 69°25'W	15(1)*
	41°23'N 69°23'W	15(1)*
	41°23'N 69°23'W	6(1)*
	41°20'N 69°23'W	3(1)*
29 May 81	41°24'N 68°54'W	7(1)
08 Jun 81	41°34'N 68°54'W	10(1)
	41°34'N 69°18'W	5(1)
12 Jul 81	40°29'N 69°19'W	40(1)
	40°42'N 68°53'W	6(1)*
	40°42'N 68°53'W	6(1)
13 Jul 81	41°47'N 66°06'W	12(1)
19 Jul 81	41°54'N 69°48'W	50(1)*
21 Jul 81	42°25'N 70°26'W	160(1)
	42°19'N 70°22'W	10(1)
22 Jul 81	42°56'N 70°12'W	18(1)
23 Jul 81	42°27'N 70°26'W	350(1)
01 Sep 81	41°45'N 69°38'W	25(1)
22 Oct 81	42°02'N 67°08'W	6(1)
	42°08'N 67°06'W	15(1)
29 Oct 81	42°00'N 67°50'W	4(1)
10 Feb 82	39°51'N 73°00'W	12
	39°51'N 73°00'W	6(1)
	39°51'N 73°00'W	2(1)
23 Feb 82	42°28'N 66°19'W	5(1)
24 Mar 82	39°51'N 72°51'W	7(1)
	39°51'N 72°51'W	8(1)
	39°51'N 72°51'W	70(2)
	39°51'N 72°51'W	55(3)
19 May 82	42°09'N 67°10 W	8(1)
22 May 82	41°22'N 68°47'W	5(1)
	41°23'N 68°54'W	5(1)
	41°23'N 68°54'W	3(1)
	41°24'N 68°58'W	2(1)
	41°24'N 68°58'W	1
	41°24'N 68°58'W	4(1)
	41°25'N 69°01'W	2
	41°25'N 69°01'W	1
	41°28'N 69°11'W	4(1)

	41°28'N 69°11'W	4(1)
	41°27'N 69°19'W	5(1)
	41°23'N 69°10'W	3(1)
	41°22'N 69°07'W	3(1)
	41°18'N 69°06'W	4(1)
	41°18'N 69°06'W	3(1)
	41°28'N 69°06'W	3(1)
	41°15'N 69°05'W	4(1)
	41°15'N 69°05'W	3(1)
	41°12'N 69°05'W	2(1)
08 Jun 82	42°48'N 68°23'W	1
19 Jul 82	40°50'N 67°13'W	60
28 Jul 82	41°33'N 66°42'W	25
	41°41'N 66°23'W	65
	41°39'N 66°08'W	25
	41°48'N 65°59'W	5
30 Jul 82	41°58'N 66°33'W	4
	41°58'N 66°33'W	8
31 Jul 82	42°39'N 68°22'W	12
	42°55'N 68°34'W	4
05 Aug 82	42°47'N 70°04'W	3
	42°28'N 70°19'W	3
	41°41'N 69°31'W	17
	41°41'N 69°31'W	5
	41°41'N 69°31'W	10
	41°41'N 69°31'W	2
	41°42'N 69°38'W	15
	41°41'N 69°46'W	20
	41°24'N 69°21'W	10
	41°24'N 69°21'W	10
	41°22'N 69°16'W	8
	41°22'N 69°16'W	4
	41°22'N 69°16'W	3
16 Aug 82	41°42'N 69°19'W	7(1)
	41°42'N 69°22'W	7(1)
	41°42'N 69°22'W	5(1)
	41°42'N 69°22'W	1
19 Aug 82	42°11'N 68°02'W	25(1)
	43°30'N 66°55'W	5(1)
	43°33'N 67°32'W	5(1)
	43°33'N 67°32'W	3(1)
14 Sep 82	43°21'N 67°52'W	75(1)
16 Nov 82	41°45'N 69°13'W	30(1)
17 Nov 82	41°32'N 69°24'W	5(1)
	41°30'N 69°21'W	5(1)
	41°30'N 69°21'W	5(1)
02 Dec 82	43°22'N 67°42'W	6(1)
05 Dec 82	41°35'N 68°47'W	115(3)
	41°48'N 69°27'W	25(1)
	41°49'N 69°29'W	15(1)
18 Feb 83	39°34'N 73°25'W	6(1)
07 Apr 83	41°42'N 69°40'W	6(1)
	41°40'N 69°37'W	15(1)
12 Apr 83	41°39'N 69°10'W	2(1)
21 Apr 83	41°57'N 70°17'W	20(1)
01 May 83	41°56'N 69°55'W	6(1)
	41°32'N 69°23'W	15(1)

	41°21'N 69°04'W	4(1)
05 May 83	40°53'N 68°48'W	10(1)
	40°52'N 68°48'W	20(1)
	40°52'N 68°50'W	2(1)
	40°48'N 69°01'W	12(1)
	40°48'N 69°04'W	8(1)
11 May 83	40°59'N 67°32'W	10(1)
18 May 83	41°23'N 68°28'W	200(1)
	41°24'N 68°30'W	50(1)
	41°24'N 68°45'W	58(3)
14 Jul 83	41°15'N 70°55'W	10(1)*
28 Aug 83	43°09'N 69°19'W	400(1)*
	43°24'N 69°29'W	100(1)
	43°24'N 69°29'W	3(1)
21 Oct 83	41°08'N 66°23'W	30(1)*
01 Nov 83	42°38'N 68°26'W	12(1)
02 Nov 83	42°34'N 67°02'W	40(1)*
	42°34'N 67°01'W	8(1)*
	42°33'N 67°0 'W	12(1)
	42°32'N 66°57'W	20(2)
	42°31'N 66°54'W	32(3)
	42°30'N 66°52'W	12(2)
	42°29'N 66°49'W	53(4)
	42°29'N 66°43'W	13(1)*
07 Nov 83	43°27'N 69°10'W	15(1)
	43°35'N 69°18'W	25(1)
03 Dec 83	41°14'N 69°06'W	15(1)
	41°17'N 69°07'W	9(1)*
08 Dec 83	41°56'N 69°47'W	26(2)
	41°47'N 69°30'W	7(1)
White-beaked		
07 Apr 83	41°28'N 69°38'W	8(1)
11 Jun 83	40°25'N 67°41'W	3(1)
Grampus		<u>Grampus griseus</u>
15 Jul 80	39°08'N 72°45'W	9(1)*
21 Jul 80	39°03'N 73°40'W	8(1)*
	38°53'N 73°43'W	4(1)*
23 Jul 80	39°29'N 72°36'W	8(1)*
	40°12'N 71°51'W	10(1)*
17 Jul 80	39°44'N 70°56'W	2(1)
15 Aug 80	39°39'N 70°25'W	2(1)*
	39°52'N 70°00'W	6(1)*
25 Sep 80	38°42'N 72°49'W	15(1)*
18 May 81	40°29'N 68°41'W	10(2)*
	40°30'N 68°39'W	5(1)
15 Jun 81	37°33'N 74°36'W	35(1)
17 Jul 81	40°17'N 68°20'W	50(1)*
	40°23'N 68°11'W	50(1)*
	40°27'N 68°05'W	10(1)*
	40°30'N 68°00'W	11(1)
14 Sep 81	37°14'N 74°43'W	3(1)*

01 Oct 81	39°03'N 72°44'W	25(1)
	39°05'N 72°40'W	5(1)*
06 Oct 81	40°07'N 70°36'W	25(1)*
23 Mar 82	36°55'N 74°28'W	4(1)
	36°56'N 74°26'W	3(1)
	37°04'N 74°20'W	1(1)
	37°11'N 74°11'W	6(1)
18 May 82	42°08'N 66°23'W	40(1)
01 Jul 82	39°50'N 70°06'W	4(1)
26 Sep 82	39°56'N 68°59'W	5(1)
27 Sep 82	40°17'N 68°52'W	10(1)
	40°17'N 68°52'W	5(1)
	40°17'N 68°52'W	7(1)
09 Mar 83	38°05'N 73°24'W	1
02 Apr 83	39°48'N 70°48'W	6(1)
31 May 83	38°40'N 73°13'W	1(1)
04 Oct 83	39°32'N 71°15'W	12(1)

Pilot Whale — Globicephala spp.

09 Jun 80	41°07'N 67°20'W	5(1)
10 Jun 80	40°44'N 68°43'W	5(1)*
	40°41'N 68°45'W	25(2)
	40°50'N 68°50'W	2(1)*
	40°42'N 68°46'W	4(1)*
26 Sep 80	35°54'N 74°44'W	5(1)
20 May 81	41°05'N 67°04'W	5(1)
12 Jun 81	39°54'N 72°28'W	6(1)
29 Jun 81	40°38'N 67°29'W	4(1)*
13 Jul 81	41°49'N 66°25'W	16(2)
12 Jul 81	37°42'N 74°11'W	5(1)*
	42°17'N 66°02'W	20(1)*
	42°14'N 65°02'W	30(1)
21 Oct 81	41°56'N 67°53'W	2(1)*
	41°56'N 67°53'W	2(1)*
11 Nov 81	40°51'N 68°48'W	10(1)*
	40°51'N 68°51'W	41(6)*
	40°52'N 68°53'W	57(6)*
	40°52'N 68°56'W	10(1)*
	40°53'N 68°59'W	16(2)*
	40°54'N 69°02'W	10(1)*
21 Dec 81	40°02'N 70°48'W	9(1)
	40°04'N 70°53'W	5(2)
10 Feb 82	39°29'N 74°45'W	8
19 Mar 82	38°41'N 72°25'W	15(1)
	38°53'N 73°09'W	8(1)*
24 Mar 82	39°11'N 72°15'W	25(2)
23 Apr 82	40°21'N 66°14'W	5(1)
24 Apr 82	40°31'N 66°31'W	10(1)
25 Apr 82	40°40'N 66°47'W	5(1)*
18 May 82	42°08'N 66°18'W	18(1)*
25 Jun 82	38°00'N 73°20'W	15(1)
	38°17'N 73°27'W	30(1)
26 Jun 82	37°37'N 73°59'W	12(1)
	37°28'N 74°07'W	5(1)
28 Jun 82	37°56'N 73°33'W	15(1)

01 Jul 82	39°54'N 70°03'W	4(1)
27 Jul 82	41°16'N 67°18'W	5(1)
	41°19'N 67°15'W	5(1)
	41°18'N 67°12'W	2(1)
28 Jul 82	41°31'N 66°48'W	2(1)
	41°32'N 66°40'W	2(1)
	41°28'N 66°36'W	1
15 Aug 82	40°16'N 67°22'W	7(1)
16 Aug 82	40°26'N 67°15'W	15(1)
	40°30'N 67°12'W	5(1)
	40°19'N 67°21'W	4(1)
14 Aug 82	41° 33N 67°20'W	2(1)
17 Sep 82	34°27'N 76°30'W	16(1)
23 Sep 82	40°09'N 68°21'W	75(1)
	40°10'N 68°12'W	5(1)
24 Sep 82	40°52'N 67°45'W	1*
25 Sep 82	40°36'N 67°39'W	5(1)
05 Oct 82	40°22'N 71°52'W	8(1)
06 Oct 82	39°53'N 71°59'W	13(3)
	39°55'N 71°59'W	20(4)
19 Oct 82	41°15'N 68°36'W	20(1)
	40°59'N 68°32'W	6(1)
	40°58'N 68°33'W	5(1)
	40°57'N 68°32'W	5(1)
	40°47'N 68°28'W	8(1)
	40°46'N 68°30'W	5(1)
	40°46'N 68°31'W	3(1)
20 Oct 82	40°26'N 68°06'W	40(1)
	40°29'N 67°43'W	3(1)
	40°29'N 67°40'W	4(1)
21 Oct 82	40°41'N 67°02'W	15(1)
25 Oct 82	42°34'N 65°25'W	6(1)
28 Oct 82	41°34'N 69°20'W	40(1)
	41°34'N 69°20'W	20(1)
11 Nov 82	41°10'N 68°41'W	5(1)
	41°11'N 68°47'W	3(1)
	41°11'N 68°47'W	2(1)
	41°11'N 68°47'W	2(1)
	41°13'N 69°24'W	8(1)
16 Nov 82	41°38'N 69°22'W	4(1)
	41°38'N 69°22'W	6(1)
	41°38'N 69°22'W	4(1)
	41°38'N 69°22'W	1(1)
	41°34'N 69°28'W	6(1)
	41°32'N 69°30'W	15(1)
17 Nov 82	41°32'N 69°24'W	6(1)
	41°24'N 69°13'W	2(1)
	41°21'N 69°08'W	3(1)
	41°21'N 69°08'W	6(1)
	41°21'N 69°08'W	12(1)*
	41°20'N 68°55'W	5(1)
	41°20'N 68°55'W	6(1)
	41°20'N 68°41'W	4(1)*
20 Nov 82	41°11'N 66°56'W	6(1)
09 Dec 82	41°17'N 69°15'W	6(1)
	41°16'N 69°18'W	14(3)
	41°16'N 69°21'W	8(2)

21 Feb 83	37°56'N 74°14'W	6(1)
25 Feb 83	32°44'N 79°29'W	1(1)
09 Mar 83	37°47'N 73°56'W	1*
16 Mar 83	38°00'N 73°32'W	8(2)
24 Mar 83	39°56'N 71°51'W	2(1)
	40°04'N 71°45'W	2(1)
05 May 83	40°32'N 70°08'W	2(2)
	40°27'N 70°13'W	8(1)
18 May 83	40°59'N 68°21'W	4(1)
08 Jun 83	40°35'N 70°58'W	8(1)*
19 Jun 83	43°15'N 69°16'W	5(1)
06 Jul 83	40°40'N 70°09'W	2(1)
09 Jul 83	38°17'N 73°38'W	15(1)
24 Aug 83	41°27'N 66°51'W	2(1)
26 Aug 83	42°05'N 66°49'W	2(1)
12 Oct 83	41°13'N 69°01'W	8(3)
02 Nov 83	42°21'N 66°07'W	5(1)*
03 Dec 83	40°54'N 69°11'W	4(1)
	40°55'N 69°05'W	1*

Harbor Porpoise		<u>Phocoena phocoena</u>
18 Aug 80	42°57'N 69°59'W	1
20 Mar 82	38°39'N 74°18'W	7(1)
	38°37'N 74°16'W	2(1)
04 Aug 82	43°49'N 68°23'W	9(1)
	43°45'N 68°39'W	2(1)
18 Aug 82	44°13'N 67°32'W	5(1)
	44°16'N 67°30'W	5(1)
	44°16'N 67°30'W	2(1)
	44°20'N 67°25'W	1
	44°20'N 67°25'W	2(1)
	44°22'N 67°23'W	1
	44°24'N 67°21'W	2(1)
	44°24'N 67°21'W	4(1)
	44°26'N 67°20'W	2(1)
	44°27'N 67°18'W	3(1)
	44°30'N 67°14'W	3(1)
	44°32'N 67°12'W	4(1)
	44°49'N 66°48'W	1
	44°49'N 66°46'W	3(1)
	44°49'N 66°43'W	2(1)
19 Aug 82	43°51'N 66°37'W	1*
	43°49'N 66°37'W	2(1)
	43°38'N 66°35'W	5(1)
20 Oct 82	40°29'N 68°18'W	10(1)
05 Apr 83	40°07'N 68°41'W	1
27 Apr 83	42°48'N 68°39'W	6(1)
28 Apr 83	43°22'N 68°14'W	2(1)
	43°38'N 67°53'W	5(1)
05 May 83	40°40'N 69°30'W	2(1)
Beaked Whale		<u>Mesoplodon</u> sp.
09 Sep 82	41°30'N 69°00'W	1
23 Sep 82	40°08'N 68°32'W	3(1)
Sperm Whale		<u>Physeter macrocephalus</u>
15 Jul 80	37°50'N 73°51'W	7(1)*
	37°40'N 74°00'W	3(1)*
	37°31'N 74°02'W	2(1)*
25 Jul 80	40°12'N 71°32'W	1*
19 Jul 80	37°23'N 74°14'W	2(1)*
25 Sep 80	37°50'N 73°27'W	1
07 Jun 81	40°10'N 68°54'W	1*
18 Aug 81	39°35'N 72°28'W	1*
10 Feb 82	39°42'N 72°40'W	4(1)
23 Mar 82	36°46'N 74°36'W	2(1)*
	36°46'N 74°35'W	1
	36°49'N 74°3 'W	1
	36°53'N 74°30'W	5(1)
	36°56'N 74°26'W	1
	36°58'N 74°24'W	2(1)
	37°04'N 74°20'W	1
	37°11'N 74°14'W	1
24 Mar 82	39°09'N 72°29'W	2(2)

	30°09'N 72°26'W	1
20 Apr 82	39°55'N 69°50'W	2
	39°57'N 70°12'W	1
	39°56'N 69°58'W	1
30 Apr 82	39°13'N 69°20'W	1*
25 Jun 82	37°57'N 73°22'W	1
26 Jun 82	37°16'N 74°19'W	3(1)*
28 Jun 82	38°03'N 73°30'W	1
30 Jun 82	39°57'N 70°06'W	1
13 Aug 82	40°13'N 66°48'W	3(1)*
15 Aug 82	40°23'N 67°17'W	1
	40°25'N 67°15'W	1
16 Aug 82	40°29'N 67°14'W	1
14 Aug 82	40°42'N 66°37'W	1
	40°12'N 66°11'W	3(1)
	40°10'N 66°09'W	4(1)
27 Oct 82	42°47'N 66°19'W	2(1)
	42°43'N 66°59'W	1
	42°42'N 67°10'W	2(1)
01 Dec 82	40°44'N 69°59'W	3(1)
21 Feb 83	38°06'N 73°50'W	1
27 Feb 83	36°40'N 74°37'W	3(1)
	36°42'N 74°36'W	1
04 Apr 83	39°56'N 69°20'W	2(1)
	39°55'N 69°40'W	2(1)*
25 May 83	37°33'N 73°09'W	2(1)*
	37°30'N 73°11'W	4(1)
	37°26'N 73°15'W	4(2)
09 Oct 83	40°59'N 70°30'W	1
	40°59'N 70°27'W	1
03 Nov 83	42°39'N 66°11'W	1
	42°49'N 66°18'W	1
	42°55'N 66°25'W	2(2)
02 Dec 83	40°39'N 70°09'W	2(1)
	40°38'N 70°07'W	2(2)*

Unidentified Dolphin		Delphinidae sp.
10 Jun 80	40°54'N 68°49'W	1*
23 Jun 80	39°19'N 72°21'W	5(1)*
26 Jul 80	40°16'N 70°50'W	1*
18 Jul 80	37°28'N 74°11'W	6(1)*
	37°23'N 74°14'W	2(1)*
	37°07'N 74°27'W	2(1)
20 Jul 80	36°32'N 75°45'W	1*
	36°55'N 75°55'W	5(1)
01 Aug 80	40°01'N 69°00'W	2(1)*
18 Aug 80	43°22'N 70°05'W	8(1)*
20 Aug 80	41°15'N 69°06'W	4(1)*
25 Aug 80	38°49'N 72°45'W	10(1)
26 Sep 80	35°54'N 74°44'W	2(1)
	35°54'N 74°44'W	3(1)
	35°17'N 75°12'W	1*
28 Sep 80	37°38'N 74°21'W	4(1)
16 Oct 80	42°15'N 69°43'W	5(1)*
20 Oct 80	40°58'N 66°59'W	8(1)*

21 Oct 80	41°16'N 66°19'W	1
23 Oct 80	43°07'N 66°52'W	6(1)*
	42°43'N 67°27'W	6(1)
29 Oct 80	43°22'N 68°06'W	6(1)
25 Mar 81	38°56'N 73°31'W	30(1)*
20 May 81	41°19'N 66°58'W	10(1)*
03 Jun 81	40°15'N 68°08'W	1*
08 Jun 81	41°35'N 69°15'W	15(1)
	41°34'N 69°18'W	4(1)
28 Jun 81	40°47'N 68°48'W	10(1)
30 Jun 81	41°36'N 68°26'W	3(1)*
14 Jul 81	42°07'N 66°40'W	6(1)*
19 Jul 81	42°49'N 70°23'W	12(1)
21 Jul 81	43°13'N 70°01'W	6(1)
15 Jul 81	40°30'N 71°09'W	15(1)*
16 Jul 81	40°29'N 70°10'W	15(1)*
17 Jul 81	40°22'N 68°14'W	60(1)
28 Aug 81	42°56'N 69°47'W	15(1)*
30 Aug 81	41°30'N 66°09'W	2(1)
	41°30'N 66°25'W	1
	41°30'N 66°25'W	6(1)
31 Aug 81	40°29'N 68°09'W	5(1)
	40°29'N 68°09'W	6(1)
01 Sep 81	41°41'N 69°11'W	5(1)
21 Dec 81	39°59'N 70°40'W	3(1)*
10 Feb 82	39°29'N 72°47'W	3
	39°53'N 73°00'W	40
16 Mar 82	40°06'N 72°35'W	8(1)
19 Mar 82	38°38'N 73°08'W	2(1)*
	38°41'N 72°25'W	40(1)
21 Mar 82	38°06'N 74°25'W	7(1)
22 Mar 82	37°33'N 74°34'W	90(3)
	37°16'N 75°01'W	5(1)
23 Mar 82	36°56'N 74°26'W	75(2)
	37°02'N 74°21'W	10(1)
	37°09'N 74°16'W	15(1)
24 Mar 82	39°10'N 72°17'W	1
	39°13'N 72°10'W	1
02 May 82	38°34'N 69°49'W	50(1)*
03 May 82	39°49'N 71°15'W	2(1)
18 May 82	42°08'N 66°23'W	10(1)
21 May 82	41°51'N 68°11'W	2(1)
25 Jun 82	37°57'N 73°22'W	20(1)*
	38°20'N 73°25'W	30(1)*
01 Jul 82	39°55'N 69°54'W	15(1)
	39°44'N 69°59'W	50(1)
28 Jul 82	41°30'N 66°32'W	3(1)
	41°41'N 66°23'W	20(1)
	41°40'N 66°15'W	60(1)
02 Aug 82	44°20'N 67°38'W	2(1)
	44°24'N 67°06'W	1
09 Mar 83	38°05'N 73°24'W	4
	37°47'N 73°56'W	8
	37°42'N 74°04'W	4
12 Mar 83	34°09'N 76°01'W	2
	34°07'N 76°04'W	2
	34°07'N 76°03'W	3

12 May 83	41°10'N 67°46'W	5(1)
25 May 83	38°53'N 71°49'W	1
	37°26'N 73°15'W	40(1)
26 May 83	36°05'N 74°35'W	25(1)
	35°55'N 74°44'W	50(1)
07 Jun 83	39°53'N 72°28'W	2(1)
08 Jun 83	40°29'N 70°55'W	10(1)
09 Jun 83	40°08'N 69°33'W	3(1)*
10 Jun 83	41°12'N 69°05'W	2(1)
12 Jun 83	40°31'N 67°41'W	6(2)
	40°37'N 67°39'W	5(3)
13 Jun 83	41°51'N 67°16'W	15(1)
20 Jun 83	42°23'N 70°04'W	5(1)
02 Jul 83	42°28'N 70°08'W	1*
06 Jul 83	40°29'N 70°11'W	2(1)
08 Jul 83	39°45'N 72°01'W	2(1)
	39°45'N 72°01'W	1
09 Jul 83	38°17'N 73°38'W	1*
11 Jul 83	38°41'N 74°58'W	6(1)
	38°46'N 75°00'W	3(1)
28 Aug 83	42°27'N 69°15'W	5(1)*
19 Sep 83	33°28'N 76°40'W	2(1)*
	33°28'N 76°40'W	1*
22 Sep 83	36°57'N 76°02'W	1*
08 Oct 83	40°05'N 70°14'W	12(1)*
01 Nov 83	42°38'N 68°26'W	6(1)
12 Aug 82	39°25'N 67°52'W	20(1)
14 Aug 82	40°22'N 67°16'W	100(1)
15 Aug 82	40°28'N 67°13'W	20(1)
	40°24'N 67°18'W	200(1)
17 Aug 82	40°09'N 67°30'W	10(1)
13 Aug 82	43°12'N 69°05'W	1
14 Aug 82	40°14'N 66°13'W	50(1)
15 Aug 82	40°36'N 67°03'W	15(1)
16 Aug 82	41°43'N 69°25'W	6(1)
17 Aug 82	42°40'N 69°50'W	4(1)*
	34°27'N 76°30'W	40(1)
18 Sep 82	33°47'N 77°51'W	5(1)
	33°29'N 77°50'W	7(1)
19 Sep 82	32°46'N 77°48'W	1
20 Sep 82	33°35'N 76°43'W	5(1)
22 Sep 82	35°39'N 75°19'W	5(1)
23 Sep 82	36°40'N 75°53'W	6(1)
25 Sep 82	40°23'N 67°28'W	75(1)
	40°23'N 67°28'W	1
09 Nov 82	41°43'N 69°45'W	5(1)
16 Nov 82	42°07'N 68°47'W	2(1)
16 Mar 83	38°13'N 73°23'W	8(1)
	37°52'N 73°36'W	5(1)
02 Apr 83	39°53'N 70°44'W	2(1)
20 Apr 83	41°56'N 67°38'W	3(1)
20 Nov 83	38°21'N 73°50'W	10(1)
04 Dec 83	41°07'N 68°09'W	1
06 Dec 83	41°11'N 69°08'W	1
20 Dec 83	41°5 'N 70°23'W	6(1)

Minke Whale — *Balaenoptera acutorostrata*

22 Jul 80	39°50'N 73°26'W	2(1)*
31 Jul 80	41°40'N 68°17'W	1*
27 Aug 80	42°03'N 69°47'W	2(1)*
28 Sep 80	37°31'N 74°39'W	1
22 Feb 81	43°28'N 66°46'W	1*
11 Mar 81	41°03'N 69°23'W	1*
29 Jun 81	40°41'N 67°50'W	1
07 Jul 81	41°09'N 70°59'W	1*
19 Jul 81	42°06'N 70°11'W	1*
23 Jul 81	42°25'N 70°28'W	1
27 Aug 81	42°06'N 70°21'W	1
30 Aug 81	41°31'N 66°19'W	1
	41°30'N 66°25'W	1
08 Feb 82	36°46'N 74°44'W	1
	36°44'N 75°01'W	1
28 Jul 82	41°32'N 66°40'W	1
	41°28'N 66°35'W	1
	41°27'N 66°33'W	2
	41°41'N 66°21'W	1
	41°414N 66°23'W	1
28 Jul 82	41°40'N 66°15'W	2(1)
30 Jul 82	42°05'N 66°57'W	1
04 Aug 82	43°41'N 68°39'W	1
	43°30'N 68°42'W	1
	43°25'N 68°50'W	1
	42°59'N 68°55'W	1
	42°58'N 68°55'W	2(1)
	42°58'N 68°54'W	2(1)
05 Aug 82	42°34'N 70°16'W	1
	41°41'N 69°46'W	1
15 Aug 82	40°26'N 67°16'W	3(1)
	41°04'N 68°09'W	1*
14 Sep 82	43°23'N 67°47'W	1
24 Sep 82	40°29'N 67°33'W	2(1)
07 Oct 82	38°56'N 72°53'W	1
14 Oct 82	41°25'N 69°38'W	1
15 Mar 83	41°10'N 71°15'W	1
	41°08'N 71°18'W	1
02 Apr 83	40°36'N 70°36'W	1
07 Apr 83	41°11'N 69°18'W	1*
	41°22'N 69°30'W	1
05 May 83	40°35'N 69°59'W	1
13 Jun 83	41°36'N 67°05'W	1
	42°10'N 67°16'W	1*
	42°08'N 67°06'W	1
14 Jun 83	42°40'N 66°20'W	1
20 Jun 83	42°23'N 70°04'W	1
09 Aug 83	40°57'N 71°21'W	1*
25 Aug 83	41°50'N 66°18'W	1*
26 Aug 83	42°07'N 67°18'W	1*
04 Oct 83	39°55'N 71°52'W	1
03 Dec 83	41°57'N 70°16'W	5(1)

Sei Whale		*Balaenoptera borealis*
25 Aug 80	40°42'N 69°07'W	1
02 Apr 83	40°02'N 70°16'W	2(1)
04 Apr 83	39°55'N 69°45'W	2(1)
25 May 83	38°34'N 72°12'W	1
29 May 83	37°51'N 74°40'W	1
27 Jul 83	40°04'N 73°33'W	1*
09 Aug 83	41°09'N 71°16'W	1*
12 Aug 83	40°21'N 71°49'W	1*
16 Aug 83	41°08'N 68°58'W	1
Humpback Whale		*Megaptera novaeangliae*
11 Jun 80	41°38'N 69°39'W	1
	41°38'N 69°39'W	1
08 Aug 80	42°27'N 70°15'W	3(1)*
	42°27'N 70°21'W	17(1)
16 Aug 80	41°11'N 69°14'W	2(1)*
17 Aug 80	42°26'N 70°24'W	1*
18 Aug 80	42°47'N 70°27'W	1*
28 Aug 80	42°35'N 70°11'W	4(1)*
28 Sep 80	37°16'N 75°02'W	1*
18 Dec 80	40°52'N 67°40'W	1*
30 Jun 81	41°43'N 69°46'W	2(1)
19 Jul 81	42°27'N 70°23'W	2(1)
	42°28'N 70°23'W	1
	42°28'N 70°23'W	2(1)
	42°48'N 70°21'W	2(1)
	42°50'N 70°18'W	2(1)
22 Jul 81	42°30'N 70°27'W	9(3)
23 Jul 81	42°25'N 70°28'W	1
	42°26'N 70°24'W	12(1)
21 Jul 81	42°28'N 70°30'W	1*
	42°25'N 70°26'W	1
	42°29'N 70°22'W	5(4)
28 Aug 81	42°53'N 70°25'W	4(1)*
	42°58'N 70°06'W	3(1)*
01 Sep 81	41°39'N 69°17'W	1*
03 Nov 81	42°19'N 70°20'W	2(1)*
28 Jul 82	41°33'N 66°42'W	1
05 Aug 82	42°11'N 70°24'W	2(1)
	41°42'N 69°29'W	2(1)
	41°42'N 69°36'W	1
	41°42'N 69°38'W	3
	41°41'N 69°41'W	1
	41°41'N 69°41'W	1
	41°41'N 69°41'W	2
	41°22'N 69°16'W	3(1)
14 Aug 82	40°39'N 67°94'W	1*
16 Aug 82	40°21'N 67°19'W	1
	41°42'N 69°19'W	2(1)
	41°42'N 69°22'W	1
06 Nov 82	42°42'N 70°42'W	8(1)
08 Nov 82	42°22'N 70°12'W	1
11 Nov 82	41°12'N 69°06'W	1
07 Dec 82	42°54'N 70°22'W	2(2)
	42°53'N 70°25'W	3(2)
08 Dec 82	42°10'N 70°19'W	1

	42°12'N 70°18'W	2(2)
	40°42'N 70°12'W	3(1)
04 Mar 83	42°12'N 70°29'W	1
06 Mar 83	42°29'N 70°24'W	1*
02 Apr 83	39°51'N 70°45'W	
04 Apr 83	39°55'N 69°30'W	1
07 Apr 83	41°14'N 69°20'W	1
	41°42'N 69°40'W	1
	41°40'N 69°37'W	2(1)
	41°38'N 69°32'W	4(2)
18 Apr 83	42°49'N 66°30'W	1*
26 Apr 83	42°15'N 70°22'W	2(1)
01 May 83	41°37'N 69°35'W	2(1)
	41°35'N 69°30'W	1
	41°31'N 69°21'W	2(1)
	41°39'N 69°18'W	2(1)
	41°27'N 69°12'W	2(1)
	41°19'N 68°58'W	2(1)
	41°15'N 68°52'W	1
18 May 83	41°24'N 68°45'W	1
28 May 83	37°33'N 75°07'W	2(1)
20 Jun 83	42°25'N 70°24'W	3(2)
02 Jul 83	42°38'N 70°31'W	3(2)
16 Aug 83	41°04'N 69°00'W	22(1)*
17 Aug 83	41°03'N 69°09'W	1
	41°08'N 69°13'W	3(1)*
	41°18'N 69°12'W	1*
31 Aug 83	41°36'N 69°31'W	7(1)
	41°36'N 69°31'W	2(1)
	41°35'N 69°29'W	4(1)
	41°34'N 69°29'W	1*
18 Oct 83	41°24'N 69°05'W	3(1)
26 Oct 83	42°18'N 70°14'W	4(3)
	42°24'N 70°27'W	1
06 Nov 83	43°30'N 68°28'W	2(2)
09 Nov 83	41°59'N 69°49'W	2(1)
03 Dec 83	41°57'N 70°16'W	1
08 Dec 83	42°04'N 60°03'W	1
20 Dec 83	42°05'N 70°14'W	4(1)
	41°53'N 70°27'W	1

Right Whale — Eubalaena glacialis

22 Jul 80	42°59'N 70°11'W	1
07 Apr 83	41°10'N 69°18'W	1*
13 Apr 83	41°00'N 68°47'W	1
01 May 83	41°20'N 69°02'W	4(2)
22 May 83	41°20'N 68°42'W	1*
18 May 83	41°24'N 68°28'W	2(2)
10 Jun 83	41°20'N 69°09'W	1

Fin/probable Fin Whale		*Balaeonoptera physalus*
07 Jun 80	40°17'N 69°47'W	1*
11 Jun 80	41°19'N 69°20'W	1*
	41°30'N 69°25'W	1
	41°30'N 69°26'W	2(1)
	41°30'N 69°26'W	1
	41°32'N 69°23'W	1*
	41°32'N 69°23'W	1*
	41°38'N 69°39'W	5(1)
	41°38'N 69°39'W	2(1)
	41°40'N 69°45'W	3(3)*
15 Jul 80	39°33'N 72°25'W	2(1)*
19 Jul 80	38°02'N 74°23'W	2(1)*
21 Jul 80	38°44'N 73°44'W	1*
	38°39'N 73°19'W	2(1)
22 Jul 80	39°50'N 73°26'W	1*
	39°50'N 73°30'W	2(1)*
23 Jul 80	40°57'N 71°18'W	4(1)
	40°58'N 71°15'W	4(1)
	39°26'N 72°30'W	3(1)*
	39°19'N 72°21'W	1*
25 Jul 80	40°23'N 71°35'W	2(1)*
26 Jul 80	41°30'N 71°13'W	1*
28 Jul 80	40°41'N 69°03'W	1*
30 Jul 80	41°37'N 69°30'W	2(1)*
	41°32'N 69°25'W	3(1)
08 Aug 80	42°49'N 70°32'W	2(1)*
	42°27'N 70°21'W	3(1)
	42°27'N 70°21'W	16(1)
16 Aug 80	41°14'N 69°18'W	1*
	41°14'N 69°18'W	2(1)*
	41°19'N 69°21'W	2(1)*
17 Aug 80	42°14'N 70°07'W	2(1)*
	42°26'N 70°24'W	1*
	42°26'N 70°24'W	1*
	42°32'N 70°16'W	1*
18 Aug 80	42°48'N 70°22'W	4(1)*
	43°16'N 70°08'W	1*
24 Aug 80	40°37'N 69°05'W	1*
25 Aug 80	40°41'N 69°06'W	1
	41°07'N 69°12'W	1
	41°15'N 69°18'W	1
	41°16'N 69°23'W	1
	41°13'N 69°21'W	1
	41°17'N 69°20'W	1*
27 Aug 80	41°40'N 69°28'W	1
	41°59'N 69°45'W	1*
	42°03'N 69°47'W	1*
	42°06'N 69°49'W	1*
	42°08'N 69°50'W	1
	42°17'N 70°17'W	1*
29 Aug 80	42°27'N 69°04'W	1*
30 Aug 80	41°43'N 69°05'W	1*
	41°41'N 69°06'W	1*
	41°36'N 69°05'W	1*
	41°21'N 69°02'W	1*

	41°36'N 69°05'W	1*
28 Sep 80	37°26'N 74°40'W	2(1)*
	37°26'N 74°40'W	2(1)*
09 Oct 80	40°10'N 69°50'W	1*
21 Oct 80	42°03'N 66°20'W	2(1)*
22 Oct 80	43°01'N 66°21'W	2(1)*
28 Oct 80	43°19'N 69°43'W	2(1)*
	43°21'N 69°20'W	1*
22 Dec 80	42°16'N 69°43'W	1*
	42°06'N 70°11'W	1*
05 Mar 81	42°16'N 68°00'W	1*
07 Mar 81	40°24'N 67°46'W	2(1)*
25 Mar 81	38°50'N 73°31'W	1*
08 Jun 81	41°35'N 69°15'W	1
	41°31'N 69°24'W	1
12 Jun 81	39°18'N 73°43'W	2(1)
	39°06'N 74°38'W	2(1)
13 Jun 81	38°38'N 74°38'W	1*
16 Jun 81	38°08'N 74°09'W	1
18 Jun 81	39°02'N 73°11'W	4(1)*
	39°05'N 73°04'W	2(1)*
30 Jun 81	41°34'N 68°26'W	1*
	41°39'N 69°42'W	4(1)*
08 Jul 81	40°58'N 72°01'W	1*
09 Jul 81	39°45'N 73°22'W	1
	39°46'N 73°26'W	1*
10 Jul 81	40°44'N 72°14'W	1
	40°45'N 72°15'W	1
	40°46'N 71°51'W	1
11 Jul 81	41°07'N 70°41'W	4(1)
	41°07'N 70°41'W	3(1)
12 Jul 81	37°21'N 74°46'W	1*
13 Jul 81	38°20'N 74°15'W	2(1)*
	38°34'N 74°06'W	1*
	38°45'N 73°29'W	1
	41°55'N 66°10'W	2(1)
	41°57'N 66°07'W	4(1)
19 Jul 81	42°06'N 70°11'W	1*
	42°11'N 70°21'W	1
	42°11'N 70°21'W	1
	42°28'N 70°23'W	2(1)*
	42°28'N 70°23'W	2(1)*
	42°41'N 70°26'W	1*
	43°04'N 70°09'W	1*
21 Jul 81	42°28'N 70°30'W	5(1)*
	42°38'N 70°30'W	2(1)*
	42°28'N 70°26'W	3(1)*
	42°25'N 70°26'W	2(1)
22 Jul 81	43°00'N 70°11'W	2(1)
	42°59'N 70°11'W	1*
	42°32'N 70°22'W	2(1)*
	42°32'N 70°24'W	7(1)*
23 Jul 81	42°25'N 70°28'W	2(1)*
	42°27'N 70°26'W	6(1)
11 Aug 81	40°16'N 72°23'W	1
14 Aug 81	39°44'N 73°44'W	1
16 Aug 81	39°35'N 72°50'W	1*

17 Aug 81	39°45'N 71°58'W	1*
18 Aug 81	39°28'N 72°26'W	1*
	39°30'N 72°26'W	2(1)
	39°32'N 72°24'W	2(1)*
	39°35'N 72°26'W	4(1)*
	39°34'N 72°27'W	1*
	42°19'N 70°22'W	11(2)
27 Aug 81	42°05'N 70°20'W	2(1)*
	42°06'N 70°21'W	1
28 Aug 81	42°52'W 70°30'W	2(1)
	42°58'N 70°06'W	1*
	42°58'N 70°06'W	1*
02 Sep 81	40°13'N 70°25'W	1*
28 Sep 81	37°58'N 74°17'W	1*
06 Oct 81	40°01'N 70°34'W	1
05 Nov 81	43°20'N 69°23'W	2(1)*
17 Nov 81	41°23'N 69°36'W	1
08 Dec 81	42°13'N 67°55'W	1*
10 Dec 81	42°58'N 69°59'W	2(1)*
16 Mar 82	40°35'N 72°58'W	1(1)
	40°06'N 72°35'W	4(1)
	40°06'N 72°35'W	1(1)
22 Mar 82	37°17'N 74°44'W	1
	37°15'N 74°45'W	1
23 Mar 82	37°15'N 74°11'W	2(1)
24 Mar 82	39°52'N 71°26'W	2(1)
20 Apr 82	39°59'N 70°26'W	1
03 May 82	40°03'N 71°17'W	1
18 May 82	42°08'N 66°20'W	1*
19 May 82	42°09'N 67°10'W	3
22 May 82	41°20'N 68°42'W	2(1)*
	41°29'N 69°16'W	2(1)
	41°20'N 69°18'W	2(1)
	41°27'N 69°19'W	3(1)*
	41°22'N 69°07'W	1
01 Jun 82	41°33'N 69°27'W	1*
02 Jun 82	42°49'N 66°20'W	2(1)*
05 Jun 82	42°33'N 67°41'W	1
	42°39'N 67°41'W	2(1)
25 Jun 82	37°50'N 73°28'W	2(1)
13 Jul 82	40°35'N 72°18'W	1
21 Jul 82	41°10'N 68°53'W	1
27 Jul 82	40°54'N 66°47'W	1
28 Jul 82	41°32'N 66°40'W	1
05 Aug 82	42°34'N 70°16'W	1
	42°28'N 70°19'W	1
	42°28'N 70°19'W	2
	42°27'N 70°11'W	1
	41°34'N 69°46'W	1
	41°38'N 69°38'W	1
	41°40'N 69°33'W	2
	41°40'N 69°33'W	1
	41°42'N 69°31'W	2
	41°41'N 69°31'W	1
	41°41'N 69°31'W	1
	41°42'N 69°29'W	1
	41°42'N 69°36'W	1

	41°42'N 69°38'W	1
	41°42'N 69°38'W	1
	41°41'N 69°41'W	2(1)
	41°41'N 69°41'W	2(1)
	41°41'N 69°41'W	2(1)
	41°41'N 69°41'W	1
	41°41'N 69°44'W	4(4)
06 Aug 82	41°05'N 69°04'W	1
	41°07'N 69°05'W	1
	41°07'N 69°05'W	2(1)
	41°16'N 69°07'W	1
	41°29'N 69°13'W	1
	41°09'N 69°05'W	4(4)
	41°14'N 69°07'W	3(3)
	41°16'N 69°07'W	2(2)
15 Aug 82	40°28'N 67°13'W	1
16 Aug 82	41°42'N 69°19'W	2(2)
	41°42'N 69°22'W	3(3)
	41°42'N 69°22'W	3(3)
	42°07'N 70°10'W	1
	42°07'N 70°14'W	2(1)
	42°07'N 70°14'W	1
	42°07'N 70°14'W	3(1)
	42°07'N 70°14'W	2(1)
	42°07'N 70°14'W	1
	42°07'N 70°14'W	2(1)
17 Aug 82	42°20'N 70°28'W	1
18 Aug 82	44°49'N 66°48'W	1
19 Aug 82	43°49'N 66°37'W	2(1)
	43°33'N 67°32'W	1
	42°39'N 67°02'W	6(1)
	42°31'N 67°20'W	1
14 Sep 82	43°21'N 67°54'W	1
	43°21'N 67°52'W	1
23 Sep 82	40°15'N 68°01'W	1
24 Sep 82	40°43'N 67°40'W	1
05 Oct 82	40°10'N 70°44'W	1
06 Oct 82	40°22'N 71°51'W	1
08 Oct 82	39°41'N 73°00'W	1
	39°38'N 73°07'W	1
19 Oct 82	40°46'N 68°30'W	2(1)
20 Oct 82	40°30'N 68°20'W	4(1)
	40°30'N 68°20'W	2(1)
	40°29'N 68°18'W	1
	40°25'N 68°14'W	3(1)
	40°25'N 68°14'W	1
	40°26'N 68°10'W	1
	40°26'N 68°10'W	2(1)
	40°26'N 68°04'W	2(1)
	40°26'N 68°02'W	1*
	40°27'N 68°00'W	3(1)
	40°28'N 67°56'W	1
	40°29'N 67°46'W	1
	40°29'N 67°40'W	2(1)
	41°29'N 67°40'W	1
	40°29'N 67°40'W	1
	40°30'N 67°31'W	3(1)

	40°27'N 67°53'W	1
21 Oct 82	40°41'N 67°02'W	1
	40°43'N 67°04'W	2(1)
	40°43'N 67°04'W	3(1)
	40°43'N 67°04'W	1
	40°40'N 66°51'W	2(1)
	40°44'N 66°48'W	1
	40°48'N 66°47'W	3(1)
23 Oct 82	42°10'N 66°39'W	1
	42°15'N 66°37'W	1
24 Oct 82	41°30'N 66°03'W	1
	41°35'N 65°59'W	2(1)
	41°40'N 66°00'W	2(2)
	41°42'N 66°00'W	1
25 Oct 82	42°42'N 65°46'W	1
28 Oct 82	41°55'N 69°02'W	1
	41°34'N 69°20'W	1
	41°34'N 69°20'W	2(1)
	41°34'N 69°20'W	2(2)
	41°34'N 69°20'W	3(1)
	41°30'N 69°24'W	2(1)
	41°55'N 69°02'W	1(1)
08 Nov 82	42°21'N 70°13'W	1
	42°17'N 70°16'W	1
	42°21'N 70°13'W	2(1)
09 Nov 82	41°36'N 69°30'W	2(1)
11 Nov 82	41°11'N 68°54'W	3(1)
	41°11'N 68°54'W	2(1)
16 Nov 82	41°45'N 69°13'W	1
	41°40'N 69°19'W	1
19 Nov 82	40°23'N 67°41'W	1
21 Nov 82	41°11'N 66°21'W	2(1)
05 Dec 82	41°40'N 68°31'W	1
07 Dec 82	43°12'N 70°02'W	1
	43°07'N 70°04'W	2(1)
	42°54'N 70°22'W	1
18 Jan 83	41°11'N 68°53'W	1
22 Jan 83	41°16'N 66°19'W	1
01 Feb 83	42°10'N 69°12'W	2(1)
21 Feb 83	38°31'N 73°19'W	1
28 Feb 83	37°35'N 74°25'W	1
10 Mar 83	36°53'N 75°26'W	1
15 Mar 83	41°18'N 71°00'W	1
16 Mar 83	38°47'N 73°02'W	2(2)
	38°47'N 73°02'W	1
	38°44'N 73°04'W	2(2)
	38°42'N 73°05'W	1
20 Mar 83	37°59'N 74°14'W	1
	38°14'N 73°49'W	1
	38°15'N 73°46'W	1
	38°22'N 73°38'W	1
	38°24'N 73°34'W	1*
	38°27'N 73°31'W	1
24 Mar 83	39°49'N 71°55'W	1
	39°32'N 72°07'W	1
	39°47'N 71°57'W	3
29 Mar 83	40°49'N 71°49'W	1

02 Apr 83	39°48'N 70°48'W	2(1)
	39°53'N 70°44'W	1
	40°02'N 70°19'W	3(3)
04 Apr 83	39°55'N 09°43'W	1
	39°55'N 69°37'W	2(1)
	39°55'N 69°37'W	2(1)
	39°55'N 69°27'W	1
05 Apr 83	40°06'N 68°50'W	1
	40°06'N 68°45'W	2(1)
	40°06'N 68°43'W	1
	40°22'N 68°22'W	1
	40°23'N 68°21'W	2(1)
	40°26'N 68°17'W	1
	40°28'N 67°58'W	1
	40°27'N 67°56'W	1
06 Apr 83	40°44'N 68°14'W	2(1)
	40°44'N 68°14'W	2(1)
	40°35'N 68°49'W	2(1)
15 Apr 83	41°46'N 65°45'W	1
18 Apr 83	42°30'N 66°30'W	1*
27 Apr 83	42°37'N 68°42'W	1
01 May 83	41°37'N 69°35'W	1
	41°37'N 69°35'W	2(2)
	41°36'N 69°33'W	1
	41°35'N 69°30'W	2(2)
	41°34'N 69°27'W	2(1)
	41°32'N 69°23'W	1
	41°20'N 69°02'W	1
05 May 83	40°30'N 70°10'W	1
18 May 83	41°23'N 68°28'W	1
	41°24'N 68°28'W	1
	41°24'N 68°30'W	3(3)
28 May 83	37°17'N 75°19'W	2(1)
29 May 83	37°51'N 74°40'W	1
30 May 83	39°15'N 73°46'W	1
	38°20'N 73°58'W	1
01 Jun 83	39°39'N 73°45'W	1
02 Jun 83	39°37'N 72°45'W	2(2)
	39°33'N 72°40'W	4(2)
	39°32'N 72°38'W	3(1)
10 Jun 83	41°15'N 69°05'W	2(1)
	41°39'N 68°59'W	1*
13 Jun 83	42°10'N 67°16'W	5(1)*
	42°11'N 67°14'W	2(1)
14 Jun 83	42°31'N 66°22'W	1
02 Jul 83	42°28'N 70°31'W	1
04 Jul 83	41°59'N 67°41'W	1*
06 Jul 83	40°55'N 69°49'W	1
14 Jul 83	40°59'N 71°29'W	4(1)
	40°58'N 71°26'W	2(2)
	40°58'N 71°21'W	5(3)
	40°57'N 71°17'W	5(2)
27 Jul 83	40°04'N 73°33'W	1
29 Jul 83	38°23'N 74°05'W	1
04 Aug 83	39°45'N 72°35'W	1
09 Aug 83	41°09'N 71°16'W	1*
	41°01'N 71°05'W	1

12 Aug 83	40°38'N 71°25'W	1
13 Aug 83	40°31'N 70°14'W	1
16 Aug 83	41°24'N 68°43'W	1
	41°06'N 69°01'W	1*
17 Aug 83	41°08'N 69°11'W	2(1)
	41°17'N 69°13'W	1*
	41°23'N 69°21'W	1*
18 Aug 83	41°40'N 69°45'W	3(1)
26 Aug 83	42°07'N 67°18'W	3(1)*
31 Aug 83	41°16'N 69°19'W	4(1)*
04 Oct 83	39°32'N 72°12'W	1
	39°31'N 72°18'W	1
07 Oct 83	40°02'N 70°58'W	1*
08 Oct 83	39°57'N 70°06'W	1
	39°56'N 69°54'W	1
	40°04'N 69°56'W	1
10 Oct 83	40°14'N 68°30'W	1*
11 Oct 83	40°25'N 67°53'W	1
01 Nov 83	42°17'N 68°30'W	1
02 Nov 83	42°26'N 66°15'W	2(1)
06 Nov 83	43°47'N 68°13'W	1
08 Nov 83	42°59'N 70°24'W	1
	42°40'N 70°24'W	1

Unidentified large whale		*Balaenopterid spp./ Physeter macrocephalus*
07 Jun 80	40°19'N 70°57'W	1*
15 Jul 80	38°13'N 73°31'W	1*
	37°31'N 74°02'W	1*
25 Jul 80	40°19'N 71°33'W	1*
20 Jul 80	36°17'N 75°17'W	1*
30 Jul 80	42°00'N 69°47'W	1*
15 Aug 80	40°01'N 69°42'W	1*
	40°03'N 69°40'W	1*
16 Aug 80	41°19'N 69°21'W	2(1)*
	41°21'N 69°22'W	1*
	41°25'N 69°24'W	1
	41°27'N 69°24'W	1
20 Aug 80	41°19'N 69°07'W	1*
21 Aug 80	40°26'N 68°32'W	1*
28 Aug 80	42°35'N 70°11'W	1*
08 Oct 80	41°06'N 71°03'W	1
09 Oct 80	40°10'N 69°46'W	1*
07 Oct 80	39°53'N 72°29'W	1*
	39°50'N 72°27'W	1*
16 Oct 80	42°15'N 69°43'W	5(1)
17 Oct 80	40°57'N 69°25'W	2(1)*
21 Oct 80	41°12'N 66°18'W	2(1)*
22 Oct 80	43°35'N 66°43'W	1
28 Oct 80	43°14'N 69°48'W	4(1)*
24 Feb 81	41°09'N 66°21'W	1
19 Mar 81	39°59'N 70°45'W	1*
25 Mar 81	38°56'N 73°31'W	1*
	39°28'N 72°56'W	1*
	39°32'N 72°52'W	1*
	39°53'N 72°28'W	1
03 Jun 81	40°04'N 69°01'W	1*
12 Jun 81	40°02'N 72°33'W	1
16 Jun 81	38°09'N 74°13'W	1*
	38°08'N 74°09'W	2(1)
26 Jun 81	40°55'N 71°06'W	1*
27 Jun 81	40°31'N 70°17'W	1*
10 Jul 81	40°48'N 72°01'W	1
	40°46'N 71°51'W	1
19 Jul 81	42°50'N 70°23'W	1
10 Jul 81	39°58'N 73°41'W	1
	38°56'N 74°32'W	1*
21 Jul 81	42°27'N 70°34'W	3(1)*
	42°28'N 70°30'W	2(1)*
17 Aug 81	39°45'N 71°58'W	1*
	42°17'N 66°:2'W	1*
27 Aug 81	42°06'N 70°21'W	1
01 Sep 81	41°40'N 69°14'W	1*
	41°42'N 69°31'W	1*
15 Oct 81	40°15'N 68°40'W	1
05 Nov 81	43°01'N 69°23'W	2(1)*
12 Nov 81	40°40'N 70°16'W	1
08 Dec 81	42°39'N 67°41'W	1
29 Jan 82	42°52'N 70°25'W	2
	42°55'N 70°14'W	1

30 Jan 82	42°10'N 67°28'W	1
06 Feb 82	39°51'N 73°34'W	1
20 Apr 82	40°00'N 70°28'W	1
23 Apr 82	40°16'N 66°24'W	1
	40°20'N 66°20'W	2*
19 May 82	41°52'N 67°16'W	1
21 May 82	41°51'N 68°11'W	1*
02 Jun 82	42°49'N 66°20'W	2(1)*
04 Jun 82	44°10'N 67°01'W	1*
05 Jun 82	43°11'N 67°41'W	1*
06 Jun 82	44°03'N 68°03'W	1
	43°52'N 68°36'W	1*
09 Jun 82	42°06'N 68°34'W	1*
21 Jun 82	37°31'N 73°21'W	1*
29 Jun 82	38°23'N 72°45'W	2(1)*
01 Jul 82	39°55'N 70°06'W	1
16 Jul 82	40°50'N 71°22'W	1
21 Jul 82	41°12'N 68°45'W	1
06 Aug 82	41°07'N 69°05'W	3(1)
	41°28'N 69°16'W	1
16 Aug 82	41°42'N 69°22'W	1
15 Sep 82	37°22'N 74°33'W	1
25 Sep 82	40°20'N 67°33'W	1*
25 Sep 82	40°26'N 67°35'W	1
06 Nov 82	42°50'N 70°39'W	1
	42°42'N 70°42'W	1
08 Nov 82	42°24'N 70°10'W	1
	42°22'N 70°12'W	1
	42°22'N 70°12'W	1
	42°21'N 70°13'W	1
	42°21'N 70°13'W	1
	42°18'N 70°16'W	1
	42°22'N 70°26'W	2(1)
10 Nov 82	41°49'N 68°06'W	1
11 Nov 82	41°10'N 69°15'W	1
16 Nov 82	42°00'N 68°55'W	1
30 Nov 82	40°17'N 71°35'W	1
04 Dec 82	42°00'N 66°58'W	2(1)
27 Jan 83	42°47'N 68°40'W	1
03 Mar 83	42°03'N 70°11'W	1*
16 Mar 83	37°32'N 73°47'W	1
	35°38'N 75°28'W	1
20 Mar 83	38°09'N 73°59'W	1
	38°11'N 73°57'W	1
24 Mar 83	39°35'N 72°09'W	1
02 Apr 83	39°58'N 70°27'W	1
	40°02'N 70°19'W	1
04 Apr 83	39°55'N 69°45'W	1
10 May 83	40°09'N 68°01'W	1*
	40°06'N 67°59'W	2(1)*
	40°43'N 68°08'W	1
13 May 83	40°54'N 67°33'W	1*
	40°53'N 67°33'W	2(1)*
18 May 83	41°24'N 68°30'W	5(2)
07 Jun 83	40°37'N 72°52'W	1
10 Jun 83	41°28'N 69°20'W	1
	41°39'N 68°59'W	1*

13 Jun 83	41°34'N 67°03'W	1
29 Jul 83	38°23'N 74°05'W	1
31 Aug 83	41°19'N 69°21'W	1
	41°16'N 69°19'W	2(1)
11 Oct 83	40°25'N 67°53'W	2(1)*
03 Nov 83	42°36'N 66°07'W	1
08 Dec 83	42°01'N 70°12'W	1
14 Dec 83	41°59'N 67°24'W	1*

Appendix 2. List of sea turtle sightings from June 1980 to December 1983 (*indicates general observation).

Loggerhead Turtle		*Caretta caretta*
17 Jul 80	36°37'N 75°23'W	1*
21 Jul 80	39°05'N 73°40'W	1
26 Jul 80	40°43'N 71°03'W	1
24 Aug 80	40°24'N 67°40'W	1
28 Sep 80	37°34'N 74°39'W	1
28 Sep 80	37°38'N 74°21'W	1
13 Jun 81	38°22'N 74°35'W	1
13 Jun 81	38°21'N 74°38'W	1
12 Jul 81	37°36'N 74°47'W	1
12 Jul 81	37°41'N 74°47'W	1
12 Jul 81	37°41'N 74°47'W	1
12 Jul 81	37°43'N 74°47'W	1
12 Jul 81	37°45'N 74°28'W	1
12 Jul 81	37°45'N 74°25'W	1
12 Jul 81	37°43'N 74°20'W	1
11 Sep 81	37°48'N 74°45'W	1
19 Sep 81	34°58'N 76°09'W	1
14 Aug 82	40°54'N 66°47'W	1
16 Sep 82	36°02'N 74°47'W	2(1)
22 Sep 82	35°18'N 75°22'W	1
	35°32'N 75°22'W	1
20 Nov 82	40°42'N 67°10'W	1
15 Mar 83	35°01'N 75°46'W	1*
17 Mar 83	34°57'N 75°31'W	1
	34°53'N 75°37'W	1
25 May 83	37°47'N 72°57'W	1
26 May 83	35°43'N 75°24'W	1
	35°58'N 75°20'W	1
28 May 83	37°17'N 75°19'W	1
24 Sep 83	38°12'N 75°05'W	1
Atlantic Ridley Turtle		*Lepidochelys kempi*
23 Jul 80	40°53'N 71°45'W	1
23 Jul 80	40°54'N 71°38'W	1
13 Jun 81	38°22'N 74°55'W	1
Green Turtle		*Chelonia mydas*
20 Jul 80	36°28'N 75°42'W	1
22 Jul 80	39°47'N 73°11'W	1*
Leatherback Turtle		*Dermochelys coriacea*
22 Jul 80	39°38'N 73°00'W	1
30 Sep 81	38°21'N 74°55'W	1
Unidentified turtle		
17 Jul 80	36°39'N 75°09'W	1

20 Jul 80	36°37'N 75°49'W	1*
27 Jul 80	40°26'N 69°54'W	1
28 Jul 80	40°35'N 68°55'W	1
12 Jun 81	39°18'N 73°43'W	1
15 Jun 81	37°33'N 74°40'W	1
12 Jul 81	36°41'N 74°45'W	1
12 Jul 81	37°48'N 74°45'W	2
12 Jul 81	37°45'N 74°28'W	1
11 Aug 81	40°24'N 72°58'W	1
11 Sep 81	40°06'N 73°32'W	1
01 Oct 81	39°05'N 72°40'W	1
15 Aug 82	40°25'N 67°13'W	1(1)*
22 Sep 82	35°30'N 75°22'W	1
20 Oct 82	40°32'N 68°22'W	1
27 Jul 83	40°13'N 73°25'W	1
16 Nov 83	35°37'N 74°58'W	1