TECHNICAL/AGENCY REVIEW DRAFT

REVISED RECOVERY PLAN FOR PIPING PLOVERS

Charadrius melodus

BREEDING ON THE GREAT LAKES AND NORTHERN GREAT PLAINS

June 28, 1994

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(Original Plan Approved May 12, 1988)

Prepared by the Great Lakes / Northern Great Plains

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Date: June 28, 1994

EXECUTIVE SUMMARY

Current Status: Piping plovers are listed as threatened in the Northern Great Plains and Atlantic Coast and endangered in the Great Lakes. Lack of productivity, population decline, and increased threats to habitat suggest that the species should be listed as endangered in the Northern Great Plains. The species is considered endangered in Canada.

Habitat Requirements and Limiting Factors: Piping plovers in the Great Lakes nest on open sandy beaches, frequented by recreational users, on Lake Superior and Lake Michigan in northern Michigan. Birds in the Northern Great Plains nest on sand bars and gravel beaches along major prairie rivers (e.g. Missouri, Platte, Niobrara) where navigation, power, irrigation, recreation, and development pressures decrease habitat suitability. They also nest on alkali beaches of prairie lakes. Here, wetland drainage, habitat alteration, and increased predation due to human disturbance have significantly lowered productivity. Great Lakes and Northern Great Plains (and possibly most Atlantic Coast) piping plovers winter primarily along beaches, sandflats, and algal flats on the Gulf of Mexico. Plans for dredging and recreational development, particularly on Laguna Madre TX, pose a serious threat for the entire species.

Recovery Objective: To attain population viability, the recovery objective for the Northern U.S. Great Plains is set at 2,300 breeding pairs with a distribution as outlined in the plan. In order to prevent extirpation, the Great Lakes reclassification objective is set at 150 pairs.

Recovery Criteria: Both populations are seriously declining, hence recovery objectives are set to stabilize populations.

Actions Needed:

1. Determine current distribution and population trends throughout the annual cycle.
2. Determine habitat requirements and status.
3. Protect, enhance, and increase Piping Plover populations.
4. Preserve and enhance Piping Plover habitat.
5. Implement public education programs to enhance Piping Plover conservation.
6. Coordinate recovery efforts; appoint a recovery coordinator.

Cost of Recovery for FY 1995-1999: details are summarized in the implementation schedule.

	Need 1	Need 2	Need 3	Need 4	Need 5	Need 6	Total
1995	$175K	$50K	$38K	$0K	$15K	$50K	$238K
1996	145	50	38	0	15	50	298
1997	75	50	38	0	15	50	228
1998	75	50	38	0	15	50	228
1999	60		38	0	15	50	163
Total	$530K	$200K	$190K	$0K	$75K	$250K	1,245K

Date of Recovery: The status of these populations is too precarious to predict recovery date.

DISCLAIMER

Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect listed species. Plans are published by the U.S. Fish and Wildlife Service, sometimes prepared with the assistance of recovery teams, contractors, State agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views nor the official positions or approval of any individuals or agencies involved in the plan formulation, other than the U.S. Fish and Wildlife Service. They represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Director or Regional Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Literature Citations should read as follows:

U.S. Fish and Wildlife Service 1994. Draft revised recovery plan for Piping Plovers, *Charadrius melodus*, breeding on the Great Lakes and Northern Great Plains of the United States. U.S. Fish and Wildlife Service, Twin Cities, MN.

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The fees for recovery plans vary depending on their length.

ACKNOWLEDGEMENTS

This recovery plan was prepared by the Great Lakes/Northern Great Plains Piping Plover Recovery Team for the U.S. Fish and Wildlife Service. We appreciate the assistance of Jonathan Plissner in preparing Appendix 3 (Essential Habitat). Further, we thank William Harrison and Ronald Refsnider for comments and discussion regarding this revised plan. Finally, we sincerely appreciate the cooperation rendered by state and federal agencies in the Great Lakes and Northern Great Plains for their contribution to Piping Plover conservation during the first 5 years of recovery (1988-1993).

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I. INTRODUCTION

The Piping Plover (Charadrius melodus Ord) has been a species of concern throughout North America since the early 1900's. At the turn of the century, as now, piping plovers bred on prairie rivers and alkali wetlands of the Northern Great Plains, on sandy Great Lakes shorelines, and on Atlantic coast beaches. Recently, numbers of birds and breeding sites have declined (Haig and Oring 1985; USFWS 1985, 1987, 1988; Haig and Plissner 1993). Furthermore, the geographic gap between breeding populations continues to grow as breeding activity declines on the Great Lakes (Haig and Plissner 1993).

In December 1982, the U.S. Fish and Wildlife Service took action by identifying the Piping Plover as a candidate species for addition to the list of threatened and endangered wildlife (47 Federal Register 58454). In January 1986, the Piping Plover was listed as threatened and endangered under provisions of the Endangered Species Act of 1973 (50 Federal Register 50726-34). Piping plovers on the Great Lakes were listed as endangered, while the remaining Atlantic and Northern Great Plains birds were listed as threatened. Piping plovers on migration and in wintering areas were classified as threatened.

In 1986, the U.S. Fish and Wildlife Service appointed the Atlantic Coast and Great Lakes/Northern Great Plains recovery teams to develop recovery plans for piping plovers (Section 4 of the Endangered Species Act). These teams have worked together and with Canadian recovery teams to make progress in achieving recovery objectives outlined in the first plans (USFWS 1987, USFWS 1988, Canadian Wildlife Service 1993). This revised plan outlines a strategy for further recovery of inland breeding piping plovers in the U.S. and all piping plovers that winter along the Gulf of Mexico.

Description

The piping plover, whose name describes its melodic mating call, is one of six North American species of belted plovers. Piping plovers have a body length of 17 cm (Palmer 1967) and weigh between 46 and 64 g (x = 55 g; Haig 1992). Wing lengths span 11.0-12.7 cm, tarsi range from 2.1-2.4 cm, and culmen lengths vary from 1.0 to 1.4 cm (Wilcox 1959; Prater et al. 1977; Haig 1992). Throughout the year, adults have a sand-colored upper body, white undersides, and orange legs. A white wing stripe and white rump are also visible in flight. During the breeding season, adults acquire single black forehead and breast bands, and orange bills. In general, males have more complete bands than females, and inland birds have more complete bands than Atlantic coast birds (Wilcox 1959, Prater et al. 1977, Haig and Oring 1988a). Nonbreeding birds lose the bands and orange on their bill, but are easily distinguished from snowy plovers (*Charadrius alexandrinus*) and collared plovers (*Charadrius collaris*) by their slightly larger size and orange legs (Haig 1992). Juvenile plumage is similar to adult nonbreeding plumage. Juveniles acquire adult plumage the spring after they fledge (Prater et al. 1977).

Taxonomy

Originally described as a race of *Charadrius hiaticula* (Wilson and Bonaparte, no date), the taxonomy of piping plovers has undergone a number of revisions. Ord (1824) was the first to consider the Piping Plover a separate species, but it was not until the fourth edition of the American Ornithologists' Union (AOU) Checklist that the original binomial, *Aegialitis meloda*, was changed to *Charadrius melodus* (AOU 1931). In addition to changes in the binomial, ornithologists have argued for over 100 years about designation of two subspecies: *C. m. melodus* (Atlantic birds) and *C. m.*

circumcinctus (inland birds). Moser (1942) argued that the extent and brightness of breast bands differed between inland and coastal birds. This facilitated acceptance of the two subspecific designations (AOU 1945). Wilcox (1959) reported a variety of breast band forms on birds from Long Island, NY. Subsequent morphological measurements of Atlantic and inland birds did not indicate a significant difference between birds from different regions (Wilcox 1959). Electrophoretic analyses did not indicate a genetic difference among local or regional populations in Saskatchewan, Manitoba, North Dakota, Minnesota, and New Brunswick (Haig and Oring 1988b). Nevertheless, the subspecies designation is currently maintained by the AOU (1957), but is under review for the next edition (R. Banks, U.S. Fish and Wildlife Service).

Distribution

Historically, piping plovers bred across three geographic regions: 1) U.S. and Canadian Northern Great Plains from Alberta to Manitoba and south to Nebraska; 2) Great Lakes beaches; and 3) Atlantic coastal beaches from Newfoundland to North Carolina. Winter sites were not well described, although piping plovers were generally seen along the Gulf of Mexico, on southern U.S. Atlantic coastal beaches from North Carolina to Florida, in eastern Mexico, and on scattered Caribbean Islands (Haig and Oring 1985). Details of the historic distribution are reviewed elsewhere (Haig 1986, USFWS 1988).

Currently, the species' range remains similar to historic range accounts except that piping plovers breeding in the Great Lakes have almost disappeared (Figure 1, Table 1, Haig and Plissner 1993). In 1993, northern Michigan had the only productive breeding population of piping plovers in the Great Lakes. Winter data remain sparse making it difficult to evaluate loss of nonbreeding sites (Table 2). Migratory routes have not been described. The distributions listed below resulted from the 1991 International Piping Plover census.

Distribution of Piping Plovers in winter and during the breeding season in 1991.

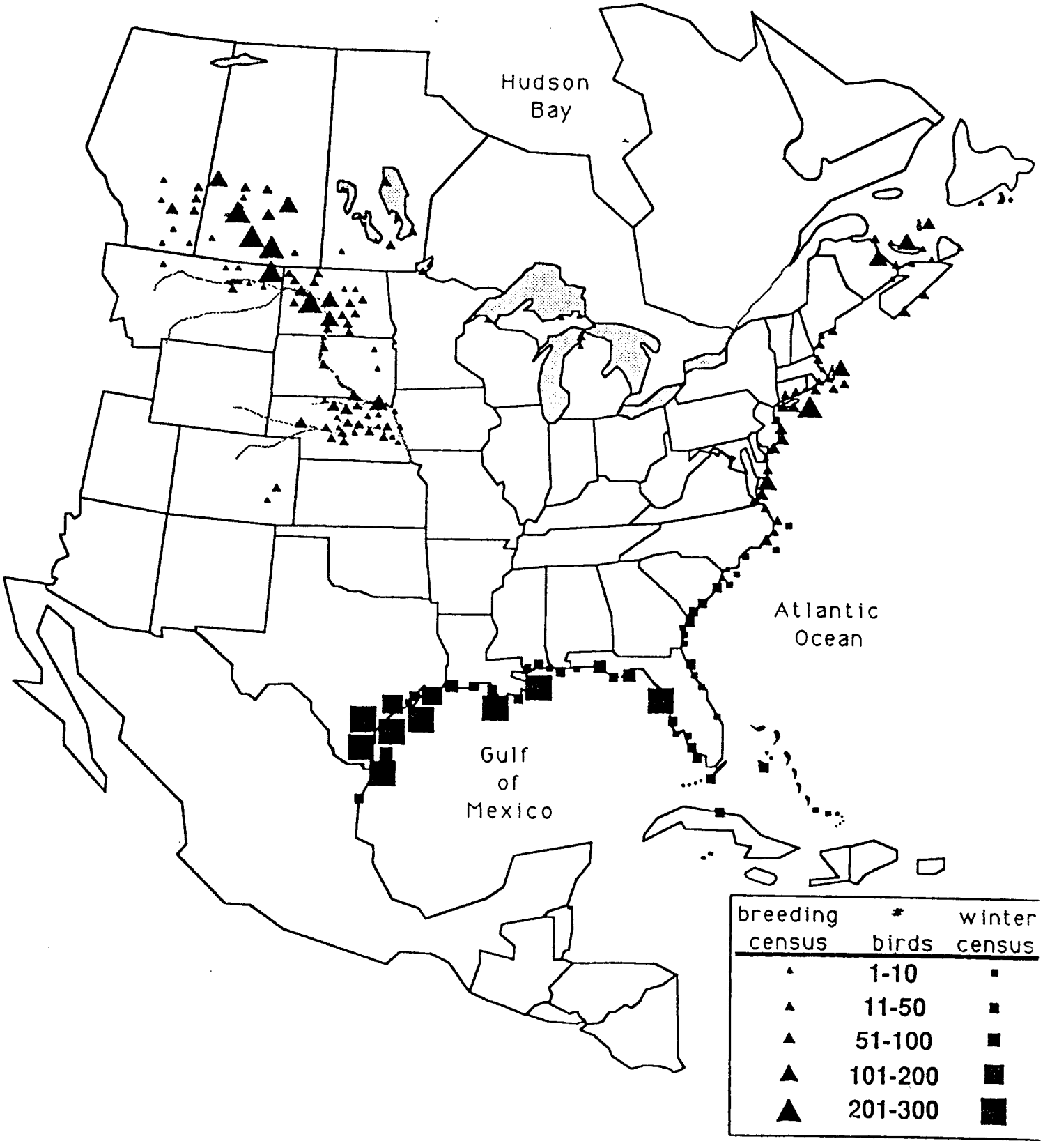

TABLE 1:

NORTH AMERICAN BREEDING PAIR ESTIMATE FROM THE 1991 INTERNATIONAL PIPING PLOVER CENSUS.

Geographic Region	Pairs
ATLANTIC COAST	938
United States	702
Canada	236
GREAT LAKES	17
United States	17
Canada	0
NORTHERN GREAT PLAINS	1486
United States	897
Canada	589
TOTAL	2441
United States	1616
Canada	825

TABLE 2

BREEDING PAIR ESTIMATE FOR THE GREAT LAKES AND NORTHERN U.S. GREAT PLAINS FROM THE 1991 INTERNATIONAL PIPING PLOVER CENSUS.

Location	Pairs	Source
GREAT LAKES:	17	
Duluth, Minnesota	0	L. Pfannmuller, Minnesota DNR
Michigan	17	T. Wiese, Michigan DNR
Wisconsin	0	S. Matteson, Wisconsin DNR
NORTHERN GREAT PLAINS:	897	
Colorado	3	D. Nelson, Colorado Bird Observatory
Iowa	6	D. Howell, Iowa Nat. Areas Inventory
Lake of the Woods, MN	6	S. Maxson, Minnesota DNR
Montana	105	D. Christopherson, USFWS
Nebraska*	139	R. Lock, NE Game & Parks; J. Sidle, USFWS
North Dakota	496	R. Kreil, ND Game and Fish
South Dakota*	142	N. McPhillips, USFWS; E. Dowd, SD GF&P
TOTAL	914	

*Missouri River numbers for Nebraska and South Dakota are presented as South Dakota pairs.

TABLE 3: 1991 PIPING PLOVER WINTER CENSUS

Location	Number of Birds	Source
U.S. Atlantic	178	
North Carolina	20	Henson, NC Wildlife Resources Comm.
South Carolina	51	Spinks, Wilkinson, Murphy, SC Wildlife MRD
Georgia	37	Johnson, Georgia DNR
Florida	70	Runde, Florida Game & Freshwater Fish Comm.
U.S. Gulf	3,206	
Florida	481	Runde, Florida Game & Freshwater Fish Comm.
Alabama	12	Clay, Alabama Dept. Conservation & Nat. Res.
Mississippi	59	McDearman, MS Dept. of Wildlife Conservation
Louisiana	750	Martin, LA Natural Heritage Program
Texas	1,904	Eubanks, Fremata Inc.
Mexico Gulf	27	Sada, Pro Natura
Caribbean	40	
Bahamas	29	Fettig
Turks and Caicos	0	Bradley, Fabian, Fabian
Cuba	11	Blanco, Garrido
Jamaica	0	Levy
Puerto Rico	0	Lee, USFWS
Cayman Islands	0	Marsden
TOTAL	3,451	

Northern Great Plains: Currently, the most westerly breeding piping plovers in the U.S. occur in Montana on sandflats above the west end of Fort Peck Dam (Valley County), on the shorelines of the Big Dry Arm of Fort Peck Reservoir (Garfield and McCone counties), on the saline wetlands near Dagmar and Medicine Lake National Wildlife Refuge (Sheridan County), and in Pondera County in western Montana.

In North Dakota, piping plovers breed in 23 counties along the Missouri River and on alkali wetlands in the central region of the state. Approximately 15% of breeding pairs occur on the free-flowing stretch of the Missouri River and the north end of Lake Oahe. This encompasses habitat from below the Garrison Dam south to the mouth of the Cannonball River in McLean, Burleigh, Oliver, Morton, Emmons, Sioux, and Mercer counties. Birds have also nested on the Yellowstone River in McKenzie County. The remaining 85% breed in alkali wetlands on the Missouri Coteau, principally in Kidder, McLean, Sheridan, Ward, Mountrail, McHenry, and Pierce Counties.

Most breeding activity in South Dakota occurs on sandbars along the Missouri River from the Fort Randall Dam to Springfield, and from Yankton to Ponca, Nebraska. Breeding also occurs on silty flats, sandy beaches and gravel parking lots of Lake Oahe from Whitlocks Crossing south. Other isolated nesting locations include sandbars and causeways directly below Oahe Dam, and occasionally on saline wetlands in northeast South Dakota. Breeding season sightings (no documented nesting) have been reported for Campbell, Fall River, Harding, Hyde, and Walworth counties (G. Vandel, South Dakota Game, Fish, and Parks).

Birds breeding in Nebraska are found on sandbars and at commercial sand pits along three major rivers. In the northeastern corner of the state, nesting occurs along approximately 64 km of the upper Missouri River and along 153 km of the lower Niobrara River. Further south, piping plovers are found

along approximately 386 km of central- and lower Platte River habitat from the Missouri River west to Lexington. Breeding occurs at Lake McConaughy in western Nebraska and on the Middle Loup and Loup rivers in central and eastern Nebraska.

Breeding activity in Iowa has occurred during the past five years on ash ponds owned by Iowa Public Service in Woodbury County and by Iowa Power and Light in Pottawattamie County along the Missouri River. Piping plovers have recently been discovered in Kiowa County, Colorado on shorelines of Nee Grande and Nee Noshe Reservoirs. No additional birds were found in surrounding areas during the 1991 census. Birds nesting at Lake of the Woods, Minnesota use habitat similar to both prairie and Great Lakes areas. Their distribution in this area has declined substantially over the past 5-10 years (Maxson 1993). They now only nest on Pine and Curry Island, a state owned Scientific and Natural Area. Finally, some nesting has recently occurred in Great Salt Plains National Wildlife Refuge, Oklahoma, but appears to be sporadic (Boyd 1991).

Great Lakes Region: The only breeding birds remaining on the Great Lakes occur along lakes Michigan and Superior beaches in northern Michigan. The International Census indicated breeding birds in six counties: Alger, Luce, Mackinac, Chippewa, Emmet, Charlevoix, and Leelanau.

Gulf of Mexico: The complete winter distribution of piping plovers remains to be determined, especially in Mexico and on Caribbean islands, yet specific U.S. Gulf of Mexico and Atlantic coast sites are becoming better recognized for their importance to nonbreeding birds. Band returns indicate that most inland piping plovers winter along the Gulf of Mexico, although a few inland birds have been sighted wintering on the Atlantic Coast on Sunshine Key, Florida. Piping plovers use Texas beaches and sandflats along the entire Gulf coast from Brownsville to Sea Rim State Park. Large concentrations are

found in the following counties: Jefferson, Chambers, Galveston, Brazoria, Matagorda, Calhoun, Aransas, Nueces, San Patricio, Kleberg, Willacy, and Cameron. In Louisiana, piping plovers winter along the Gulf in Cameron Parish and Jefferson Parish. Birds winter along the coast of Mississippi in Harrison, Hancock, and Jackson counties, and on Gulf Island National Seashore. Use of sites in Alabama is restricted to Mobile and Baldwin counties and principally occurs on Dauphin Island.

The number of piping plovers recorded in a single year in Florida is usually less than 100, yet there are a number of sites where birds are regularly seen. Color-banded inland birds have been seen most frequently along the Florida panhandle from Santa Rosa County east to St. George Island (Franklin County), and further south from Clearwater Beach (Pinellas County) to the Florida Keys. Atlantic birds use northeastern Florida beaches from Jacksonville south to Fort Pierce. Winter use of sites in Caribbean, Central American, and other southern areas remains poorly documented. Sporadic sightings of piping plovers have been reported in the Bahamas, Barbados, Bermuda, Cuba, Jamaica, Mexico, and Virgin Islands (Haig and Plissner 1993).

Life History

Breeding chronology and behavior: Piping plovers are migratory shorebirds that spend approximately 3-4 months on northern U.S. and southern Canadian breeding sites. In North Dakota, birds begin arriving on breeding grounds in mid-April (Prindiville Gaines and Ryan 1988); by mid-May, most piping plovers have returned to North Dakota, Minnesota, Manitoba, and other inland sites (Haig 1985, Wiens 1986, Prindiville Gaines and Ryan 1988). Courtship behavior includes aerial flights, digging of several nest scrapes, and a ritualized stone-tossing behavior (Cairns 1977, 1982; Haig 1992). Finished nest cups, frequently lined with small pebbles or shell fragments,

are shallow depressions approximately two cm deep and six cm in diameter. Territories are actively defended by both adults. Egg laying commences the second or third week of May. Females lay an egg every other day until a four-egg clutch is complete. Both sexes share incubation duties which last for 25-31 days (Wilcox 1959, Cairns 1977, Prindiville 1986, Wiens 1986, Haig and Oring 1988a). In Manitoba, incubation began with the laying of the first egg (Haig 1992) while Cairns (1977) did not report the onset of incubation in Nova Scotia until the third egg was laid. Cairns reported equal division of incubation duties between the sexes, but males in Manitoba assumed more diurnal incubation duties during laying and just prior to hatch than females (Haig 1992).

In the Midwest, eggs begin to hatch from late May to mid-June. The precocial chicks hatch within one half to one day of each other and are able to feed themselves within hours. Brooding duties are shared by males and females, although females in Manitoba deserted broods as early as the first week after hatch (Haig 1992). Broods generally remain on nesting territories but may expand their movements as they mature or are disturbed. Fledging time varies from 21 days in Manitoba (Haig and Oring 1988a) and North Dakota (Prindiville 1986) to 30-35 days on Long Island, New York (Wilcox 1959). In Minnesota, breeding adults were observed departing the nesting grounds as early as mid-July and the majority had left by early August (Wiens 1986). Juveniles depart a few weeks later and have largely disappeared by late August (Wiens 1986). Adult males in Manitoba were observed to remain with broods until after fledging and were frequently seen moving into nonbreeding flocks with their chicks (Haig 1992).

Piping plovers exhibit a predominantly monogamous mating system, although, mate-switching may occur during the breeding season (Haig and Oring 1988a) and between years (Wilcox 1959, Wiens 1986, Haig and Oring 1988a).

Apparently, mate-switching between years occurs regardless of previous reproductive success (Wiens 1986, Haig and Oring 1988a). In Manitoba, most former mates were present in nesting areas in subsequent years, thus making it possible for pair bonds to persist if birds chose to do so (Haig 1992). During a single year, most adults raise only one brood of up to four chicks. When nests are destroyed, adults may renest up to four times (USFWS 1987). On average, pairs fledge 0.3-2.1 chicks per year (Haig and Oring 1985). Flemming et al. (1988) observed that pairs on undisturbed beaches fledged more chicks than those nesting on beaches with intense recreational activity. Young plovers are able to breed the year after fledging.

Population viability: Piping plovers on the Great Lakes and Northern Great Plains of the U.S. make up approximately 37% of U.S. breeding pairs (Table 1). Birds nesting on rivers make up the majority of these pairs (Table 2). Censuses provide helpful status information, yet population viability cannot be assessed without further analyses. While difficult to assess, estimates of site-specific mortality and fecundity are critical. Root et al. (1992) estimated adult survivorship for birds at the John E. Williams Nature Preserve in North Dakota to be 0.66, slightly less than congenerics. Additional stochastic modelling by Ryan et al. (1993) indicated that the Northern Great Plains population is declining by 7% annually. When current adult (0.66) and immature (0.60) survival rates were held constant, a 31% increase (from the current 0.86 to 1.13) in chicks fledged per pair was needed to stabilize the population. Annual population increases of 1%-2% required 1.16-1.19 chicks fledged/pair annually. Such growth would result in the Northern Great Plains population reaching recovery levels in 30-53 years. One to five-year delays in the initiation of 1% population growth caused 13-67 year delays in reaching recovery (Ryan et al. 1993). Further application of these results are used in formation of the recovery objective.

Electrophoretic analysis of Piping Plover populations across North America did not indicate a quantifiable genetic difference between major breeding regions (Haig and Oring 1988b), however additional analyses using the polymerase chain reaction are now being carried out to substantiate previous results (S. Haig, pers. comm.). Furthermore, local populations appeared to be in equilibrium. Lack of variability occurred for some populations, but inbreeding was not significant.

Dispersal patterns: Breeding site fidelity for piping plovers ranges from 15% in Nova Scotia (Cairns 1977) to 92.3% in Minnesota (Haig and Oring 1987). Return patterns do not differ significantly between males and females (Haig and Oring 1988a). Furthermore, return patterns to specific breeding sites do not seem influenced by previous reproductive success (Wiens 1986, Haig and Oring 1988a). In Manitoba, adults exhibited two patterns: those that hatched chicks the year before, returned to the same breeding site but changed territories; but adults that experienced nest failure the year before generally changed sites (Haig and Oring 1988a). Adults have been known to disperse as far as from Lake of the Woods, Minnesota to northern Lake Winnipeg (546 km) in consecutive years (Haig and Oring 1988c).

The percentage of chicks returning to fledging sites ranges from 4.7% in New York to 20.2% in Minnesota (Wilcox 1959, Wiens 1986). In Manitoba, first year males and females return in equal numbers (Haig 1992). Chick dispersal is difficult to characterize, although, long range dispersal distances have been documented. For example, a chick from southern Manitoba was found at Long Point, Ontario a year after hatch (Haig and Oring 1988c).

Home range: The Piping Plover's home range during the breeding season is usually limited to the wetland, lakeshore, or section of beach on which its nest is located. In Manitoba, however, birds whose nests were destroyed often changed territories and breeding sites prior to renesting. Males that changed

territories generally changed breeding sites. Females generally changed territories on the same site. Distances between sites varied from 3-100 km (Haig and Oring 1988a). Investigation into movements of individual birds between beaches and spoil islands at Dauphin Island, Alabama, and on the Upper Texas Coast are beginning to provide better information about home ranges of wintering birds (Johnson 1987; T. Eubanks, pers. comm.).

Territoriality: Piping plovers defend territories during the breeding season (i.e., throughout courtship, laying, incubation, and brood care) and at some winter sites. During the breeding season, both members of the pair defend a nesting territory which may or may not contain their foraging area. Piping plovers in Nova Scotia had separate nesting and feeding territories (Cairns 1977), whereas birds in Saskatchewan had combined territories (Whyte 1985). Piping plovers in Manitoba exhibited both patterns in some areas (Haig 1992). Spacing of territories varied from one pair per beach to a semi-colonial situation where 30 or more pairs place nests less than 25 m apart.

Defense of feeding areas varies with habitat and stage of the annual cycle. New arrivals to breeding grounds and nonbreeding birds tend to forage on undefended areas (Cairns 1977, Haig 1992). During courtship, incubation, and early brood-rearing, most piping plovers forage on their territories (Cairns 1977, Whyte 1985, Haig 1992). Haig (1987b) and Eubanks (pers. comm.) observed piping plovers feeding on territories on some Texas beaches, but did not observe territory defense on adjacent sandflat feeding areas. Studies underway in Alabama may provide information on defense of feeding areas by nonbreeding birds in winter (Johnson 1987).

Diet: Little is known about the diet of piping plovers or their foraging behavior during any phase of the annual cycle. The species' sensitivity to human disturbance and its status requires the use of nondisruptive techniques to sample food while birds are present. Low population numbers rule out

collection of birds for stomach content analysis. Bent (1929) reported the stomach contents of four piping plovers from Alabama as containing marine worms, insects (fly larvae and beetles), crustaceans, molluscs, and other small marine animals (and their eggs). Similarly, in Nova Scotia, Cairns (1977) observed piping plovers feeding on marine worms averaging 2.5-7.5 cm in length. She suggested their diet consisted of marine worms, minute worms, and crustaceans.

Whyte (1985) carried out invertebrate sampling on Piping Plover territories at Big Quill Lake in Saskatchewan, and found the following families present (percents represent percent of species found in all samples): Coleoptera: Carabidae (26.9%), Dytiscidae (15.3%); Hemiptera: Corixidae (19.2%) and Saldidae (2.3%); and Diptera: Chironomidae (9.5%) and Ephidridae (2.6%). Dytiscid adults and larvae, corixids, and chironomid larvae were collected in water sweeps one meter from the water's edge. He found ephidrids to be more common further upland, and collected carabids and dytiscids from the shoreline to the edge of the grassland cover. Nordstrom (1990) compared food available at the John E. Williams Nature Preserve in North Dakota with that from Great Lakes sites and found similar items, however, prey biomass was generally greater in North Dakota. Prey items included the following families: Ephydridae, Chironomidae, Dolechopodidae, and Muscidae. Studies underway on the Upper Texas Coast (T. Eubanks and C. Zonick pers. comm.) are beginning to identify important food elements for wintering piping plovers. Finally, captive birds have survived on a diet of commercial feed, chopped egg yolks, and mealworms (Quinn and Walden 1966) or a mixture of tubifex worms, mealworms, earthworms, and cat food (Powell and Cuthbert 1993).

Interspecific interactions: Piping plovers nest in least tern (Sterna antillarum) colonies at a number of sites on Great Plains river sandbars, sand pits, and Atlantic Coast beaches (Schwalbach 1988, Dirks 1990, Kirsch 1991,

Sidle et al. 1992; Ziewitz et al. 1992, and others). Threats are similar for both species, compounding problems associated with destruction of their habitat. In Nova Scotia, piping plovers nested within colonies of Arctic terns (Sterna paradisaea) and common terns (Sterna hirundo) (Cairns 1977). Similarly, piping plovers at Lake of the Woods, Minnesota, nested in the midst of a common tern colony (Wiens 1986). In central North Dakota, piping plovers commonly nest in association with American avocets (Recurvirostra americana). Circumstantial evidence suggested that piping plovers nesting near avocets had higher nest success than those nesting in the absence of avocets (Prindiville 1986), however survival of artificial Piping Plover nests in avocet colonies was not higher than controls (Macer and Ryan 1991b).

Habitat Requirements

Piping plovers, like most members of the genus Charadrius, breed in open, sparsely vegetated habitats. In north-central North America, piping plovers nest on barren sand and gravel Great Lakes shorelines, and along sand and gravel shores of rivers and lakes in the Great Plains. Described below are factors that contribute to optimal habitat conditions. In times of drought or other adverse conditions, the birds will use less than optimal habitat but productivity may suffer (Weber and Martin 1991).

Inland Lakes: This habitat type includes the large inland lakes of the Great Lakes states (e.g., Lake Michigan, Lake Superior, and Lake of the Woods, MN) and Northern Great Plains (e.g., Lake McConaughy, NE; Lake Oahe, SD). Also included are the much smaller prairie sloughs and saline wetlands. Along large inland lakes, plovers nest on open, sand and gravel beaches on islands (Powell and Cuthbert 1992) or the mainland. Beaches may be adjacent to dunes and are surrounded by prairie parkland (Lake of the Woods) or northern hardwood/coniferous forest (Great Lakes). In the northern Great Plains,

permanent to seasonally flooded, palustrine wetlands are used by breeding birds. Typically, nests are placed on dry salt flats, or gravel beaches. Surrounding habitat may include pasture or rangeland composed of short or mixed grass prairie. Although the preference of piping plovers for open beaches has been repeatedly noted in the literature, quantitative data on habitat characteristics, evidence of habitat selection, and information on the relative quality of inland lake habitats remain scarce.

Several studies have suggested that beach width and the area from the water's edge to the line of upland vegetation, may affect habitat use by breeding piping plovers: in Michigan, beaches were wider in territories of mated pairs ($x = 31$ m) than in territories of unmated males ($x = 26$ m) (Lambert and Ratcliff 1981). Whyte (1985) recorded minimum nest-to-water distances of 40 m at his Saskatchewan study area and suggested that beaches less than 20-30 m in width were not likely to be used by piping plovers. In Alberta, however, Weseloh and Weseloh (1983) calculated a mean beach width of only 11.7 m at nest sites. But they noted that these seemed to be the widest beaches available. Prindiville Gaines and Ryan (1988) reported mean beach width to be larger in occupied territories ($x = 33$ m) than in unoccupied beaches ($x = 13.6$ m) at her North Dakota study sites. Narrow beaches may be low quality Piping Plover breeding sites because predators may be more successful at locating nests along narrow strips (less than 20 m) of beach than on wider areas (Prindiville Gaines and Ryan 1988). Nests on narrow, gently sloping beaches also are likely to be destroyed by increasing water levels or wave action during storms (Haig and Oring 1985).

The amount and distribution of beach vegetation affects Piping Plover habitat selection and reproductive success. Niemi and Davis (1979) searched nine beaches along Lake Superior and found six of ten Piping Plover nests on beaches with the least vegetative cover (5%). They also reported that

occupied beaches with the greatest percent cover (42%) had vegetation clumped in bands. Prindiville Gaines and Ryan (1988) found no difference in vegetative cover between territories (x = 3.4%) and unoccupied sites (x = 3.8%). However, vegetation was more clumped in territories than in unoccupied areas. Furthermore, territories in which Piping Plover nests were successful had either less vegetation or more clumped vegetation than territories with unsuccessful nests (Prindiville Gaines and Ryan 1986).

Substrate composition may also affect habitat selection by piping plovers and influence nest success. Cairns (1977) found 31 of 38 nests in Nova Scotia on mixed sand and gravel and stated that those nests were less conspicuous than those on sand alone. Whyte (1985) reported that piping plovers were more likely to establish nests on gravel than was expected by chance alone. In North Dakota, gravel was generally more evenly distributed and in greater concentration on Piping Plover territories than at unoccupied sites (Prindiville 1986). Prindiville also reported greater nest success (59%) for nests placed on gravel versus those on alkaline substrate (15%).

In summary, evidence from wetland and deep water habitats in the Northern Great Plains and Great Lakes suggests that beach width as well as abundance and distribution of vegetation and gravel are important factors affecting Piping Plover habitat selection and reproductive success. Wide beaches (> 20 m) with less than 5% vegetative cover, highly clumped vegetation and/or with extensive gravel create large blocks of homogeneous substrate that provide a suitable habitat for breeding piping plovers.

Prairie Rivers: Piping plovers nesting on the Missouri, Platte, Niobrara, Yellowstone and other rivers use beaches and dry, barren sandbars in wide, open channel beds. Vegetative cover on nesting islands is usually less than 25% (Ziewitz et al. 1992). Although plover density is high in these

areas, there are insufficient quantitative data that relate habitat characteristics to reproductive success in riverine habitats.

Twenty-eight Platte River sandbars, occupied by nesting piping plovers, averaged 286 m in length and 55 m in width (Faanes 1983). Vegetative cover on those sandbars averaged 25.4%. Piping Plover nests averaged 16 m (n = 39) from the water's edge, but the mean height above river level was only 0.2 m (n = 14) (Faanes 1983). Ziewitz et al. (1992) found similar results except that nests on the Central Platte were initiated at lower elevations (x=0.39 m) than the Lower Platte (x=0.49 m). The mean nest-to-water distance for eight nests on Lake Sakakawea, North Dakota, was 46.2 m and the mean height above water level was 1.0 m (North 1986). All eight nests were successful in 1985 but if the water level of this Missouri River reservoir had been manipulated, as it was in 1984, five of the eight nests would have been inundated (North 1986).

Feeding Habitat: Piping plovers feed primarily on exposed beach substrates by pecking for invertebrates at, or less than, one centimeter below the surface (Cairns 1977, Whyte 1985). In Saskatchewan, Whyte (1985) noted that adults concentrated foraging efforts within five meters of the water's edge. He found broods also fed most often near the shore, but their use of upland beach habitats was greater than that of adults. Cairns (1977) reported that chicks tended to feed on firmer sand at greater distances from the shoreline than adults. At Lake of the Woods, Minnesota, and on Long Island-Chequamegon Point, Wisconsin, adult piping plovers seemed to prefer shoreline or beach pool edges (wet sand) over open beach (dry sand) as feeding sites (Wiens 1986; S. Matteson, Wisconsin Department of Natural Resources). Additional data are needed to determine whether food abundance or quality at breeding, migratory, or wintering sites are limiting piping plovers.

Gulf of Mexico Winter Sites: During the winter, piping plovers use beaches, sandflats, and dunes along Gulf of Mexico coastal beaches and

adjacent off-shore islands (Haig and Oring 1985; Johnson and Baldassarre 1988; Nicholls and Baldassarre 1988a,b). Spoil islands in the Intercoastal Waterway are also used. Research that further quantifies these habitats is currently underway (C. Zonick, pers. comm.)

Reasons for Decline

The Piping Plover is a species with highly variable annual reproductive success that uses freshwater and saline wetland habitats throughout the annual cycle. These ephemeral habitats render birds susceptible to frequent nest destruction, and consequently, large population fluctuations. Early 20th century accounts report that shorebird hunting caused the first known major decline of the species (Bent 1929, Hall 1960). There are no comprehensive population estimates for the entire species prior to 1980 (Cairns and McLaren 1980), although there are specific sites or regions where substantial declines occurred (Haig and Plissner 1993). Factors discussed below are those considered to levy the greatest threat to recovery.

Habitat alteration and destruction: Loss of sandy beaches and other littoral habitats due to recreational/commercial developments and dune stabilization on the Great Lakes, Atlantic Coast, and Gulf of Mexico are partially responsible for the decline of the species (Bent 1929, Cairns 1977, Flemming et al. 1988, Haig and Oring 1985, USFWS 1985, and others). Also in the Great Lakes, historical nesting sites have been destroyed by high water levels, flooding, or eroding beaches (Russell 1983). Where breeding does occur on Great Lakes and Atlantic Coast sites, reproductive success can be curtailed by human disturbance. Vehicular and foot traffic destroys chicks and eggs. The presence of people on beaches can inhibit incubation and other breeding behavior, further decreasing reproductive success (e.g., Cairns 1977, Flemming et al. 1988).

Reservoirs, channelization of rivers, and modification of river flows have eliminated sandbar nesting habitat along hundreds of kilometers of the Missouri and Platte rivers in the Dakotas, Iowa, and Nebraska. Before regulation of river flows, summer flow patterns were relatively predictable. Peak flows occurred in May and June and then declined during the rest of the summer. Spring flows covered some sandbars, but piping plovers were able to nest as water levels dropped and sandbars became available. Currently, regulated flows can be unpredictable and may fluctuate greatly (Sidle et al. 1992). Diversion of peak flows responsible for scouring river sandbars has resulted in the encroachment of vegetation. Consequently, piping plovers are often faced with finding a nest site outside the channel or not nesting at all. In addition, river mainstem reservoirs now trap much of the sediment load resulting in less aggradation and more degradation of the river bed and subsequently less sandbar nesting habitat. Commercial sand and gravel mining operations along river banks have created sandy spoil piles that are used for nest sites. Eggs and young are vulnerable to predation and human disturbance from pit operations or adjacent housing projects. Eventually, nesting habitat is lost to vegetation encroachment and/or housing and recreational development.

Although some saline wetlands in the northern Great Plains have been drained or modified, the impact of this activity has not been specifically investigated. Freshening of water on saline wetlands in central North Dakota decreased their quality as vegetation encroached on nesting habitat (Prindiville Gaines and Ryan 1986).

Winter habitats are threatened by industrial or urban expansion that could result in wholesale destruction of sites. Site quality may be threatened by increased human use of beaches for recreational purposes. Habitat quality may be substantially lowered, at least on a short-term basis,

by oil spills. Wintering sites near existing oil trans-shipment facilities, and oil tanker shipping lanes should be identified and regularly monitored for spills. The stabilization of barrier island sand flats also has been identified as a potential threat to Piping Plover habitat. Stabilization may result in encroachment of vegetation that reduces the quality of, or eliminates altogether, wintering sites.

Overutilization of plover habitat by humans: Human disturbance can vary from stepping on eggs, to being close enough to nests to preclude incubation, to drawing predators into an area by dropping litter near a clutch or brood. Piping Plover response to direct human disturbance varies considerably across the breeding range making it difficult to predict from one site to the next (Flemming et al. 1988, MacIvor et al. 1990, Strauss 1990, Patterson et al. 1991, and others). Thus, reactions to humans will have to be assessed on a site by site basis.

Disease or predation: Disease is not known to be a problem for piping plovers. Predation, however, is a major problem throughout the breeding range. Its effect is unknown during other times of the year. Increased urbanization and use of beaches has brought an increase in the number of unleashed pets and unnaturally high densities of gulls and other predators such as skunks (Mephitis spp.) and foxes (Vulpes spp.). Cattle trampling nesting habitat may also affect site use (Smith et al. 1993), nest success, and chick survival (Prindiville 1986).

Considerable effort has been rendered toward mitigation of the effects of predation on productivity. Numerous forms of predator exclosures have been designed and used throughout the breeding range with good success (Rimmer and Deblinger 1990, Deblinger et al. 1992, Melvin et al. 1992). Key to their success was the diligence of monitoring. Likewise, use of electric fences can

be helpful in situations where a relatively small piece of habitat, such as a peninsula, can be protected from mammalian predators (Macer and Ryan 1991a).

Inadequate regulatory mechanisms: Regulatory mechanisms that need to be examined closely to insure Piping Plover recovery include water control and diversion policies for major prairie rivers and dredging operations in Gulf of Mexico winter sites. Inadequate water control in either area could result in significant losses for the entire species. Recent federal recognition of the species' status by the U.S. and Canada has improved the outlook for the plover's future. Implementation of recovery plans by both countries will further assure protection of habitat for the species.

Future threats: Many future threats are similar to current problems, e.g., increased recreational/commercial development of beaches, wetland drainage, water level manipulation on rivers, increased predation, lack of undisturbed nesting habitat, and stabilization of winter sites. Natural increases in water levels that historically may have had minor impact when populations were larger may now cause birds to shift away from traditional sites and experience repeated reproductive failure. There is great potential for serious mortality as a result of an oil spill in the Gulf of Mexico. For example, large concentrations of piping plovers spend the winter at or near the Port of Houston, TX. Emergency measures should be worked out ahead of time before disaster strikes. Finally, the impact of agricultural runoff into wetlands, pesticide drift, botulism (Haig 1986c), and environmental contaminants has not been carefully investigated, but may prove detrimental in the future.

II. RECOVERY

The purpose of this plan is to describe actions necessary to achieve recovery of piping plovers breeding in the Great Lakes and Northern Great Plains. The first step in this approach is to set a quantifiable goal (i.e. the Recovery Objective) that, when reached, will assure population viability. Technical experts and state and federal resource agencies were consulted to determine status of current populations and habitats, as well as their potential for increase. The remainder of this plan outlines steps necessary to achieve this Recovery Objective.

Recovery Objective

Recognizing that the Piping Plover has a broad distribution and occupies a variety of habitat types and sizes, the Recovery Objective was set based on what is needed to achieve long-term persistence and population viability. This assessment took into account the following factors: 1) distribution and abundance data collected from 1988-91; 2) knowledge of how thoroughly each state has been surveyed; 3) historic population data; 4) loss of viable habitat; 5) assessment of the potential to increase breeding pairs at currently occupied sites; 6) assessment of the potential to establish breeding pairs at unoccupied sites; and 7) results of population viability analyses for recovery of the Northern Great Plains population in the United States and Canada (Ryan et al. 1993).

Northern Great Plains Population:

Recognizing the poor productivity of piping plovers throughout the Northern Great Plains (Ryan et al. 1993), and the significant population increases that must be reached to consider this population recovered, birds on the Northern Great Plains are considered to be on the verge of being

"Endangered" (see task 137 of stepdown). Thus, to be considered a viable population, and to reach the point where delisting can be considered, Piping Plover populations on the Northern Great Plains will have to attain the following criteria:

A. Number of birds in the U.S. Northern Great Plains states will increase to 2,300 pairs.

B. Recovery Objective of 2,000 birds in Prairie Canada will be attained (Canadian Wildlife Service 1993).

When these two goals are attained this population level should ensure 95% survival of piping plovers for 100 years (M. Ryan, pers. comm.). These population levels can be attained by maintaining current adult and immature survival rates and increasing reproductive output to 1.13 chicks fledged per pair (Ryan et al. 1993). This recovery goal was established assuming all piping plovers in the U.S. Northern Great Plains and Prairie Canada comprise one panmictic population. In actuality, these birds make up a metapopulation (i.e. a series of small populations with variable interpopulation interchange regardless of international boundaries) and as such our goals reflect the need to recover the Canadian birds as well as U.S. birds. Appropriate demographic data were not available to undertake a metapopulation viability analysis. Had these data been available, population viability goals would be much higher. Further, without incorporating Canadian birds in these analyses, U.S. recovery goals would have to be much higher to insure long-term viability. Thus, this approach represents a conservative method of estimating viability. The goal will be reassessed as better demographic data become available.

C. Essential breeding and winter habitat (Appendix 3) has received long term protection.

D. The 2,300 pairs needed to attain viability in the U.S. will be maintained in the following distribution for 15 years (assuming three major censuses were carried out during this period).

Distribution of breeding pairs needed for recovery in the U.S. Northern Great Plains:

Montana - 300 pairs

North Dakota - 750 pairs

Missouri River - 150 pairs

Missouri Coteau - 600 pairs

South Dakota - 400 pairs (including 300 pairs shared with Nebraska on Missouri R.)

Missouri River below Gavin's Point - 300 pairs (shared with Nebraska)

Other Missouri River sites - 75 pairs

Other sites - 25 pairs

Nebraska - 525 pairs (including 300 pairs on Missouri R. shared with South Dakota)

Platte and North Platte River - 150 pairs

Niobrara River - 50 pairs

Missouri River - 300 pairs (shared with South Dakota)

Loup River system - 25 pairs

Colorado - 20 pairs

Iowa - 5 pairs

Minnesota - 25 pairs (Lake of the Woods)

The remaining 575 pairs needed to achieve population viability will be distributed throughout the Northern Great Plains of the U.S.

Great Lakes Population:

In order to prevent extirpation of piping plovers on the Great Lakes, the following criteria will be attained:

A. Number of birds will increase to 150 pairs.

B. Essential breeding and winter habitat (Appendix 3) will be protected.

C. The 150 pairs will be maintained in the following distribution for 15 years (assuming at least three censuses have been conducted during this time).

Duluth/Superior - 5 pairs

Wisconsin - 15 pairs (including Duluth/Superior)

Michigan - 100 pairs

Other Great Lakes sites - 35 pairs

Attainment of these criteria will trigger consideration of reclassification of the Great Lakes population to threatened status. Development of criteria that would lead to delisting will begin at that time.

Step-Down Outline

The step-down outline lists tasks that need to be undertaken in order to meet the recovery objectives for Great Lakes and Northern Great Plains piping plovers. Steps (or tasks) are presented in a logical sequence, rather than in order of importance. Some steps are underway, while others may take years before they are begun. A detailed explanation of these steps is presented in the Narrative section of this plan. Following the Narrative, the Implementation Schedule prioritizes steps that need to be taken in the next five years.

1. Determine current distribution and population trends for piping plovers throughout the annual cycle.
    11. Carry out international census of all piping plovers at breeding and wintering sites every 5 years.
    12. Establish international Geographic Information System (GIS) for monitoring distribution and status of piping plovers throughout the annual cycle.
    13. Assess status and distribution of breeding populations.
        131. Survey beaches, sandbars, and other suitable habitats to determine additional breeding locations.
        132. Census known and potential breeding sites.
        133. Implement long-term monitoring of reproductive success at selected sites in each state and province.
        134. Assess dispersal patterns and genetic diversity.
        135. Assess mortality.
        136. Consider reclassifying the Northern Great Plains population of piping plovers as "endangered".
    14. Assess status and distribution of piping plovers during migration.

15. Assess status and distribution of piping plovers during winter.

151. Develop and utilize winter survey guidelines.

152. Survey beaches and other suitable habitat to determine winter distribution.

153. Census major wintering areas annually.

154. Monitor movement and fidelity of birds within and among winter sites.

155. Assess population mixing in wintering areas.

156. Assess mortality of wintering piping plovers.

2. Determine habitat requirements and status.

21. Determine breeding habitat requirements and status.

211. Assess characteristics, including prey resources, of breeding habitat.

212. Quantify and evaluate available breeding habitat.

213. Identify current or potential threats to breeding habitat.

22. Determine migration habitat requirements and status.

221. Assess characteristics, including prey resources, of migration habitat.

222. Quantify and evaluate available habitat.

223. Identify current or potential threats to migration habitat.

224. Consider designation of important breeding sites as Critical Habitat.

23. Determine winter habitat requirements and status.

231. Assess characteristics, including prey resources, of winter habitat.

232. Quantify and evaluate available winter habitat.

233. Identify current or potential threats to winter habitat.

234. Consider designation of important winter sites as Critical Habitat.

3. Protect, enhance and increase Piping Plover populations.

31. Protect, enhance, and increase Piping Plover populations during the breeding season.

311. Manage habitat at breeding sites to ensure high reproductive success.

3111. Evaluate predator impacts on eggs and chicks; identify species responsible for the damage.

3112. Evaluate techniques for predator management and implement where appropriate.

3113. Restrict human and vehicular access to nesting areas.

3114. Restrict livestock and domestic animals at nesting sites.

3115. Manage water levels to reduce nest and chick loss.

3116. Modify or eliminate development activities that adversely impact reproductive success of piping plovers.

312. Assess the feasibility of recovery via intensive management of a limited number of sites for high reproductive output.

313. Assess the need to implement techniques for population supplementation.

3131. Develop criteria by which captive or foster rearing options should be considered.

3132. Develop and test safe and reasonable techniques for use in population supplementation.

32. Protect and enhance Piping Plover populations during migration and winter.

321. Manage areas to maximize survival of birds during migration.

322. Manage winter areas to maximize survival of birds during winter.

3221. Investigate and mitigate the effects of environmental contaminants.

3222. Investigate and mitigate the effects of habitat loss due to dredging and other channel maintenance activities.

3223. Investigate and mitigate the effects of other human activities on winter survival.

4. Preserve and enhance habitat.

41. Provide protection and conservation of breeding habitat.

411. Identify areas of Essential Habitat.

412. Identify and rectify threats to Essential Habitat.

413. Establish liaison with agencies and organizations with land and water management responsibilities.

414. Revise, establish, or utilize land and water laws and regulations to provide protection for lakes, rivers, and prairie wetlands.

415. Develop criteria and priorities for habitat protection.

416. Develop and implement site-specific conservation plans for riverine habitat.

4161. Determine effects, including direct, indirect, and cumulative of river hydraulics, flow regimes, and sediment discharge on breeding and foraging habitat.

4162. Identify and implement river flow regimes that will protect and enhance breeding and foraging habitat.

4163. Restore island habitat on rivers.

4164. Protect piping plovers nesting on existing artificial breeding sites on rivers.

4165. Identify need and techniques of improving habitat via substrate management and vegetation control through physical and/or non-toxic chemical means; implement techniques.

4166. Study feasibility and determine need for creating new habitat; implement trials to determine success rates of creating new habitat.

417. Develop and implement site-specific conservation plans for prairie lake/reservoir habitat.

4171. Identify lake and reservoir water control policies where existing and potential Piping Plover habitat is threatened.

4172. Identify needs and techniques for suitable substrate management and vegetation control; implement.

4173. Identify needs and techniques for managing water levels; implement.

4174. Study feasibility of, determine need for, and implement trials to determine success rates of creating new habitat.

418. Develop and implement site-specific conservation plans for prairie wetland habitat.

4181. Identify threats to essential prairie wetland habitats and develop and implement policies or conservation actions to eliminate those threats.

4182. Develop conservation plans for use of lands adjacent to nesting beaches; contact landowners and assist in implementation.

4183. Identify the need for and techniques to maintain and improve nesting habitat along prairie wetlands; implement.

4184. Determine the need for creation of new habitat along prairie wetlands and develop habitat where appropriate.

419. Develop and implement conservation plans for Great Lakes habitat.

4191. Develop site-specific conservation plans for birds nesting on private land.

4192. Maintain plover protection program at all breeding sites.

4193. Maintain predator management efforts at all breeding sites.

420. Evaluate success of protection and conservation techniques.

42. Provide protection and conservation of migration habitat.

43. Provide protection and conservation of winter habitat.

431. Identify areas of Essential Habitat.

432. Identify and rectify threats to Essential Habitat.

433. Establish liaison with agencies and organizations with land and water management responsibilities.

434. Revise or establish land and water laws and regulations to provide habitat protection.

435. Develop criteria and priorities for habitat protection.

436. Develop management techniques that increase survival of piping plovers in winter.

437. Develop and implement comprehensive, site-specific conservation plans for piping plovers during winter.

438. Modify construction activities that may reduce or negatively alter winter habitat.

439. Eliminate current or potential threats to habitat.

440. Evaluate success of protection and conservation techniques.

5. Develop and implement an education program that publicizes information about the Piping Plover, including its life history, reasons for decline, and options for recovery.

51. Inform and educate the general public about threats to piping plovers throughout the annual cycle.

511. Identify target audiences among the general public.

512. Develop and distribute educational materials appropriate to each audience.

513. Develop press releases for newspapers, radio, and TV, that highlight specific Piping Plover projects.

514. Provide controlled viewing opportunities if and when appropriate.

52. Inform and educate public resource management agencies about threats to piping plovers throughout the annual cycle.

521. Identify critical resource agency constituents.

522. Develop educational materials appropriate to respective agencies and their management authority.

523. Provide public resource agencies with periodic updates on the plover's status and progress of recovery efforts.

6. Coordinate recovery efforts.

61. Designate a recovery coordinator.

62. Coordinate research and conservation activities with federal, state, local, and private organizations.

63. Coordinate international research and conservation activities.

64. Coordinate development of a public information program at the national and international level.

Narrative

The Narrative gives further details and justification for each step listed in the Step-Down Outline. Steps critical for recovery in the next five years are outlined and prioritized in the Implementation Schedule.

1. Determine current distribution and population trends of the Piping Plover throughout the annual cycle.

The effectiveness of current conservation efforts will not be well-understood until comprehensive distribution and census data have been collected. Future plans for recovery also will be stalled until a more accurate picture of the species' status is defined.

11. Carry out international Piping Plover census at breeding and wintering sites every five years.

To quantify progress towards reaching recovery goals, U.S. and Canadian recovery teams will coordinate an international census of piping plovers every five years. The first census was carried out in 1991 and is a benchmark to gage recovery progress. The next census is scheduled for 1996.

12. Establish international Geographic Information System for monitoring distribution and status of piping plovers throughout the annual cycle.

Overall recovery is achieved through the sum of thousands of local conservation actions. Unless a global database is established, our ability to trace progress towards recovery and fine tune our approach will be diminished. Thus, maps, images, and alpha-numeric data of Piping Plover status and distribution need to be combined into a geographic information system (GIS). The GIS will be available to agencies and organizations involved with Piping

Plover recovery. This data base could be maintained by a Piping Plover coordinator (see section 6).

13. Assess status and distribution of breeding populations.

Inland piping plovers are widely distributed as scattered pairs or in high concentrations at breeding areas. Furthermore, plovers are capable of dispersing great distances during or between years. Continued search for new sites and evaluation of known sites is necessary to fill the gap in our current knowledge of the birds' status.

131. Survey beaches, sandbars, and other suitable habitats to determine additional breeding locations.

The 1991 International Census resulted in a census of all known breeding sites and surveys into potential habitat. As a result, the largest gap in our current knowledge of inland breeding birds is in Montana. Additional surveys should be carried out in alkali wetlands of northeastern Montana.

132. Census known and potential breeding sites.

Once breeding sites are identified, annual censuses of adults should be carried out for several years until permanence of the population is established. Following this period, censusing should continue at least once every 3 years and should become part of the international census.

133. Implement long-term monitoring of reproductive success at selected sites in each state and province.

Frequent nest destruction lowers productivity of a site, rendering counts of breeding pairs less meaningful than monitoring that also includes counts of fledged chicks. These estimates of reproductive success are critical for

evaluating population viability. While every breeding site cannot be monitored annually, establishment of representative sites where long-term demographic data can be collected on an annual basis will help assess recovery progress. Representative sites will be determined in each state and state/federal biologists will be asked to collect pertinent information. Monitored sites should include representative habitats and large, medium, and small local populations. Site-specific success (measured in terms of number of chicks fledged per pair), mortality, population size, and dispersal patterns need to be monitored annually. Causes of reproductive failure should be identified whenever possible. Results of annual estimates will be entered in the GIS database (see section 12) and used in future assessment of recovery objectives.

134. Assess dispersal patterns and genetic diversity within and between populations.

Site fidelity has been assessed for local populations in New York (Wilcox 1959), Manitoba (Haig and Oring 1988c), Minnesota (Wiens 1986, Haig and Oring 1987), Nebraska (G. Lingle, Platte River Whooping Crane Habitat Maintenance Trust), and Michigan (Pike 1985), yet little is known about site fidelity along rivers on the Northern Great Plains. Band returns are beginning to outline directions and distances dispersed by adults and chicks not returning to former nest sites (Haig and Oring 1988c). Continued monitoring of movements of banded birds in major breeding areas will fill the gap in our understanding of dispersal.

Knowledge of how new breeding sites are colonized and where new birds originated will be useful in developing comprehensive population viability models. Assessment of within and between population genetic diversity will provide a measurement of population status. Establishment of population specific molecular genetic markers will help determine the genetic identity (or distance) of specific local and regional populations (S. Haig, pers. comm.). Previous genetic studies (Haig and Oring 1988b) using electrophoresis resulted in general estimates of heterozygosity, but were not population specific. This work would also facilitate identification of population movement during migration and in winter. This is a critical issue because we still have not identified the winter sites of many breeding birds.

135. Assess mortality.

Factors such as human disturbance, predation, and water level regulation have reduced nesting and fledging of piping plovers. Factors affecting adult mortality, however, have never been directly addressed for any part of the annual cycle. During the breeding season, predation by mink (Mustela vison), great horned owl (Bubo virginianus) and coyote (Canis latrans), and black-billed magpies (Pica pica) has been unsubstantiated. It is important to determine the extent and cause of adult and juvenile mortality during the breeding season.

136. Consider reclassifying the Northern Great Plains population as "Endangered".

While additional information will fine-tune our understanding of the status of piping plovers, current data (see "Recovery Objectives") suggest the Northern Great Plains birds do not constitute a viable population. Further, threats to their riverine habitat, increased predation on human-altered prairie wetlands, and threats to winter sites in Texas and Mexico, justify reclassification. This should be undertaken immediately.

14. Assess status and distribution of piping plovers during migration. Little is known about Piping Plover migration. Migratory routes have not been described for spring or fall. Delineation of diet, habitat use, and behavior of the birds during this time is virtually unknown. Before intensive individual field studies are undertaken, coordination of surveys of potential sites should be carried out with natural resource employees or local birders to determine if piping plovers are stopping en route to wintering sites. There should also be a partnership established between the Western Hemisphere Shorebird Reserve Network to help identify migration sites. So far, biologists in the most likely stop-over sites (e.g., Cheyenne Bottoms, Kansas; Salt Plains National Wildlife Refuge, Oklahoma) have not reported great numbers of piping plovers (Haig and Plissner 1993).

15. Assess status and distribution of piping plovers during winter. Piping plovers spend 7-8 months of the year on Gulf of Mexico and Atlantic coast winter sites, yet most field research has been carried out on breeding birds. Studies of other neotropical migrants have shown that factors limiting nonbreeding birds may be as severe or worse than threats encountered during other times of

the year. Extension of the few studies that have addressed these issues should continue and additional research should begin.

151. Develop and utilize winter survey guidelines.

Standardized techniques to assess Piping Plover use of an area are being developed to ensure efficient assessment of a local site's importance to wintering plovers (T. Eubanks, pers. comm.). These techniques need to be tested, refined, and implemented as soon as possible.

152. Survey beaches and other suitable habitat to determine winter distribution.

Winter censuses on the Gulf of Mexico provide an outline of the current winter distribution, and identify beach, sandflat and algal flat areas as important habitat-types for the species. Currently, 63% of the total population can be accounted for during the winter (Haig and Plissner 1993). Further surveys are needed along Laguna Madre in Texas and Mexico, in coastal Louisiana, and on Caribbean islands to determine wintering areas for the remainder of the population.

153. Census major winter areas annually.

Annual censuses of major areas will provide an indication of their continuing importance and status as post-breeding sites. These sites need to be identified and the responsible agency contacted to assure appropriate censusing. The 1996 International Census will expand upon annual censuses to include all winter sites.

154. Monitor movement and fidelity of birds within and among wintering sites.

Although post-breeding piping plovers use several habitat types, their use of areas on a daily or seasonal basis is unclear. Monitoring movements of birds among sites will provide information for habitat protection and management.

155. Assess population mixing on wintering areas.

Establishment of genetic markers for breeding populations will facilitate identification of breeding populations when plovers are on their wintering grounds. This will enhance our understanding of the relative importance of specific winter sites, as well as help determine the winter location of Atlantic Coast breeding birds.

156. Assess mortality of wintering piping plovers.

The extent of mortality to post-breeding piping plovers has not been addressed. It is not clear if adults and juveniles exhibit differential mortality, or if post-breeding birds face greater threats than breeding birds. Population models will be more accurate when we are able to apportion mortality relative to population and time of year.

2. Determine habitat requirements and status.

Habitat alteration has been identified as one of the principal causes of the Piping Plover population and range decline. Recovery of the species will be substantially affected by identification and protection of Essential Habitat. We also need to manage habitat to maximize productivity and survival. Setting priorities for protection of remaining sites and determining habitat management actions will require detailed knowledge of Piping Plover habitat requirements and the availability and quality of existing sites.

21. Determine breeding habitat requirements and status.

Quantitative data of Piping Plover breeding habitat are scant. There is little information on optimal conditions for reproductive success. This information would include factors such as: beach width, percent vegetation, water conditions, estimate of site security, prey availability, slope of site, etc. Data should be collected at appropriate sites used and not used (abandoned) by piping plovers.

211. Assess the characteristics, including prey resources, of breeding habitat.

Characteristics of breeding habitat must be investigated to identify habitat conditions tolerated by piping plovers, habitat factors that affect nest densities, and habitat conditions that yield maximum reproductive success rates. Data are needed on riverine habitats in Nebraska, South Dakota, North Dakota, and Montana. However, data on habitat variables at occupied sites will be of minimal value in the absence of associated data on reproductive success. Comparative habitat information also must be gathered at seemingly adequate, but unoccupied sites. Habitat variables of primary concern at palustrine and lacustrine sites are beach width; beach area; prey abundance and temporal availability; abundance and distribution of vegetation; substrate type, abundance, and distribution; type and amount of disturbance; and vegetation encroachment rates. At riverine sites, habitat variables should be measured at the time of nest site selection and should include: sandbar area and height above water level, vegetative cover and distribution, substrate type, river level fluctuations, and

vegetation encroachment rates. Information on prey distribution and abundance are also needed, as are estimates of the likelihood of food being a limiting habitat factor. Data should be obtained across the breeding range.

212. Quantify and evaluate available breeding habitat. As habitat assessment is undertaken, efforts to quantify existing Piping Plover habitat should be initiated. The first task should be quantification of known and potential breeding habitat. As habitat-quality data become available, existing sites should be evaluated with respect to habitat adequacy and deficiencies. Based on this information, recommendations for site protection or management actions should be made and prioritized. Development of GIS data base (#12) to quantify and rate Piping Plover breeding habitat will be an important phase of this task.

213. Identify current or potential threats to breeding habitat. As breeding habitat is identified, current or potential threats to sites should be outlined. First priority for this assessment should be given to sites used by breeding piping plovers. Second priority should be given to sites with apparent potential to support breeding plovers, but are currently unoccupied. And finally, sites of insufficient quality to support plovers, but with the potential to be enhanced by available management techniques should be considered. In addition to threats that could destroy Piping Plover breeding habitats, perturbations (e.g., vegetative encroachment or flooding) that could leave sites intact, but reduce the quality of the habitat must be

considered. Parcels in state or federal ownership should not be considered immune from future threats to piping plovers. Disturbance due to competing resource use (e.g., recreation, grazing, gas and oil exploration, vegetation encroachment, freshening of water on saline wetlands, etc.) or management of other species will have to be evaluated in terms of potential harm to piping plovers. In determining breeding habitat quality, consideration must be given to potential predation pressures at the site (e.g., proximity to a gull colony).

214. Consider designation of important breeding sites as Critical Habitat.

Extensive breeding distribution data have been gathered and, at this point, we are well aware of sites that contain a significant population of piping plovers that warrants status as Critical Habitat. A specific task force should undertake a formal evaluation and proposal of these sites for Critical Habitat designation.

22. Determine migration habitat requirements and status.

Because migration patterns of piping plovers are poorly understood, no information on habitat requirements or status is available. Once stop-over sites, if they exist, are determined, evaluation of habitat requirements should be undertaken.

221. Assess characteristics, including prey resources, of migration habitat.

If stop-over sites are identified, the habitats used should be described and quantified. Some habitat variables of interest include: vegetative cover and species composition,

other structural features, substrate types, and prey species occurrence and abundance. Quantification (time-activity budgets) of how piping plovers use the available habitats and their length of stay at stop-over sites also should be determined.

222. Quantify and evaluate available habitat.

Once migratory habitats are identified and characterized, the availability of such habitats should be determined. Initially, habitat availability in the vicinity of known stop-over sites should be assessed. If migratory habitat in the vicinity of current stop-over sites is limited, a larger scale survey of available habitat along suspected migratory corridors should be made.

223. Identify current or potential threats to migration habitat.

As stop-over habitats are identified, current and potential threats to those sites should be delineated. On publicly-owned sites (e.g., national wildlife refuges, state wildlife management areas), current use patterns or management actions that could conflict with Piping Plover use of existing habitats should be identified. On privately-owned sites, potential land-use changes that degrade existing habitats should be evaluated. At that point, availability and quality of alternative habitats could be determined. Feasibility of protecting major privately-owned stop-over sites, should be assessed.

23. Determine winter habitat requirements and status.

Few data are available on Piping Plover winter habitat requirements (Nicholls and Baldassarre 1990), although studies

underway in Texas may provide better information. There is no information on the role winter habitat abundance, distribution, and quality plays in Piping Plover population dynamics. Data relating winter habitat conditions to population status are needed.

231. Assess characteristics, including prey resources, of winter habitat.

As primary wintering areas are identified, characteristics of the habitats used by piping plovers must be quantified and variables affecting quality of those habitats elucidated. The goal of these studies should be identification of habitat features that affect overwinter survival of piping plovers, assure adequate pre-breeding condition of plovers, and favor mixing among individuals from separate breeding populations. Thus, winter habitats should be assessed with regard to Piping Plover prey abundance and distribution, roost site needs, juxtaposition of feeding and roosting habitat, and security from predation and human disturbance. Habitats near occupied sites, but not currently used by piping plovers, also should be assessed. Information on movements among wintering areas and habitats, time-activity budgets, the use of pre-migration staging areas, etc. may provide important information on habitat quality.

232. Quantify and evaluate available winter habitat.

After baseline information on habitat characteristics and quality is available, the amount and distribution of winter habitat for piping plovers should be determined. The

quality of existing habitat should also be rated and deficiencies identified.

233. Identify current or potential threats to winter habitat.

Based on data generated under Steps 231 and 232, the likelihood that winter habitat status may be limiting the growth of the Piping Plover should be evaluated. Site specific threats or potential threats should be identified so that mitigative measures can be developed and implemented.

234. Consider designation of important winter sites as Critical Habitat.

Results of the 1991 International Census reinforced conclusions from previous studies that several winter sites (see Appendix 3) support the majority of piping plovers that we can now find in the winter. As such, these areas should be considered for designation as Critical Habitat. High priority should be given to protection of areas on Laguna Madre, Bolivar, and San Luis Pass, Texas.

3. Protect and enhance Piping Plover populations.

Efforts to provide full protection to all known breeding, migration and wintering areas are essential to ensure the Piping Plover's recovery. Legal protection of areas, however, is often not enough to ensure perpetuation of breeding populations. Active conservation actions, including predator management, restricted human access, and water level management are critical components of a comprehensive plan. In the Great Lakes, where breeding populations are in immediate jeopardy of extirpation, innovative techniques to enhance and increase local populations may be essential.

31. Protect, enhance, and increase Piping Plover populations during the breeding season.

To date, breeding activity of piping plovers has been more thoroughly investigated than activities at other times of the year. Current surveys have now identified nearly all nesting areas in the U.S. Extensive survey work and intensive research investigations of several major breeding concentrations have helped delineate many factors contributing to the species decline, thus enabling the development of specific recommendations that may enhance the species' survival during the reproductive season.

311. Manage habitat at breeding sites to ensure high reproductive success.

Activities that reduce Piping Plover reproductive success and survival on its breeding grounds are among the principal factors responsible for the species' decline. Actions directed at eliminating or minimizing such impacts are essential to the plover's recovery. Habitat management that maintains or enhances beach area, especially width, may positively affect nest success. Management of vegetation or water levels can enhance beach habitat. Control of livestock activity or vehicular traffic at alkaline beach sites may reduce vegetation encroachment.

3111. Evaluate predator impacts on eggs and chicks; identify species responsible for the damage.

Investigations that focus specifically on identifying predators, and the cues they use in locating nests and/or chicks, determining the time of predation, etc., are necessary if egg and chick mortality is to

be curtailed. However, if and when implementation of predator management is considered, it will be essential to identify the species responsible for the damage prior to actions being taken.

3112. Evaluate techniques for predator management and implement where appropriate.

Predator exclosures over nests or surrounding nesting beaches have been successful in increasing Piping Plover reproductive success. Fine-tuning these techniques for specific local conditions will increase their effectiveness. Other techniques may need to be developed and implemented for unusual predation problems.

3113. Restrict human and vehicular access to nesting areas.

Disturbance caused by foot traffic and recreational vehicles is common where recreational activity is intense. These activities destroy eggs and chicks, and inhibit territory establishment, feeding behavior, incubation and other reproductive behavior. Successful techniques that restrict access to nesting areas include posting, restricted access, psychological fencing, volunteer plover protectors, and public education.

Because many plover nesting areas are located in remote areas, strict enforcement of regulations is often impractical. Although the site may receive substantial recreational use, budget restrictions rarely allow full-time monitoring by professional

staff. "Plover Protectors" who patrol beaches to enforce and explain restrictions have been successful in many states and provinces. It is essential, therefore, that actions to restrict recreational activities always be accompanied by an aggressive public relations effort that will effectively reach all potential visitors to an area and adequately explain the purpose of regulations.

Field research on piping plovers should also be carefully examined for its net effects on the reproductive success. Research proposals should be scrutinized for their benefit to Piping Plover recovery.

3114. Restrict livestock and domestic animals at nesting sites.

Pets accompanying visitors to beach areas and sandbars are responsible for direct and indirect losses to plover populations (Flemming et al. 1988). Leash laws and other restrictions that eliminate such disturbance should be developed and strictly enforced.

In alkali wetlands, a more difficult problem is caused by livestock (Prindiville 1986). Although direct mortality may occur, indirect impact is more likely. Livestock leave deep tracks in the soft, mucky shoreline around these wetlands. Tracks may remain for a year or more and can trap plover chicks that fall in. In North Dakota, piping plovers abandoned nesting beaches in a year when cattle were

present but returned the following years when cattle were absent (Smith et al. 1993). Vegetation also is more prone to grow in shoreline areas following surface disturbance by cattle. Once established, herbaceous growth can become an effective travel corridor for predators and decrease available nesting habitat. Wetlands that provide nesting habitat for piping plovers should be identified and livestock access restricted where feasible. Easements or other agreements with private landowners should be established to allow fencing of plover nesting beaches. USFWS "Partner's for Wildlife" program should be utilized to protect nesting areas in the Prairie Pothole region. Longterm monitoring of nesting beach conditions at high plover concentration areas could detect vegetation encroachment at early stages and simplify corrective management. The establishment of permanent photo stations at areas with high nesting populations is encouraged.

3115. Manage water levels to reduce nest and chick loss. A significant proportion of the Great Plains Piping Plover population resides along the Missouri, Platte, and Niobrara rivers where much habitat has been destroyed by reservoir construction, channelization, water depletion, vegetative encroachment, and modification of flow regimes (Schwalbach 1988, Kirsch 1991). This riverine habitat is subject to a number of additional threats, including untimely water

releases from dams that flood sandbar nesting habitat (Sidle et al. 1992).

Maintaining higher water levels early in the spring could help to resolve this problem. Nesting habitat, normally flooded late in the season, should be submerged when plovers begin establishing territories in late April and early May, forcing them to seek higher grounds that would be safe throughout the nesting season. High water in spring also helps keep sandbars devoid of vegetation by reducing sprouting of young herbaceous growth and by increasing deposition of sediments (Faanes 1983).

3116. Modify or eliminate development activities that adversely impact reproductive success of piping plovers.

Recreational, residential, and industrial development along lakeshores and riverfronts should be discouraged in nesting areas. Proposals for maintenance or development activities that do not directly disturb breeding habitat but that occur in the vicinity of nest sites should be closely scrutinized for their potential impact. Guidelines should be developed to determine what constitutes significant loss of Piping Plover habitat.

312. Assess the feasibility of recovery via intensive management of a limited number of sites for high reproductive output.

Intensive management for high reproductive output at a large number of Piping Plover breeding sites may create source populations (i.e., produce more chicks than required to

maintain stable local populations). Identification of breeding sites to be targeted for intensive management may prove useful in speeding the recovery process. Data are needed on the number of sites, size of local populations, and degree of reproductive output necessary to make faster recovery possible.

313. Assess the need to implement techniques for population supplementation.

Recovery tasks delineated above describe means of enhancing plover reproductive success by managing and/or controlling other aspects of their environment (e.g., predation, water levels). Because these measures outline long-term, rather than short-term solutions to downward population trends, it is critical that they be investigated and implemented prior to consideration of artificial population enhancement. Such management activities should only be considered as a last resort.

3131. Develop criteria by which captive or foster rearing options should be considered.

Prior to implementation, criteria that clarify when population enhancement techniques should be considered need to be developed. The first criteria should be that the cause of the populations' decline is understood and remedied. The second should be that no other less-manipulative management techniques will accomplish the same goal. The third is that the population has a chance for recovery. Other factors to consider include: a population's size, historical trends, and annual reproductive success. Equally

important are habitat concerns, including whether or not the site can be properly protected and managed until recovery is achieved.

3132. Develop and test safe and reasonable techniques for use in population supplementation.

Population supplementation should not take place until criteria in #3131 are met and a well-tested protocol has been established for the techniques to be used. A best case scenario is that all techniques have been successfully tried on a surrogate species and long-term results of that testing have been evaluated. If population supplementation is used for piping plovers, appropriate long-term monitoring and funding for the program should be in place prior to onset of the program.

32. Protect and enhance Piping Plover populations during migration and winter.

Each year, 30% or less of the Piping Plover's time is spent on the breeding grounds, indicating a comprehensive protection plan must also focus on the species survival during migration and winter. As stated earlier, however, migration is the most poorly understood stage of the plover life cycle and little can be recommended until migratory patterns are determined. Winter research has begun to delineate key areas where plovers spend nonbreeding months (Haig and Plissner 1993). This is a critical step in enabling biologists to extend protection measures necessary for the birds' survival year-round.

321. Manage areas to maximize survival of birds during migration.

Nothing is currently known about either the extent or causes of mortality that piping plovers encounter during migration. Work that focuses on delineating migration routes (Section 14) should be expanded to focus on causes of mortality as well. When appropriate, measures should then be taken to lessen the impact upon the species.

322. Manage winter areas to maximize survival of birds during winter.

During winter, piping plovers use habitats similar to those used during the summer. Along the southern Atlantic coast, sand, gravel, and/or cobbled marine beaches are selected, as well as intertidal beach bars and flats. Along the Gulf of Mexico, beaches, sandflats, algal flats and dunes are used.

3221. Investigate and mitigate effects of environmental contaminants.

A possible concern for Great Lakes and Great Plains plovers on wintering grounds is the potential impacts from oil spills and other contaminants, particularly along the Gulf coast. Current analysis indicates a potential problem for Great Lakes piping plovers where chick survivorship has been low and PCB levels are very high. Contaminant sources need to be identified and mitigated.

3222. Investigate and mitigate effects of habitat loss due to dredging and other channel maintenance activities.

A significant portion of piping plovers winter in areas on or adjacent to the Gulf Intracoastal Waterway (GIWW). Constant dredging of these areas poses

continual threats to habitat viability. New channels through barrier islands for commercial or recreational purposes also are being proposed for dredging. These channels can destroy Piping Plover habitat directly, or indirectly by changing bayside salinities that can affect plover foraging habitats. Careful investigation of all proposed projects is needed to minimize threats to plovers. It is critical to work with the Corps of Engineers to mitigate the effect of these activities on piping plovers.

3223. Investigate and mitigate effects of other human activities on winter survival.

Recreational, residential, and industrial developments threaten piping plovers by increasing the level of human activity. To date, studies have focused on describing impacts of such activities on nesting grounds. Future efforts also should be directed at collecting similar data from wintering areas.

4. Preserve and enhance habitat.

Because of major habitat losses and increasing demands on available habitat, protecting and enhancing existing and potential Piping Plover habitat is a major concern. Important breeding and wintering areas have been identified but enhancement and protection of essential habitat has been limited.

41. Provide protection and conservation of breeding habitat.

Essential breeding habitat (Appendix 3) will need protection and enhancement to recover the species. Efforts should include increased management activities to provide better use and

protection of existing and potential areas. All Essential Habitat needs to be provided permanent protection through appropriate fee title acquisition, permanent easement, cooperative agreements, regulatory actions, and memorandums of agreement or understanding among federal agencies and private organizations (Appendix 2). Compatibility of other uses (e.g., grazing, recreation, etc.) for breeding areas should also be determined.

411. Identify additional areas of Essential Habitat.

Essential Habitat is listed in Appendix 3. Recognizing the fragile and ephemeral nature of Piping Plover habitat, continued evaluation and designation of other areas as Essential Habitat will protect these areas from detrimental activities.

412. Identify and rectify threats to Essential Habitat.

As Essential Habitat is identified it will be necessary to understand threats to its viability and outline steps to mitigate the problem.

413. Establish liaison with agencies and organizations with land and water management responsibilities.

Due to increasing pressure for development and use of land and water resources to meet human's needs, efforts should be made to communicate with agencies, organizations, and individuals whose decisions affect the future of Piping Plover habitat. The purpose would be to resolve conflicts between known development actions and future conflicts through planning of land and water development.

414. Revise, establish, or utilize land and water laws and regulations to provide protection for lakes, rivers, and prairie wetlands.

Increasing demands for agricultural land and urban development, wetland drainage, power generation, dredging of winter sites, water for irrigation, recreational space, and operation of river mainstem reservoirs threaten or destroy Piping Plover habitat. Strict enforcement of laws and regulations, particularly those involving instream flow protection, 404 permits, and endangered or threatened species habitat protection, is needed. All land- and water-use legislation should be scrutinized for potential impact to Piping Plover habitat.

Undesirable legislation should be modified and laws enacted that will expand the consideration given wildlife during water and land development planning.

415. Develop criteria and priorities for habitat protection.

To provide adequate protection, some habitat will have to be purchased in fee title or easement. Although permanent protection of essential areas will usually be preferred, in some instances, temporary protection of ephemeral nesting areas may be achieved through agreements with state and local authorities. Protection of areas listed as Essential Habitat (Appendix 3) is based upon tradition of occupancy, number of birds present, site productivity, proximity to other protected sites, potential habitat destruction, and ephemeral nature of the site.

416. Develop and implement site-specific conservation plans for riverine habitat.

Techniques may vary from site to site depending on need and opportunity, but plans should be developed for management of essential riverine habitat (see Section 21).

4161. Determine effects, including direct, indirect, and cumulative of manipulation of river hydraulics, flow regimes, and sediment discharge on breeding and foraging habitat.

Manipulation of river flow regimes and river hydraulics through water diversion, storage of flows by mainstream dams, discharge from dams for power generation, navigation and irrigation demands, bank stabilization, and channelization has significantly altered the natural dynamic processes responsible for degradation and aggradation of sandbars used for nesting. As a result, breeding habitat is likely being lost at a higher rate than what is being created along some rivers. Although many direct effects of human manipulations have been identified, suspected indirect and cumulative impacts of ongoing and future river developments need to be determined.

4162. Identify and implement river flow regimes that will protect and enhance breeding and foraging habitat.

Control of river flows is desirable to prevent frequent inundation of nests and young, discourage growth of woody vegetation, and to maintain a nutrient base necessary for reproduction of invertebrates used as food by piping plovers.

4163. Restore island habitat on rivers.

Mid-stream islands can provide safe, productive habitat for adults and chicks. Woody and vegetative encroachment can significantly reduce viability of

this habitat. Intermittent restoration efforts will help maintain this resource.

4164. Protect piping plovers nesting on artificial breeding sites.

Islands, spoil piles, and beaches formed by dredged sand and gravel, and located adjacent to the Platte River in Nebraska and elsewhere are used by piping plovers. Birds on such habitats should be protected and their importance to the recovery effort should be evaluated.

4165. Identify need and techniques of improving habitat via substrate management and vegetation control through physical and/or non-toxic chemical means; implement techniques.

Woody vegetation will have to be removed from certain sandbars to provide suitable nesting habitat through physical or chemical means. Annual control may be necessary.

Spreading sand or gravel of particular particle size can improve substrates for nesting and increase the height of sandbars to prevent inundation.

4166. Study feasibility and determine need for creating new habitat; implement trials to determine success rates of creating new habitat.

Creation of artificial habitat may be necessary in areas where manageable habitat is non-existent. This may be particularly important in areas where natural habitat has been lost to channelization.

417. Develop and implement site-specific conservation plans for prairie lake/reservoir habitat.

Specific plans for management of lake and prairie wetland habitat should be outlined and the habitats protected.

4171. Identify lake and reservoir water control policies where existing and potential Piping Plover habitat is threatened.

Water levels affect Piping Plover reproductive success by increasing or decreasing the amount of habitat available. Changes in these levels during critical periods can delay initiation of nesting, flood nest sites or feeding areas, or possibly increase the distance from nest sites to the water's edge. Policies controlling water levels need to be scrutinized to determine the effect on Piping Plover reproductive success, and the management agencies need to be contacted to bring about necessary changes.

4172. Identify needs and techniques for suitable substrate management and vegetation control; implement techniques.

Analysis of substrate currently used by piping plovers should be conducted. Using this information, areas with potential habitat can be enhanced. Methods such as spreading sand or gravel of a particular particle size on potential nest sites could encourage or improve nesting success. Control of vegetation through various methods such as burning, herbicides, salt water spray, or physical removal should be investigated to determine the best method for each

site. On the Great Lakes, creation of ponds adjacent to lakeshores could draw birds into certain areas.

4173. Identify needs and techniques for managing water levels; implement techniques.

Lakes and reservoirs currently supporting nesting plovers or that provide suitable nesting habitat should be evaluated to determine if water level management is feasible. Where feasible, techniques should be developed to manage water levels to improve reproductive success.

4174. Study feasibility of, determine needs for, and implement trials to determine success rates of creating new habitat.

Techniques for creation of new habitat discussed in the introduction, Sections 21 and 4165 may be applicable to lake habitat.

418. Develop and implement site-specific conservation plans for prairie wetland habitat.

Threats to these ephemeral alkali wetlands of the Dakotas and Montana include wetland drainage, water freshening, vegetation encroachment, and cattle trampling. Specific management techniques should be developed to address these threats. USFWS "Partners for Wildlife" program should play a major role in working with private landowners to protect and manage these nest sites.

4181. Identify threats to essential prairie wetland habitats; develop and implement policies or conservation actions to eliminate those threats (See also 213).

Threats to prairie wetland nesting habitat may be direct, such as drainage or the freshening of alkali wetlands, or indirect, for example the nearby disruption of underground water flow or volume. There is a need to identify all such threats to essential nesting habitat in North Dakota, Montana, and South Dakota.

4182. Develop management plans for use of lands adjacent to nesting beaches; contact landowners and assist in implementation.

The characteristics and use of upland habitats adjacent to nesting beaches may influence quality of beach habitats. Vegetation type in adjacent uplands could influence food availability at nesting sites, as could use of insecticides on agricultural crops adjacent to beaches. Access to nesting beaches by cattle may be detrimental to plovers. Management plans for uplands adjacent to nest sites are important to maintain quality nesting habitat.

4183. Identify the need for and techniques to maintain and improve nesting habitat along prairie wetlands; implement.

Analysis of substrate utilized by piping plovers should be conducted. Using this information, areas with potential habitat can be enhanced. Methods such as spreading sand or gravel of a particular particle size could encourage or improve nesting success. Control of vegetation through various methods such as burning, herbicides, salt water spray, or physical

removal should be investigated to determine the best method for each site.

4184. Determine the need for creation of new habitat along prairie wetlands and develop habitat where appropriate.

Techniques for creation of new habitat (see 4165, 4174) may be applicable in developing nesting habitat along prairie wetlands.

419. Develop and implement conservation plans for Great Lakes habitat.

Great Lakes Piping Plover numbers and reproductive success have held fairly constant for the past few years, hence current efforts are barely maintaining the population. Recovery, however, will only be achieved via increased efforts at each site.

4191. Develop site specific conservation plans for birds nesting on private land.

Success of Great Lakes birds depends on cooperation from private landowners. Site-specific management plans, as well as visits with landowners will enhance Piping Plover use of these sites.

4192. Maintain plover protection program at all breeding sites.

The plover protection program has been a key to maintaining reproductive output by Great Lakes piping plovers. It is imperative to maintain this program if progress is to be made in increasing nest and chick success.

4193. Maintain predator management efforts at all breeding sites.

Much of the success for birds on the Great Lakes is due to use of predator exclosures over nests. Success will increase when these efforts are coupled with further management of avian and mammalian predators before and after eggs hatch.

420. Evaluate success of habitat protection and conservation techniques.

Adequate assessment of protection and management practices requires that certain predetermined measurements be taken to monitor accomplishments versus desired results. Additional unplanned results may occur and monitoring must be sufficient to detect and measure those effects as well as to avoid potentially detrimental impacts on Piping Plover habitat. Daily and seasonal activity patterns of plovers, along with locations of specific nesting areas, will provide key measures of the birds' response to various management practices. Monitoring vegetation to determine where changing habitat conditions exist and monitoring potential predator levels in the area should be considered. All techniques used to improve plover habitat should be evaluated to determine their cost-efficiency.

42. Provide protection and conservation of migration habitat.

If migration sites are identified, their protection and enhancement will be essential. At that point, assessment of further needs of migrating piping plovers will be carried out.

43. Provide protection and conservation of winter habitat.

Piping plovers spend up to 70% of the year in winter sites on the Atlantic coast and Gulf of Mexico. Survival and continued existence of the species depends on juveniles and adults being able to occupy suitable winter habitat. Furthermore, reproductive success of adults may be a function of their physical condition as they begin spring migration. Current severe threats to the quantity and quality of winter habitat will limit recovery of the species if factors are not brought under control.

431. Identify additional areas of Essential Habitat

Similar to breeding areas (411), many essential winter areas have been identified (Appendix 3). Recognizing that winter areas may be just as important as breeding areas for recovery of piping plovers, continued evaluation of newly discovered winter sites for consideration as Essential Habitat should be pursued.

432. Identify and rectify threats to Essential Habitat.

Because we are just now able to delineate some critical winter sites, it is important to mitigate threats to these sites as soon as possible. Threats to the prime winter sites in Texas are severe. Without immediate action, we could lose a major portion of the entire species from winter habitat loss or degradation.

433. Establish liaison with agencies and organizations with land and water management responsibilities.

Intense development of beaches for recreational use and the GIWW for shipping pose serious threats to winter habitat. Cooperative efforts among the agencies involved will insure protection of Essential Habitat.

434. Revise or establish, and utilize, land and water laws and regulations to provide habitat protection.

Applicable regulatory mechanisms such as the National Environmental Policy Act, Migratory Bird Treaty Act, Endangered Species Act (especially sections 7(a)(1), 7(a)(2), and 10(a)), and state and local zoning statutes should be invoked to bring public and private attention to bear upon the need to protect and enhance wintering habitat.

435. Develop criteria and priorities for habitat protection.

Once further research is carried out in wintering areas, specific factors will be identified as being essential for winter habitat. At that point, a land protection strategy should be developed. Areas that support the greatest number of wintering plovers, especially those supporting individuals from important subpopulations should be prioritized in a habitat management/conservation plan.

436. Develop management techniques that increase Piping Plover survival in winter.

Once Piping Plover winter habitat is identified, methods of managing those habitats should be developed and improved so that wintering habitat is of sufficient quantity and quality to accommodate and promote expansion of Piping Plover populations to more stable levels.

437. Develop and implement comprehensive, site-specific conservation plans for piping plovers during winter.

The immense span of Piping Plover habitat in Texas and Louisiana and continued threats to its viability, suggest that comprehensive plans should be prepared that address conservation of most piping plovers in winter and many other

coastal species as well. Laguna Madre alone provides habitat for endangered Whooping Cranes (Grus americana), Peregrine Falcons (Falco peregrinus), sea turtles, thousands of winter waterfowl, etc. Collaboration with the North American Waterfowl Management Plan and Wetlands for the Americas would facilitate this planning.

438. Modify construction activities that may reduce or negatively alter winter habitat.

Dredging activities on sandflats related to the GIWW and creation of new recreation developments in winter areas should be investigated and modified accordingly so that piping plovers suffer no loss of essential winter habitat.

439. Eliminate current or potential threats to winter habitat.

As winter habitat is identified, current and potential threats to each site should be determined. First priority should be given to sites currently used by piping plovers, but sites of potential use should not be neglected. Care should be taken not only to identify threats that could destroy winter habitats, but also those that could result in lowering the quality of remaining sites. Ownership of land parcels will have to be taken into consideration when assessing threats to the winter habitat.

440. Evaluate success of protection and conservation techniques.

As discussed in Section 413, an evaluation of protection and conservation techniques must be carried out throughout their development and implementation. Furthermore, comparison of cost-effectiveness for various techniques is essential to ensure rapid recovery of piping plovers.

5. Develop and implement an education program that publicizes information about the Piping Plover, including its life history, reasons for decline, and options for recovery.

The Piping Plover's successful recovery in the Great Lakes and Northern Great Plains will depend on curtailing and/or redirecting recreational and development activities. Therefore, resource managers and the general public should be provided with sufficient information to explain and justify changes in previously allowed land use. Current efforts to develop a public information program have made an impressive start in this direction but must be intensified. These efforts could also benefit from better coordination at the national level and from delineation of specific audiences that need to be targeted.

51. Inform and educate the general public about threats to piping plovers throughout the annual cycle.

The first priority in developing a public information program should be to educate the general public about the significance and value of the Piping Plover. The public's support and cooperation will ultimately be essential to the species recovery.

511. Identify target audiences among the general public.

Materials prepared to increase public awareness and appreciation of the Piping Plover can be more effective if they are developed to meet specific interests and concerns of a particular audience. Affected groups should be identified and approached with tailored plover conservation plans. For example, fishermen using sandbars or islands for picnic spots can be provided information at public access sites. Materials could also be distributed to local resorts, parks, restaurants, and other facilities that provide services to such groups.

512. Develop and distribute educational materials appropriate to each audience.

Current efforts should be expanded to make greater use of the various media, including newspapers, radio, and TV. The primary focus of this task should be to provide background information describing the plover's life history and habitat requirements. The public should also be made aware of the necessity to enact local regulations to protect the plover. Biologists should be cautious, however, that materials do not increase the potential for observer disturbance to nesting birds.

513. Develop press-releases for newspapers, radio, and TV, that highlight specific Piping Plover projects.

In several states, cooperative projects between state and federal agencies, as well as private organizations and individuals are underway to protect piping plovers. Such efforts which generate public support should be applauded and widely publicized, particularly at the local level.

514. Provide controlled viewing opportunities if and when appropriate.

Guided opportunities for observing piping plovers may be one of the best vehicles for generating public support and concern. Led by a qualified biologist under conditions that minimize or prevent disturbance to the birds, such trips can educate visitors first-hand about the need for strong protection and curtailment of some recreational activities.

52. Inform and educate public resource management agencies about threats to Piping plovers throughout the annual cycle.

Many piping plovers in the region occur on lands that are protected and/or managed by state and federal resource agencies. Recreational activities permitted on these areas (e.g., hiking, ORV use, camping) can reduce the bird's reproductive success. In some areas, particularly in the Great Plains, an agency's own activities may also pose a threat. Contact with these agencies will facilitate better management of the areas for piping plovers.

521. Identify critical resource agency constituents.

Each resource agency (state, federal, and private organizations) whose activities can impact the Piping Plover should be identified.

522. Develop educational materials appropriate to respective agencies and their management authority.

Resource managers need to be provided with basic life history information about the plover as well as specific management information and recommendations directly pertinent to their area of responsibility.

523 Provide public resource agencies with periodic updates on the plover's status and progress of recovery efforts.

It is important that each public agency responsible for ensuring the plover's survival, either directly or indirectly, be kept abreast of the success of their efforts at both the local and national level. Periodic updates not only inform them of progress being made, but also remind them of their responsibilities for Piping Plover conservation.

6. Coordinate recovery efforts.

Development of a recovery plan for piping plovers involves coordination of biologists, agencies, and governments so that the most comprehensive,

up to date information is collected and disseminated in an efficient way. Proper coordination is necessary to ensure rapid implementation of those actions necessary for full recovery. The plan will be less effective, however, if coordination does not continue throughout achievement of the recovery objective.

61. Designate a recovery coordinator.

Designation of a coordinator for each recovery team is needed. Duties of the coordinator would include: carrying out the 1996 international Piping Plover census (sect. 11); establishing a GIS data base (sect. 12); collecting annual census data; coordinating annual censusing of long-term sites (sect. 133); working on section 7 consultations; working on establishment of MOU between USFWS and COE for conservation of Piping Plover habitat in Texas (sect. 434, 435); writing conservation plans (sect. 416, 417, 418, 419, 437); searching for funding for habitat easement or acquisition; coordinating team assignments and meetings; editing and updating recovery plans; encouraging and monitoring execution of the plan's implementation schedule; maintaining collaboration with other recovery teams, and state, federal, and international agencies; and coordinating range-wide research activities for piping plovers.

62. Coordinate research and conservation activities with federal, state, local, and private organizations.

Efficient achievement of recovery goals will be enhanced through coordination of research and management with private and governmental agencies. Of immediate importance is establishment and coordination of an international banding scheme whereby birds can be easily identified throughout the annual cycle. The recovery plan outlines many facets of Piping Plover conservation

that require urgent investigation. Repetition of efforts, due to lack of coordination, will slow the recovery process and may cause undue disturbance to the birds.

63. Coordinate international research and conservation activities. Development of population management plans on an international scale will be necessary if the species is to recover throughout its range. Many factors threatening the species are similar for piping plovers breeding in Canada and the U.S. Furthermore, breeding birds from both countries use U.S., Mexican, and Caribbean wintering grounds. Currently, only 65% of the breeding population has been accounted for on U.S. wintering areas (Haig and Plissner 1993). Central American and Caribbean nations may, therefore, be of great importance to the winter survival of piping plovers. Members of U.S. and Canadian recovery efforts have successfully worked together since the species was listed. International cooperation of research activities will allow for more efficient resolution of critical issues across the species range. Strong collaboration among Canadian and U.S. recovery efforts also may facilitate initiation of more powerful protective measures on Piping Plover wintering grounds.

64. Coordinate development of a public information program at the national and international level.

Information and educational materials developed in the Great Lakes or Great Plains could be of equal benefit along the Atlantic coast and vice versa. Some materials also may be helpful to states that support wintering populations. Coordination at the federal level will reduce duplication of effort and encourage more efficient use of time and money at the state level. The birds' habitat also faces major threats in both Canada and Mexico. A coordinated

approach to raising an awareness of the plover's plight at the international level would ensure protection throughout its range.

III. IMPLEMENTATION

The Implementation Schedule outlines and prioritizes tasks deemed necessary to be undertaken in the next five years in order to maximize recovery of piping plovers in the Great Lakes and Northern Great Plains. This process will be reviewed every five years until the recovery objective is met. Therefore, priorities and tasks may change in the future.

KEY TO IMPLEMENTATION SCHEDULE

General Category (column 1):

Information Gathering - I or R (Research)

1. Population status
2. Habitat status
3. Habitat requirements
4. Management technique
5. Taxonomy
6. Demographic studies
7. Propagation
8. Migration
9. Wintering
10. Predation
11. Competition
12. Disease
13. Environmental contaminant
14. Reintroduction
15. Other information

Acquisition - A

1. Lease
2. Easement
3. Management agreement
4. Exchange
5. Withdrawal
6. Fee title
7. Other

Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor control
5. Depredation control
6. Disease control
7. Pollution control
8. Public information
9. Other management

Priority (column 4):

1. Those actions absolutely necessary to prevent extinction of the species.

2. Those actions necessary to maintain the species' current population status.

3. All other actions necessary to provide for full recovery of the species.

4. GL = Great Lakes, GP = Northern Great Plains

Agency Responsibility (column 6):

USFWS Regional Office 2 - Albuquerque
3 - Twin Cities
4 - Atlanta
5 - Boston
6 - Denver

SA = State Wildlife Agency
BLM = Bureau of Land Management
BR = Bureau of Reclamation
COE = U.S. Army Corps of Engineers
NPS = National Park Service
TNC = The Nature Conservancy
WCHT = Platte River Whooping Crane Habitat Maintenance Trust

IMPLEMENTATION SCHEDULE

General Category	Task	Task #	Priority	Task Duration	Responsibility: USFWS Region	Responsibility: Other Agencies	Costs/FY (in $1000): 1	2	3	4	5	Comments
I1	Conduct 1996 International Census.	11	1	18 months	2,3,4,5,6	SA,CWS,NPS	50	10	-	-	-	Coordinator's job
I1-3	Establish GIS database.	12	2	Ongoing	2,3,4,5,6	SA	10	10	10	10	10	Coordinator's job
I1-3	Survey new populations.	131	1	2 years	6	SA,TNC,BLM	20	30	-	-	-	Survey Montana
R1	Assess demography for viability models.	133	1	Annual	3,6	SA	50	50	50	50	50	Monitor reproduction
R1	Evaluate/Reclassify NGP population as endangered.	136	1	3 months	3,6		-	-	-	-	-	Carry out in 1994
I1-3 I9	Determine winter distribution.	152	1	2 years	2,4	SA,NPS,COE	30	30	-	-	-	Survey Laguna Madre in Texas and Mexico.
I1-3	Assess population mixing, fidelity.	154-155	3	4 years	2,4	SA,NPS	15	15	15	15	-	
M9	Evaluate/Designate Critical breeding Habitat.	214	2	2 years	3,6			-	-	-	-	-
R2,3 R9	Quantify/evaluate winter habitat.	231-232	2	4 years	2,4	SA,NPS,COE	25	25	25	25	-	
R1-3 R9	Assess threats to winter habitat.	233	1	4 years	2,4	SA,NPS,COE	25	25	25	25	-	
M9	Designate Critical winter Habitat	234	3	1 year	2,4			-	-	-	-	-
M4	Implement predator management in breeding areas.	3111-2	1 (GL) 2 (GP)	Annual Annual	3 3,6	SA,NPS SA,COE,BLM	10 10	10 10	10 10	10 10	10 10	
M3,8	Restrict human and vehicular nest access.	3113	1 (GL) 2 (GP)	Annual Annual	3 3,6	SA,NPS SA,COE	8 10	8 10	8 10	8 10	8 10	
M3	Manage water levels to reduce nest/chick loss.	3115	1 (GP)	Annual	6	SA,COE,BR						
R3,4	Assess recovery via	312	1 (GL)	Annual	3	SA,NPS						

R10 M3,4	intensive management of reproductive success.		1 (GP)	Annual	3,6	SA,COE,BR						
M3	Mitigate effect of dredging on winter birds.	3222	1	Ongoing	2,4	SA,COE						
M3,9	Establish liaisons for breeding site protection.	413	1	Ongoing	3,6	SA,COE,NPS, BR						
M3,4	Implement riverine conservation plans.	416	2	Ongoing	6	SA,COE						
M3,4	Implement prairie lake conservation plans.	417	2	Ongoing	3,6	SA						
M3,4	Implement prairie wetland conservation plans.	418	2	Ongoing	6	SA						
M3,4	Implement Great Lakes conservation plans.	419	1	Ongoing	3	SA,NPS						
M3,9 R3,9	Establish liaisons for winter habitat; revise or establish laws; develop priorities for habitat protection.	434-436	2	Ongoing	2,4	SA,COE,NPS						
M3	Develop winter conservation plan.	438	2	Ongoing	2,4	SA,COE						
M3	Modify and/or eliminate construction activities that impact winter habitat.	439	1	Annual	2,4	SA,COE,NPS						
M8	Inform public	51	3	Annual	2,3,4,6	SA,NPS,COE	10	10	10	10	10	
M8	Inform resource agencies.	52	3	Annual	2,3,4,6	SA,NPS,COE	5	5	5	5	5	
I1-11 M2-3	Coordinate recovery efforts.	61-63	1	Ongoing	2,3,4,5,6	SA,COE,NPS	50	50	50	50	50	Appoint coordinator

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APPENDIX 1

State and Federal Contact People

The following individuals have offered to provide interested parties with information pertaining to piping plovers in their state or region.

ALABAMA
Alabama Dept. of Conservation and Natural Resources
64 N. Union Street
Montgomery, Alabama 36130
205/261-3469

COLORADO
Duane Nelson
Colorado Bird Observatory
13401 Piccadilly Rd.
Brighton CO 80601
303/659-4348

FLORIDA
Don A. Wood
Game and Fresh Water Fish Commission
620 South Meridian Street
Tallahassee, Florida 32301
904/488-3831

IOWA
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LOUISIANA
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MINNESOTA Stephen Maxson
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601/961-5300

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Nebraska Game and Parks Commission
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P.O. Box 30370
Lincoln, Nebraska 68503
402/464-0641, Ext. 138

NORTH DAKOTA Randy Kreil
North Dakota Game and Fish Department
100 N. Bismarck Expressway
Bismarck, North Dakota 58501
701/221-6348

SOUTH DAKOTA Eileen Dowd
South Dakota Department of Game, Fish & Parks
Sigurd Anderson Building
Pierre, South Dakota 57501
605/773-4229

TEXAS Non-Game Program
Texas Parks & Wildlife Department
4200 Smith School Road
Austin, Texas 78744
512/389-4800

WISCONSIN Sumner Matteson
Box 7921
Madison, Wisconsin 53707
608/266-1571

APPENDIX 2

Agreements and Easements for Protection

of Essential Piping Plover Habitat

1. Memorandum of Understanding should be developed between the U.S. Army Corps of Engineers, National Park Service, U.S. Fish and Wildlife Service, and the state wildlife agency, for permanent protection and management of all essential habitat on the Missouri River in North Dakota, South Dakota, and Nebraska.

2. U.S. Fish and Wildlife Service, National Park Service, and Army Corps of Engineers should acquire easements and/or fee title of essential Piping Plover habitat on the Missouri River in North Dakota, South Dakota, and Nebraska.

3. Memorandum of Understanding should be developed between the U.S. Army Corps of Engineers, Bureau of Reclamation, U.S. Fish and Wildlife Service, Platte River Whooping Crane Habitat Maintenance Trust, and the state wildlife agency, for the permanent protection and management of all essential habitat on the Platte River in Nebraska.

4. The U.S. Fish and Wildlife Service should provide land protection of essential Piping Plover habitat on the Platte River system.

5. Memorandum of Understanding should be developed between The Nature Conservancy, Bureau of Land Management, state wildlife agency, and the U.S. Fish and Wildlife Service for the permanent protection and management of essential Piping Plover habitat at the Chain of Lakes, North Dakota.

6. Memorandum of Understanding should be developed between the North Dakota Game and Fish Department and the U.S. Fish and Wildlife Service for the permanent protection and management of essential Piping Plover habitat owned and/or managed by the North Dakota Game and Fish Department.

7. The U.S. Fish and Wildlife Service should provide land protection of essential Piping Plover habitat within the two glacial outwash plains in central North Dakota. Land protection should extend over the wetland as well as the upland.

8. Memorandum of Understanding should be developed between the National Park Service, state wildlife agency, and the U.S. Fish and Wildlife Service for the permanent protection and management of essential habitat in the Great Lakes.

9. Memorandum of Understanding should be developed between U.S. Army Corps of Engineers, National Park Service, The Nature Conservancy, state wildlife agency, and U.S. Fish and Wildlife Service, for permanent protection and management of essential wintering habitat.

10. Memorandum of Understanding should be developed between Texas Parks and Wildlife Department, Texas General Land Office, The Nature Conservancy, National Park Service, and U.S. Fish and Wildlife Service for the permanent protection of essential Piping Plover winter habitat on lands owned and/or managed by the Texas Parks and Wildlife Department.

11. Due to the presence of piping plovers on Gulf and Atlantic coastal barrier habitat, U.S. Fish and Wildlife Service will participate closely with current Department of the Interior efforts in developing the Coastal Barrier Resource System.

APPENDIX 3

Essential Breeding and Winter Habitat for Piping Plovers

Breeding in the Great Lakes and Northern Great Plains.

Alkali wetlands and riverine sandbars in the northern Great Plains, and sandy beaches along the Great Lakes provide Essential Habitat for the Piping Plover. Gulf coastal areas from Florida to Texas provide Essential Habitat for the Piping Plover during the wintering period. The Piping Plover is completely dependent on these habitats for food and nesting sites. Therefore, destruction or adverse modification of remaining habitats will cause continued reduction of the species range and eventually a serious reduction in population numbers. The areas described and mapped herein as Essential Habitat will provide the space necessary for continued existence and growth of Piping Plover populations required to meet the recovery objective. The following areas are Essential Habitat for the Piping Plover. Maps and lists were generated from the 1991 International Census. This list may be modified when better distribution and status information become available (pages where information can be found are listed below):

State	Site List	Map
Alabama	111	112
Colorado	94	95
Florida	113	114,115
Iowa	94	97
Louisiana	116	117
Michigan	92	93
Minnesota	94	96
Mississippi	116	118
Montana	98	99
Nebraska	100	103
North Dakota	104	107
South Dakota	108	110
Texas	119	121

KEY TO HABITAT DESIGNATIONS

General Habitat

A = Alkali lake
B = Protected bay
IP = Industrial pond
L = Large freshwater lakes
O = Ocean
OB = Ocean and bay sides of islands, peninsulas, etc.
R = River
RS = Large reservoir (eg. Lakes Diefenbaker and Sakakawea)
SR = Small reservoir

Microhabitat

AM = Alkali mudflat
AP = Ash pond shore
BB = Barrier sand beach
BC = Unspecified beach
BR = Sand bar
CM = Coastal mudflat
GB = Gravel bar
GC = Golf course
GL = Gravel lot
GP = Gravel pit
GS = Gravel shore
IS = Island sand beach (except barrier islands)
OR = Oyster reef
PT = Sand/gravel pit
SB = Mainland sand beach
SF = Sand flat
SG = Sand/gravel shore
SI = Silt
SP = Spoil site
SS = Sand spit
V = Vegetated shoreline
VM = Vegetation (algal) mat

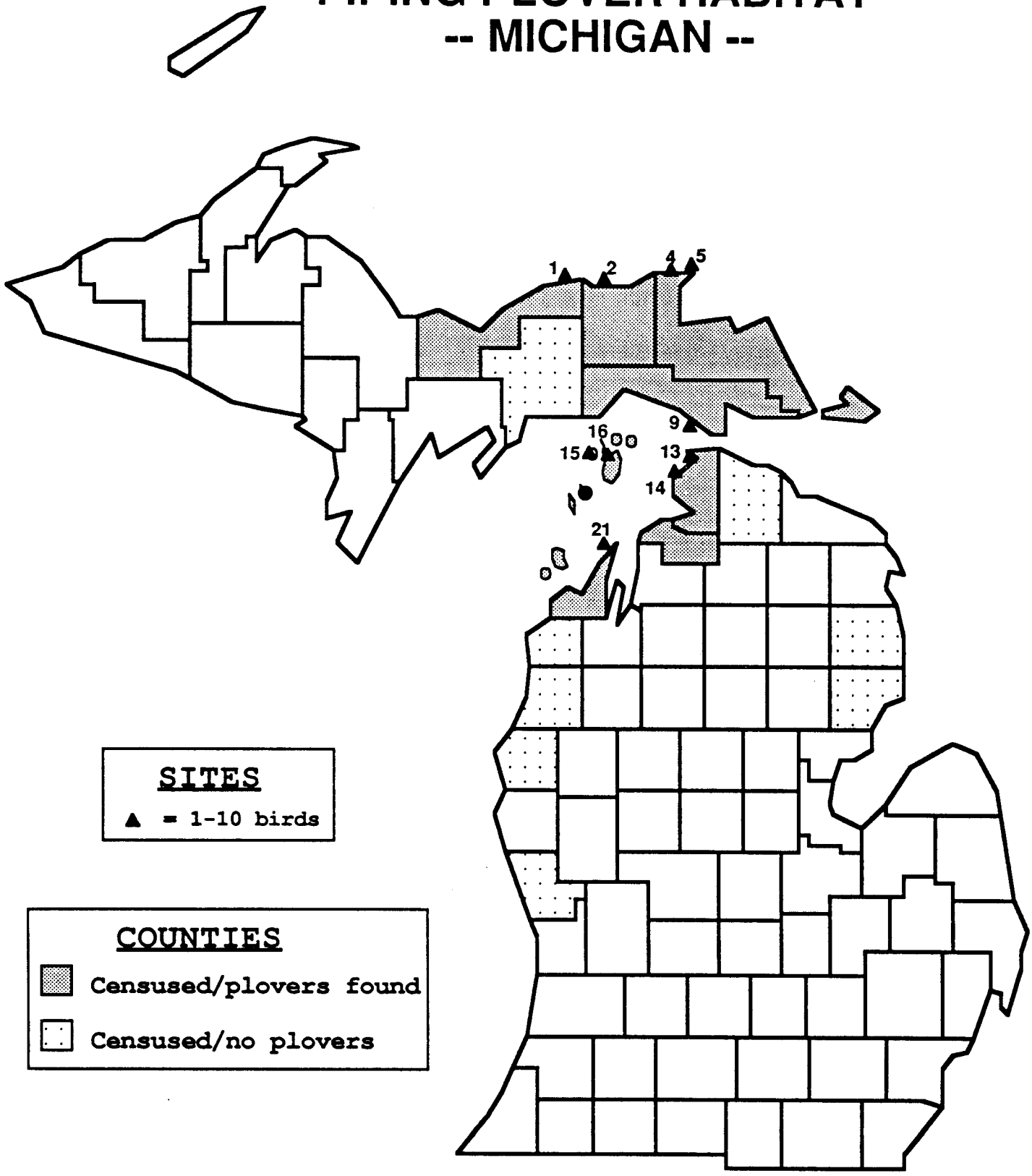
Ownership

F = Federal
I = Indian Reservation
M = Municipal
P = Private
S = State/Provincial

MICHIGAN

COUNTY	MAP #	SPECIFIC SITE, QUAD NAME, TOWNSHIP/RANGE			DATE	PAIRS	ADULTS	KM	HABITAT GEN	HABITAT MICRO	OWNER
ALGER	1	GR MARAIS INNER, GRAND MARAIS	49N	13W		3	8	4.0	L	SB	M
CHARLEVOIX	16	DONEGAL BAY, BEAVER ISLAND N	38N	10W	0524	1	2	2.4	L	IS	M
CHARLEVOIX	15	HIGH ISLAND WEST, HIGH ISLAND	38N	11W	0525	1	2	1.6	L	IS	M
CHIPPEWA	4	VERMILION, VERMILION	50N	7W		1	3	3.0	L	SB	M
CHIPPEWA	5	WHITEFISH POINT, WHITEFISH PT	50N	6W		0	1	2.0	L	SB	M
EMMET	14	CROSS VILLAGE N, CROSS VILLAGE	38N	6W	0716	3	6	1.2	L	SB	M
EMMET	14	CROSS VILLAGE S, GOOD HART	38N	6W	0603	1	2	0.4	L	SB	M
EMMET	13	LAGOON, CROSS VILLAGE	39N	5W	0626	1	2	0.8	L	SB	M
EMMET	13	POINT/ISLAND, CROSS VILLAGE	39N	6W	0626	2	4	0.4	L	IS/SB	M
EMMET	13	STURGEON BAY NORTH, PELLSTON	39N	5W	0626	1	2	0.4	L	SB	M
EMMET	13	STURGEON BAY SOUTH, PELLSTON	38N	5W	0626	1	2	0.4	L	SB	M
LEELANAU	21	CATHEAD BAY, NORTHPORT	32N	11W	0606	1	2	3.6	L	GL/SB	S
LUCE	2	DEER PARK, MUSKALUNGE LE	49N	10W	0611	0	1	2.4	L	SB	M
MACKINAC	9	PTE AUX CHENES, PTE AUX CHENES	41N	5W		1	2	5.0	L	SB	F

ESSENTIAL
PIPING PLOVER HABITAT
-- MICHIGAN --



COLORADO

COUNTY	MAP #	SPECIFIC SITE, QUAD NAME, TOWNSHIP/RANGE			DATE	PAIRS	ADULTS	HABITAT KM	HABITAT GEN/MICRO	OWNER
BENT	29	BLUE LAKE ISLAND, LONG LAKE	21S	52W	0610	0	1	0.0	SR IS	M
KIOWA	33	NEE GRANDE RSVR, SWEDE LAKE	20N	48W	0605	1	6	3.2	SR AM/SB	M
KIOWA	34	NEE NOSHE RSVR, NEE NOSHE	20S	47W	0604	1	3	6.4	SR BC	M
KIOWA	35	UPPER QUEENS RS, NEE NOSHE	20S	47W	0601	1	3	6.4	SR AM/SB	M

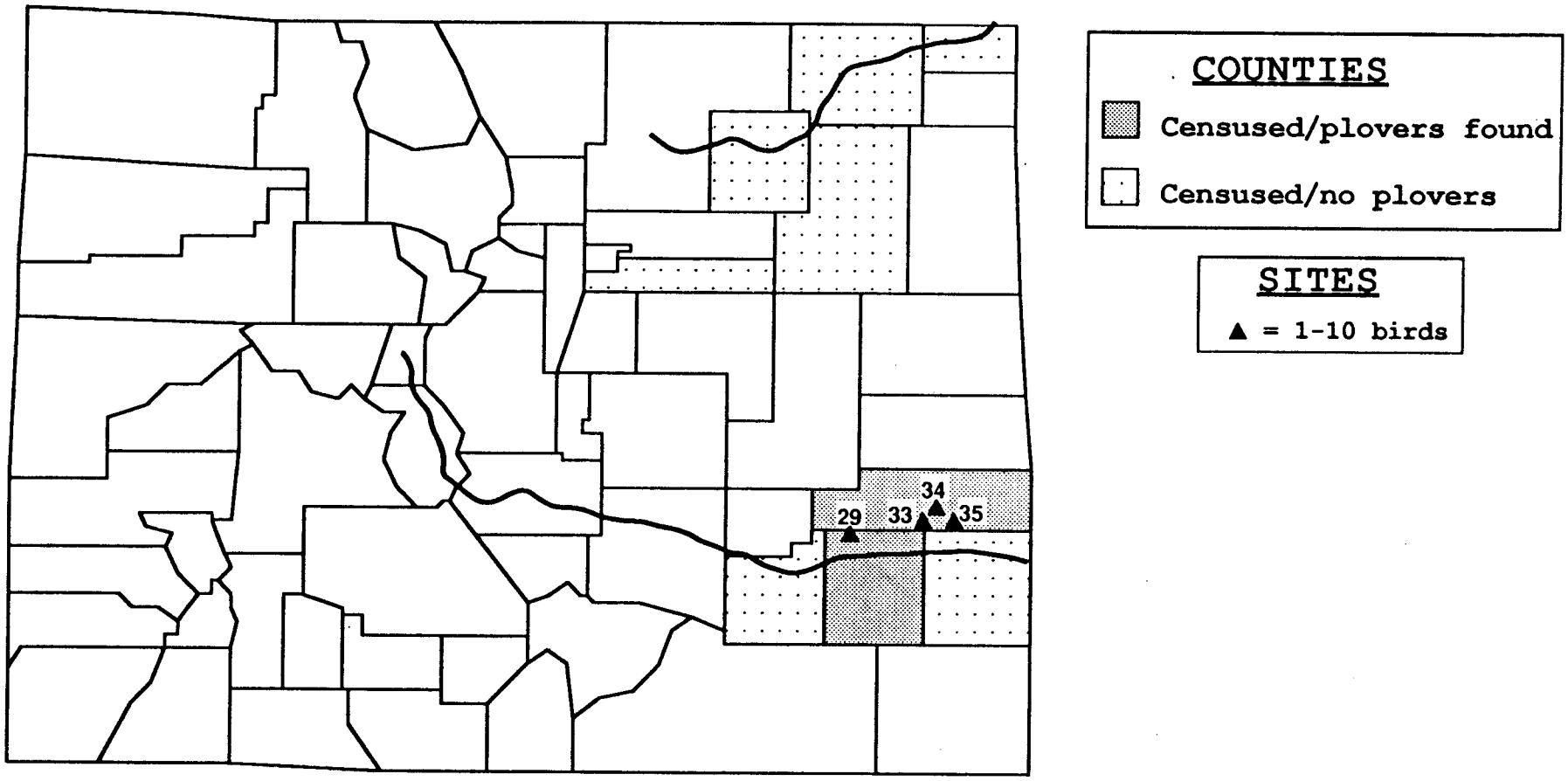
MINNESOTA

LAKE OF WOODS	3	MORRIS POINT, WILLIAMS SE	162N	32W	0611	6	13	6.4	A IS/SS	M

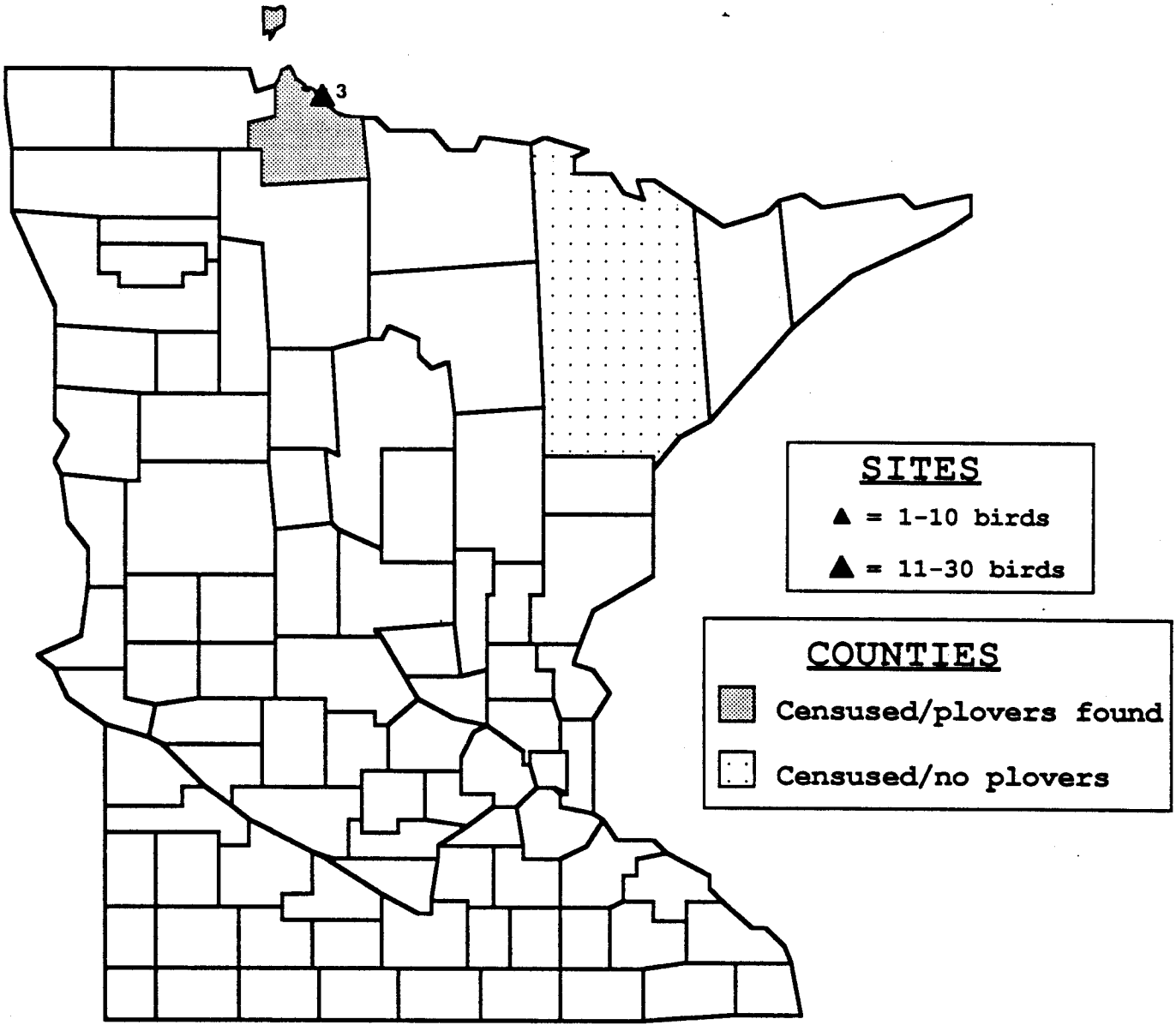
IOWA

POTTAWATTAMIE	2	IOWA P&L PONDS, COUNCIL BLUF S	74N	43W 606	0615	4	9	0.6	IP	P
WOODBURY	1	SALIX POWER PLANT, SALIX	87N	47W 717.6	0616	2	4	0.5	IP	P

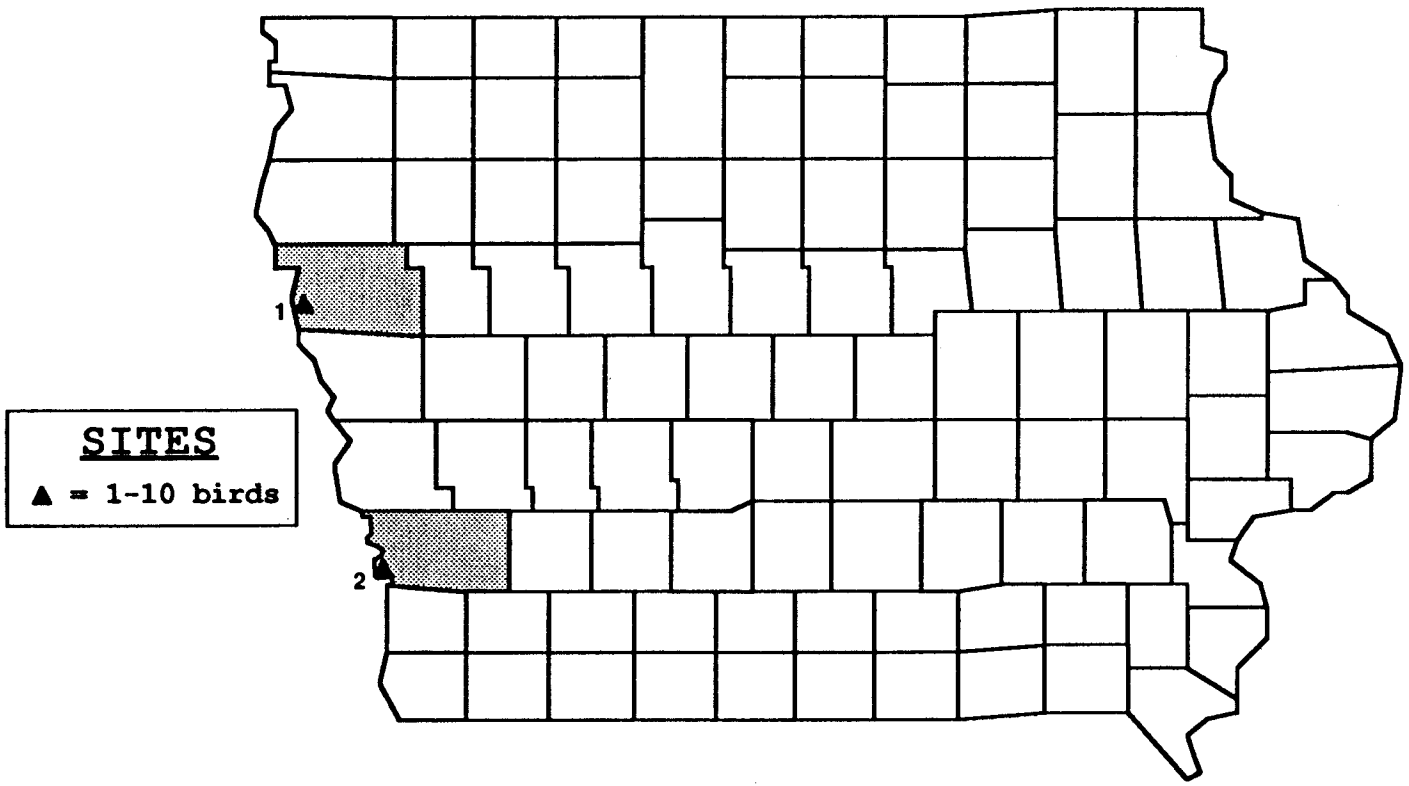
ESSENTIAL PIPING PLOVER HABITAT
-- COLORADO --



ESSENTIAL PIPING PLOVER HABITAT
-- MINNESOTA --



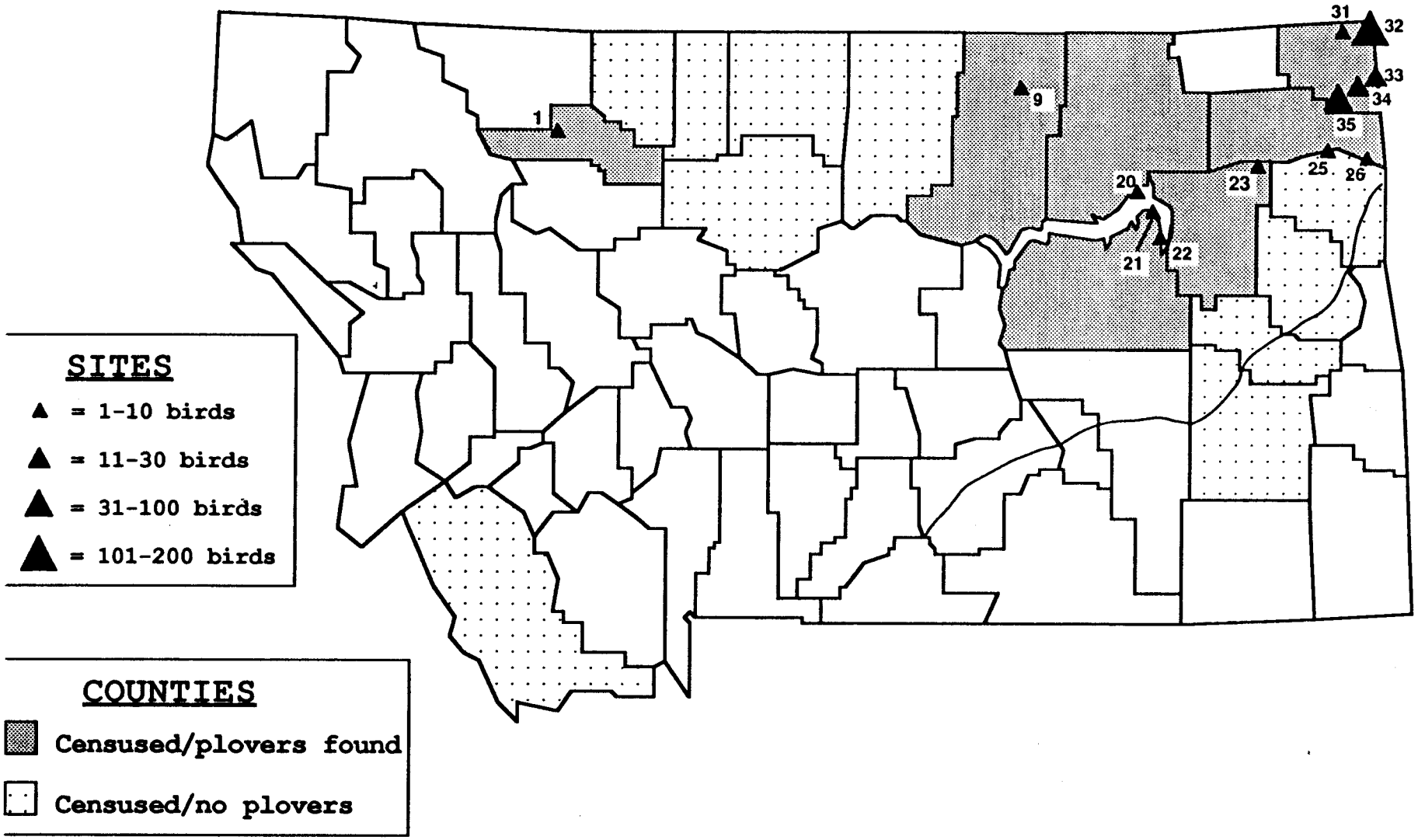
ESSENTIAL PIPING PLOVER HABITAT
-- IOWA --



MONTANA

COUNTY	MAP #	SPECIFIC SITE, QUAD NAME, TOWNSHIP/RANGE, RIVER MI				DATE	PAIRS	ADULTS	HABITAT KM	GEN/MICRO	OWNER
GARFIELD	22	BEACH #16, SPRING CRK BAY	23N	42E		0606	1	2	2.0	RS SG	F
GARFIELD	22	BEACH #24, ASH CREEK EAST	23N	42E		0606	0	2	3.3	RS SG	F
GARFIELD	22	BEACH #25, ASH CREEK EAST	22N	42E		0606	0	1	0.8	RS SG	F
GARFIELD	22	BEACH #31, SPRING CREEK BAY	24N	42E		0611	0	1	0.8	RS SB	F
GARFIELD	21	BEACH #4, BOBCAT CREEK	25N	41E		0611	1	2	0.8	RS GS	F
GARFIELD	21	BEACH #5, BOBCAT CREEK	25N	41E		0611	2	4	2.0	RS SG	F
MCCONE	23	BIG POPLAR ISLAND, NICKWALL			1686	0604	0	1	1.6	R BR	M
MCCONE	23	CHELSEA ISLAND, CHELSEA SW			1690	0604	1	2	0.8	R BR/SB	M
PHILLIPS	9	NELSON RSVR NE, HEWITT LAKE	32N	32E		0605	1	2	2.4	SR IS	M
PHILLIPS	9	NELSON RSVR NW, HEWITT LAKE	32N	32E		0603	2	4	2.4	SR GS/IS	M
PHILLIPS	9	NELSON RSVR ROG, BOWDOIN	31N	32E		0610	1	2	0.4	SR IS	M
PHILLIPS	9	NELSON RSVR S., BOWDOIN	31N	32E		0605	1	2	2.8	SR GS	M
ROOSEVELT	26	RM1594, BAINVILLE SE			1594	0605	1	2	1.2	R BR	P
ROOSEVELT	25	RM1625, DUGOUT CREEK			1625	0605	1	2	0.8	R BR	P
ROOSEVELT	25	RM1635, TWO MILE CREEK			1635	0604	0	1	3.2	R BR/SB	I/P
SHERIDAN	34	BERGER POND WPA, DAGMAR	32N	58E		0603	0	1	3.2	A AM/GR	F/P
SHERIDAN	35	DEEP LAKE, CAPENEYS LAKE	32N	57E		0604	2	4	2.4	A AM	F
SHERIDAN	32	DOG LEG WPA, WESTBY NORTH	37N	58E		0606	2	4	2.4	A AM/GB	F/P
SHERIDAN	33	ERICKSONS WPA, BRUSH LAKE	33N	58E		0603	1	3	2.8	A AM/IS	F
SHERIDAN	32	FLAT LAKE, WESTBY NORTH	37N	58E		0605	10	29	6.4	A AM/GS	F/S
SHERIDAN	35	GAFFNEY LAKE, CAPENEYS LAKE	31N	57E		0603	2	9	8.8	A AM	F
SHERIDAN	31	GALLOWAY LAKE, LONE TREE	37N	57E		0605	1	2	4.8	A	P
SHERIDAN	32	GOOSE LAKE WPA, WESTBY S	35N	58E		0612	9	27	0.0	A AM/GS	F
SHERIDAN	34	KATYS LAKE, DAGMAR	32N	57E		0603	5	15	4.8	A AM/GS	F
SHERIDAN	32	LK N OF FLAT LK, WESTBY NORTH	37N	58E		0606	1	2	2.8	A AM/GS	P
SHERIDAN	32	LK N OF STATELI, WESTBY NORTH	37N	58E		0606	1	2	1.6	A	P
SHERIDAN	35	MEDICINE LAKE, CAPENEYS LAKE	31N	56E		0603	21	65	55.9	A AM/IS	F
SHERIDAN	32	N. NOOSE LAKE, WESTBY SOUTH	36N	58E		0608	1	7	6.4	A AM/GS	P
SHERIDAN	32	NORTH LAKE, WESTBY NORTH	36N	58E		0613	2	5	6.4	A	P
SHERIDAN	33	PARRY WPA, BRUSH LAKE	33N	58E		0604	5	15	6.8	A AM/GS	F/P
SHERIDAN	32	ROUND LAKE, WESTBY NORTH	36N	58E		0615	1	2	3.2	A	P
SHERIDAN	31	SALT LAKE, PARK LAKE	37N	56E		0605	2	7	6.4	A GS	P
SHERIDAN	32	UPPER GOOSE LAKE, WESTBY SOUTH	36N	58E		0604	12	34	7.6	A	P
SHERIDAN	32	WEST GOOSE LAKE, WESTBY SOUTH	36N	58E		0614	15	39	6.4	A GS	P
VALLEY	20	BEACH #1, YORK ISLAND	26	41		0603	0	2	3.2	RS BC	F
VALLEY	20	BEACH #3, SKUNK COULEE	26N	40E		0603	0	1	1.2	RS BC	F
VALLEY	20	BEACH #32, SKUNK COULEE	26N	40E		0603	0	1	0.8	RS IS/SB	F
VALLEY	20	BEACH #8, SKUNK COULEE	25N	40E		0603	0	1	2.0	RS BC	F
VALLEY	20	BEACH #9, SKUNK COULEE	25N	40E		0603	0	1	0.8	RS IS/SB	F

ESSENTIAL PIPING PLOVER HABITAT
-- MONTANA --



NEBRASKA

COUNTY	MAP #	SPECIFIC SITE, QUAD NAME, TOWNSHIP/RANGE, RIVER MI				DATE	PAIRS	ADULTS	HABITAT KM	HABITAT GEN/MICRO	HABITAT	OWNER
BOYD/HOLT	7	10R NIOBRARA, DUSTIN	33N	15W	67.4	0618	1	2	0.0	R	BR	M
BOYD/HOLT	8	12R NIOBRARA, BUTTE SW	34N	14W	55.8	0618	0	4	0.0	R	BR	M
BOYD/HOLT	8	13R NIOBRARA, BUTTE SW	33N	14W	55.2	0618	5	13	0.0	R	BR	M
BOYD/HOLT	8	14R NIOBRARA, BUTTE SW	33N	14W	54.8	0618	1	2	0.0	R	BR	M
BOYD/HOLT	8	15R NIOBRARA, BUTTE SW	33N	13W	53.8	0618	0	3	0.0	R	BR	M
BOYD/HOLT	9	16R NIOBRARA, SPENCER S	33N	12W	44.4	0618	0	8	0.0	R	BR	M
BOYD/HOLT	9	17R NIOBRARA, SPENCER S	33N	12W	43.0	0618	3	6	0.0	R	BR	M
BOYD/HOLT	9	19R NIOBRARA, SPENCER S	33N	12W	39.7	0618	1	2	0.0	R	BR	M
BOYD/HOLT	10	20R NIOBRARA, SPENCER S	33N	11W	37.7	0619	3	6	0.0	R	BR	M
BOYD/HOLT	11	21R NIOBRARA, BRISTOW	32N	11W	33.5	0619	2	6	0.0	R	BR	M
BOYD/HOLT	11	22R NIOBRARA, BRISTOW	32N	10W	30.5	0619	1	2	0.0	R	BR	M
BOYD/HOLT	12	23R NIOBRARA, LYNCH	32N	9W	24.3	0619	1	6	0.0	R	BR	M
BOYD/HOLT	6	9R NIOBRARA, NAPER SW	33N	16W	72.0	0618	10	20	0.0	R	BR	M
BROWN/KEYA PAHA	1	1R NIOBRARA, DUTCH CREEK	32N	21W	104.2	0618	1	3	0.0	R	BR	M
BUFFALO	40	EVARTS ISL 75, KEARNEY	8N	15W		0604	1	2	0.0	R	PT	P
BUFFALO	41	KILLGORE ISL 78, NEWARK	8N	14W		0604	1	1	0.0	R	PT	P
BUFFALO	36	PLATTE RIV NPPD, ELM CREEK E	8N	18W	230	0612	2	4	0.0	R	SP	M
BUFFALO	36	PLATTE RIVER 66, ELM CREEK E	8N	18W	230.3	0612	0	2	0.0	R	BR	M
BUFFALO	37	PLATTE RIVER 68, ELM CREEK E	8N	18W	228	0611	0	1	0.0	R	BR	M
BUFFALO	39	PLATTE RIVER 74, KEARNEY	8N	16W	214.5	0611	1	2	0.0	R	BR	M
BUFFALO	41	PLATTE RIVER 77, NEWARK	8N	14W	207	0611	0	1	0.0	R	BR	M
BUFFALO	36	S CHANNEL 69, ELM CREEK WEST	8N	18W		0605	2	3	0.0	R	PT	P
BUFFALO	36	S CHANNEL 70, ELM CREEK E	8N	18W		0605	1	2	0.0	R	PT	P
BUTLER	48	BELLWOOD, COLUMBUS SE	16N	1E		0605	2	5	0.0	R	PT	P
CASS	61	CULLOM, CEDAR CREEK	13N	12E	8	0604	0	1	0.0	R	BR	M
CASS	62	PLATTSMOUTH PIT, PLATTSMOUTH	13N	13E		0604	1	2	0.0	R	PT	P
CASS	59	SOUTH BEND PIT, MANLEY	12N	11E		0604	2	4	0.0	R	PT	P
COLFAX	49	ARPS, SCHUYLER	17N	3E		0605	2	5	0.0	R	PT	P
COLFAX	49	PLATTE RIV 111, SCHUYLER	17N	3E	89.0	0613	0	1	0.0	R	BR	M
COLFAX	50	PLATTE RIV 116, ROGERS	17N	4E	84	0613	0	1	0.0	R	BR	M
COLFAX	49	WILLPIT, SCHUYLER	17N	3E		0605	1	2	0.0	R	PT	P
CUMING	22	WISNER STALP, WISNER	23N	4E		0620	1	2	0.0	R	PT	P
DAWSON	30	KIRKPATRICK PIT, GOTHENBURG	11N	25W		0603	1	2	0.0	R	PT	P
DAWSON	33	LERINGTON PIT, BERTRAND NW	9N	21W		0605	3	6	0.0	R	PT	P
DAWSON	33	OVERTON S&G, BERTRAND NW	9N	21W		0605	1	2	0.0	R	PT	P
DAWSON	32	PAULSON S&G, COZAD	10N	23W		0603	1	2	0.0	R	PT	P
DAWSON	34	PLATTE RIVER 62, BERTRAND NW	9N	20W		0605	1	2	0.0	R	PT	P
DAWSON	35	POTTER, OVERTON	8N	20W		0605	1	2	0.0	R	PT	P
DAWSON	31	WILLOW I FEEDER, WILLOW ISLAND	11N	24W		0603	0	1	0.0	R	PT	P

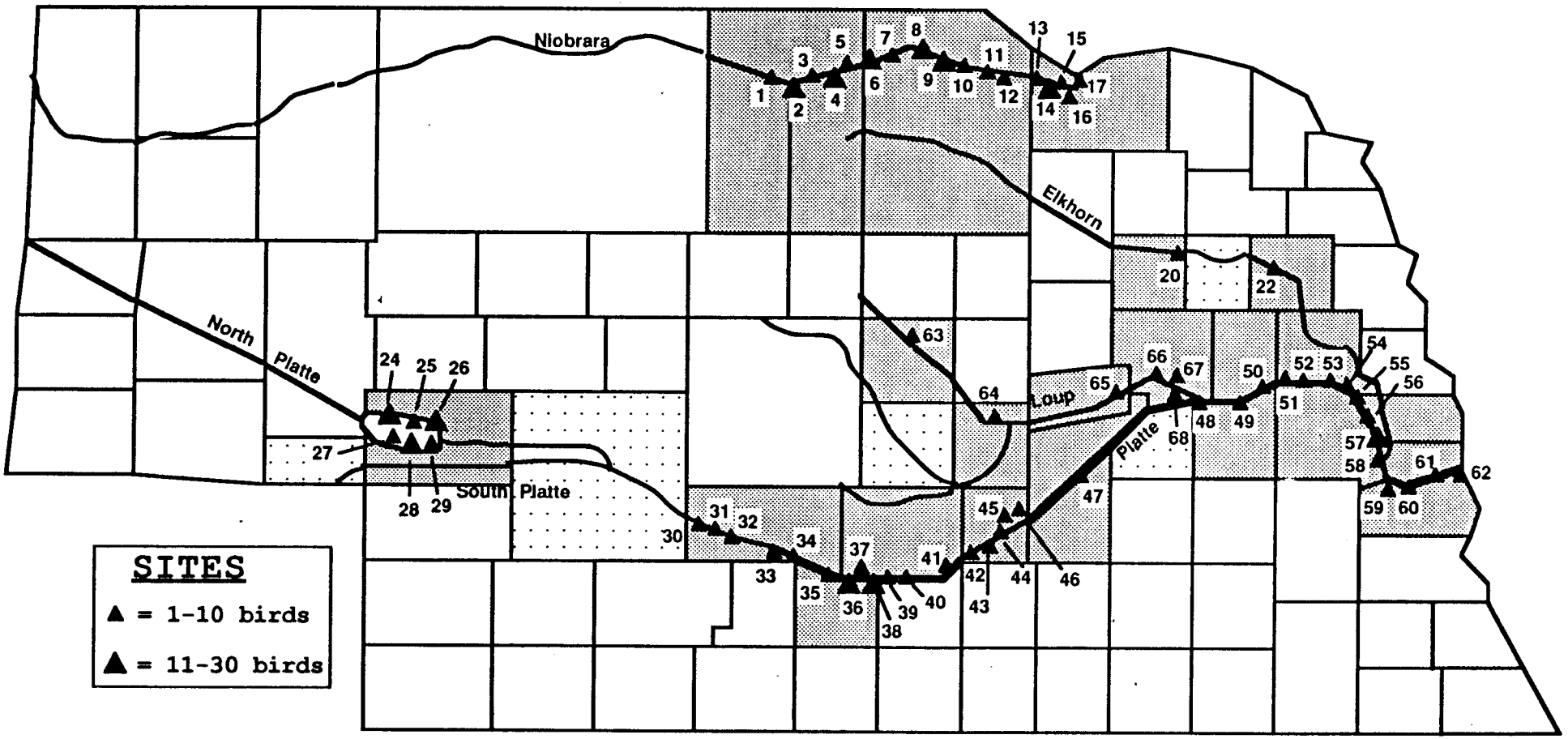
NEBRASKA cont.

COUNTY	MAP #	SPECIFIC SITE, QUAD NAME, TOWNSHIP/RANGE, RIVER MI				DATE	PAIRS	ADULTS	HABITAT KM	GEN/MICRO		OWNER
DODGE	53	HARTFORD FREMONT, FREMONT WEST	17N	8E		0604	1	2	0.0	R	PT	P
DODGE	51	PLATTE RIV 121, ROGERS	17N	5E	78.0	0613	0	3	0.0	R	BR	M
DODGE	52	PLATTE RIV 125, MALMO NW	17N	6E	70.4	0613	0	2	0.0	R	BR	M
DODGE	54	WESTERN FREMONT,FREMONT EAST	17N	8E		0603	1	1	0.0	R	PT	P
DOUGLAS	56	HARTFORD-VALLEY, VALLEY	15N	10E		0603	2	5	0.0	R	PT	P
DOUGLAS	55	PLATTE RIV 143, FREMONT EAST	16N	9E	53.6	0613	0	1	0.0	R	BR	M
DOUGLAS	57	WESTERN NORTH, WANN	13N	10E		0603	3	11	0.0	R	PT	P
HALL	45	GRND ISLD SW 86, ABBOTT	11N	10W		0604	2	5	0.0	R	PT	P
HALL	42	PLATTE RIVER 79, DENMAN	9N	12W	194	0611	0	1	0.0	R	BR	M
HALL	43	PLATTE RIVER 80, WOOD RIVER	9N	11W	183	0604	4	8	0.0	R	SP	M
HALL	44	PLATTE RIVER 82, ALDA	9N	10W	181.5	0611	0	1	0.0	R	BR	M
HALL	44	PLATTE RIVER 84, ALDA	9N	10W	180	0611	0	2	0.0	R	BR	M
HALL	46	SOUTH LOCUST, GRAND ISLAND	11N	9W		0602	2	4	0.0	R	PT	P
HALL	44	SHOEMAKER I 81, ALDA	9N	10W		0604	1	2	0.0	R	BR/SG	M
HALL	44	SHOEMAKER I 83, ALDA	9N	10W		0604	1	2	0.0	R	PT	P
HAMILTON	47	OVERLAND S&G, CENTRAL CITY E	13N	6W		0603	1	2	0.0	R	PT	P
HOWARD	64	CHRISTENSEN S&G, WOLBACH SW	15N	10W		0605	3	6	0.0	R	PT	P
KEITH	24	L MCCONAUGHY 34, BELMAR	15N	40W		0604	6	13	0.0	RS	SB	M
KEITH	24	L MCCONAUGHY 35, LEMOYNE	15N	40W		0604	1	2	0.0	RS	SB	M
KEITH	25	L MCCONAUGHY 36, LEMOYNE	15N	39W		0604	1	2	0.0	RS	SB	M
KEITH	25	L MCCONAUGHY 37, LEMOYNE	15N	39W		0604	0	2	0.0	RS	SB	M
KEITH	25	L MCCONAUGHY 38, LEMOYNE	15N	39W		0604	0	1	0.0	RS	SB	M
KEITH	26	L MCCONAUGHY 40, MARTIN	15N	38W		0604	0	1	0.0	RS	SB	M
KEITH	26	L MCCONAUGHY 41, MARTIN	15N	38W		0604	1	3	0.0	RS	SB	M
KEITH	26	L MCCONAUGHY 42, MARTIN	15N	38W		0604	0	1	0.0	RS	SB	M
KEITH	26	L MCCONAUGHY 43, OGALLALA	15N	38W		0604	2	6	0.0	RS	SB	M
KEITH	26	L MCCONAUGHY 44, OGALLALA	15N	38W		0604	1	2	0.0	RS	SB	M
KEITH	26	L MCCONAUGHY 45, OGALLALA	15N	38W		0604	0	2	0.0	RS	SB	M
KEITH	29	L MCCONAUGHY 47, OGALLALA	14N	39W		0605	2	4	0.0	RS	SB	M
KEITH	28	L MCCONAUGHY 48, BRULE NE	14N	39W		0605	1	3	0.0	RS	SB	M
KEITH	28	L MCCONAUGHY 49, BRULE NE	14N	39W		0605	1	2	0.0	RS	SB	M
KEITH	28	L MCCONAUGHY 50, BRULE NE	15N	39W		0605	3	5	0.0	RS	SB	M
KEITH	28	L MCCONAUGHY 51, BRULE NE	15N	39W		0604	1	5	0.0	RS	SB	M
KEITH	27	L MCCONAUGHY 52, BRULE NE	15N	39W		0604	1	5	0.0	RS	SB	M
KEITH	27	L MCCONAUGHY 53, BRULE NE	15N	40W		0604	0	2	0.0	RS	SB	M
KEITH	27	L MCCONAUGHY 54, BRULE NE	15N	40W		0604	1	2	0.0	RS	SB	M
KEITH	27	L MCCONAUGHY 55, BELMAR	15N	40W		0604	0	1	0.0	RS	SB	M
KNOX	13	24R NIOBRARA, MONOWI	32N	8W	20.2	0619	0	4	0.0	R	BR	M
KNOX	14	25R NIOBRARA, PISHELVILLE	32N	8W	17.0	0619	6	12	0.0	R	BR	M

NEBRASKA cont.

COUNTY	MAP #	SPECIFIC SITE, QUAD NAME,	TOWNSHIP	RANGE	RIVER MI	DATE	PAIRS	ADULTS	HABITAT KM	HABITAT GEN/MICRO	OWNER
KNOX	14	26R NIOBRARA, PISHELVILLE	32N	8W	15.6	0619	1	2	0.0 R	BR	M
KNOX	14	28R NIOBRARA, PISHELVILLE	32N	7W	13.1	0619	1	2	0.0 R	BR	M
KNOX	15	29R NIOBRARA, PISHELVILLE	32N	7W	10.5	0619	0	1	0.0 R	BR	M
KNOX	16	30R NIOBRARA, VERDIGRE NE	31N	7W	7.9	0619	1	4	0.0 R	BR	M
KNOX	17	32R NIOBRARA, VERDIGRE NE	32N	6W	2.2	0619	1	2	0.0 R	BR	M
MADISON	20	NORTHEAST S&G, NORFOLK	23N	1W		0620	1	2	0.0 R	PT	P
MERRICK	47	CNTRL CITY SPOR CENTRAL CITY W	13N	6W		0603	2	3	0.0 R	PT	P
MERRICK	47	VIPPERMAN PIT, CENTRAL CITY E	13N	6W		0603	1	1	0.0 R	PT	P
NANCE	65	LOUP RIVER DIVR, FULLERTON NE	17N	4W		0604	3	10	0.0 R	PT	P
PHELPS	38	S CHANNEL 71, ELM CREEK EAST	8N	17W		0605	3	6	0.0 R	PT	P
PHELPS	38	S CHANNEL 72, ELM CREEK EAST	8N	17W		0605	3	5	0.0 R	PT	P
PLATTE	66	CNT LYMAN-RICH2, DUNCAN	17N	1W		0604	1	2	0.0 R	PT	P
PLATTE	67	COLUMBUS PIT #1, DUNCAN	17N	1W		0604	1	2	0.0 R	PT	P
PLATTE	68	COLUMBUS PIT #2, COLUMBUS	17N	1W		0604	2	2	0.0 R	PT	P
PLATTE	48	PLATTE RIV 101, COLUMBUS	16N	1E	102.7	0613	0	2	0.0 R	BR	M
ROCK/KEYA PAHA	2	2R NIOBRARA, BASSETT NW	32N	20W	97.7	0618	0	22	0.0 R	BR	M
ROCK/KEYA PAHA	3	3R NIOBRARA, RIVERVIEW	32N	19W	93.6	0618	1	2	0.0 R	BR	M
ROCK/KEYA PAHA	3	4R NIOBRARA, RIVERVIEW	32N	19W	92.6	0618	1	2	0.0 R	BR	M
ROCK/KEYA PAHA	4	5R NIOBRARA, RIVERVIEW	32N	19W	90.5	0618	4	8	0.0 R	BR	M
ROCK/KEYA PAHA	4	6R NIOBRARA, RIVERVIEW	32N	19W	90.0	0618	0	9	0.0 R	BR	M
ROCK/KEYA PAHA	5	7R NIOBRARA, MARIAVILLE	32N	17W	80.9	0618	4	8	0.0 R	BR	M
ROCK/KEYA PAHA	6	8R NIOBRARA, MARIAVILLE	33N	17W	75.3	0618	0	1	0.0 R	BR	M
SARPY	58	GRETNA, ASHLAND EAST	13N	10E		0603	0	4	0.0 R	PT	P
SARPY	60	SCHRAMM BAR, SPRINGFIELD	12N	11E	18	0604	0	2	0.0 R	BR	M
SAUNDERS	52	BLUFF GRAVEL, NORTH BEND	17N	6E		0604	1	3	0.0 R	PT	P
SAUNDERS	52	PLATTE VLY PIT, NORTH BEND	17N	6E		0604	1	2	0.0 R	PT	P
SAUNDERS	58	WESTERN SOUTH, ASHLAND EAST	13N	10E		0603	1	6	0.0 R	PT	P
STANTON	21	PILGER, STANTON	23N	3E		0620	0	0	0.0 R	BR	M
VALLEY	63	OLSON, ORD NW	20N	14W		0617	2	4	0.0 R	PT	P

ESSENTIAL PIPING PLOVER HABITAT
-- NEBRASKA --



NORTH DAKOTA

COUNTY	MAP #	SPECIFIC SITE, QUAD NAME,	TOWNSHIP	RANGE	RIVER MI	DATE	PAIRS	ADULTS	KM	HABITAT GEN	HABITAT MICRO	OWNER
BENSON	69	PFEIFER LAKE	155	71			0	4	0.0	A		P
BENSON	69	SHIVELY WPA	156	71			0	4	0.0	A		F
BURKE	42	LOSTWOOD NWR	159	91		0607	31	78	22.5	A		F
BURLEIGH	35	LAKE ARENA	142	75		0606	0	8	0.0	A	AM	S
BURLEIGH	36	LONG LAKE NWR	138	75		0614	2	7	6.4	A	AM	F
BURLEIGH	35	RACHEL HOFF WPA	142	75		0606	2	6	4.8	A	AM	F
DIVIDE	2	MILLER LAKE	162	102		0627	17	39	4.8	A	AM	M
DIVIDE	2	NORTH LAKE N&W	162	102		0624	2	4	1.8	A	AM	M
DUNN	12	LAKE ILO NWR	145	94		0613	6	17	4.8	A	AM	F
EDDY	70	LAKE COE	149	63		0606	3	14	1.9	A	AM	M
EMMONS	39	LAKE OAHE 1265	133	79	1265	0605	6	12	0.8	RS	BR	F
EMMONS	38	LAKE OAHE 1268	134	79	1268	0604	0	1	0.4	RS	BR	F
EMMONS	38	LAKE OAHE 1270	134	79	1270	0604	0	1	0.8	RS	BR	F
EMMONS	38	LAKE OAHE 1272	135	79	1272	0604	1	2	0.4	RS	BR	F
EMMONS	38	LAKE OAHE 1274	135	79	1274	0604	0	1	0.8	RS	BR	F
EMMONS	38	LK OAHE 1268.5	134	79	1268.5	0604	1	2	0.4	RS	BR	F
KIDDER	53	BIG MUDDY LAKE	140	72		0611	1	2	6.4	A	AM	M
KIDDER	52	HORSEHEAD LAKE				0611	1	2	17.7	A	AM	M
KIDDER	53	SIBLEY LAKE	140	72		0611	3	6	8.0	A	AM	M
KIDDER	53	SPRING LAKE	140	71		0529	0	12	0.0	A	AM	M
LOGAN	65	BALTZER WPA	134	70		0611	6	18	2.4	A	AM	F
LOGAN	62	EBERLE LAKE	135	69		0612	0	6	0.0	A	AM	M
LOGAN	63	SCHWEIGERT WPA	134	69		0612	0	4	0.0	A	AM	F
MCHENRY	45	BROMLEY LAKE	153	75		0606	0	1	0.0	A	AM	M
MCHENRY	45	CROOKED LAKE	153	75		0606	1	2	0.0	A	AM	M
MCHENRY	45	LAKE LEMER	153	75		0611	0	4	0.0	A	AM	M
MCINTOSH	66	TURKEY ISLAND	131	68		0610	6	33	4.8	A	IS	M
MCLEAN	15	ARIKARA BAY	149	90		0613	4	13	0.0	RS		M
MCLEAN	18	CRYSTAL LAKE	150	84		0603	0	41	0.0	A	AM	M
MCLEAN	14	DEEPWATER CREEK BAY	149	90		0613	30	60	0.0	RS		M
MCLEAN	20	DOUGLAS CREEK BAY	147	86		0627	2	7	0.0	RS		M
MCLEAN	16	ELBOWOODS BAY 1	148	90		0613	2	4	0.0	RS		M
MCLEAN	16	ELBOWOODS BAY 2	148	90		0614	4	8	0.0	RS		M
MCLEAN	19	ENGEL LAKE	149	84		0603	0	12	0.0	A	AM	M
MCLEAN	19	ENGEL LAKE NW	149	84		0603	0	1	0.0	A	AM	M
MCLEAN	20	GARRISON COTTAG	147	85		0627	5	11	0.0	RS		M
MCLEAN		GAUB WPA				0529	0	2	0.0	A	AM	M
MCLEAN	17	GOOD BEAR BAY 1	148	90		0613	3	6	1.6	RS		M
MCLEAN	17	GOOD BEAR BAY 2	148	89		0614	6	12	0.0	RS		M

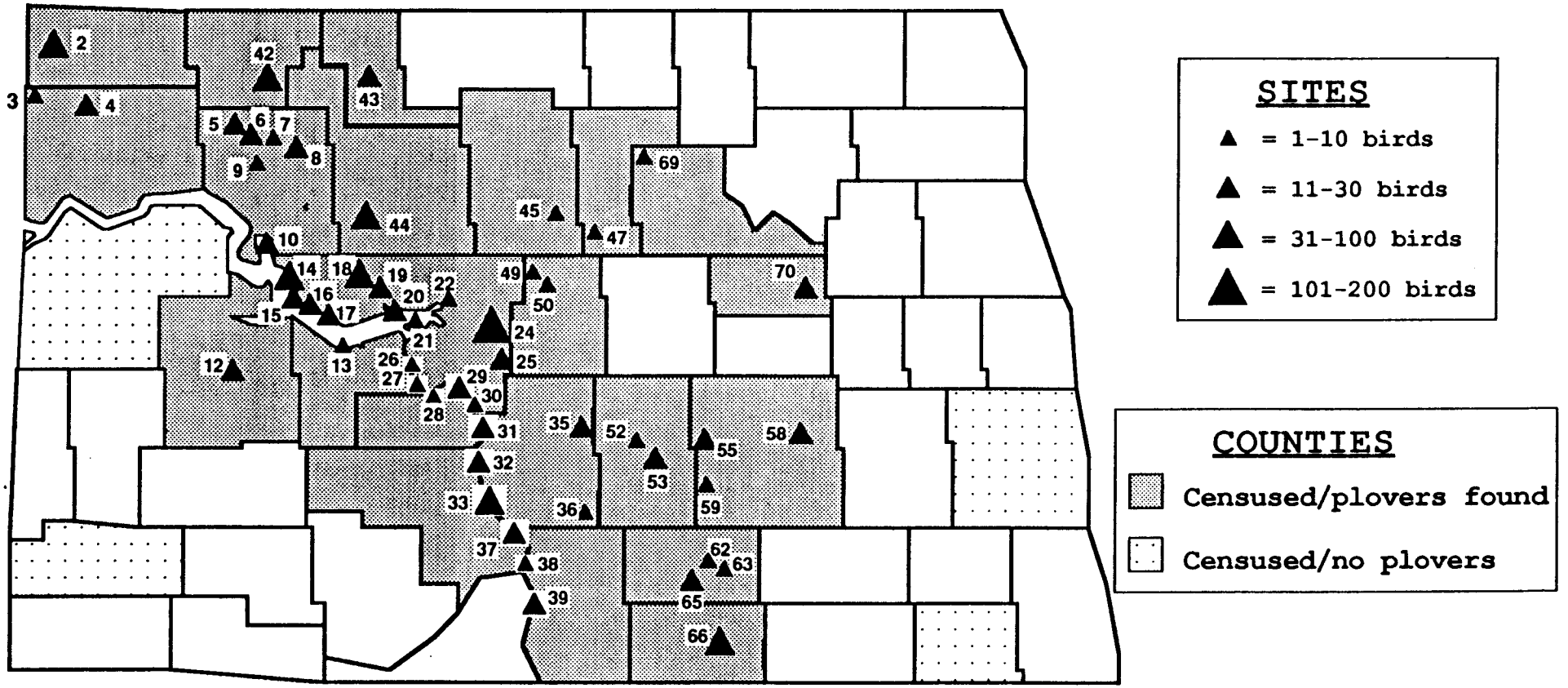
NORTH DAKOTA cont.

COUNTY	MAP #	SPECIFIC SITE, QUAD NAME, TOWNSHIP/RANGE, RIVER MI				DATE	PAIRS	ADULTS	KM	HABITAT GEN	HABITAT MICRO	OWNER
MCLEAN	24	JOHN E. WILLIAMS PRESERVE	147	80		0612	76	152	0.0	A	AM	F
MCLEAN	25	KOENIG WPA				0610	2	5	3.2	A	AM	M
MCLEAN	22	LAKE NETTIE	148	81			0	2	0.0	A		F
MCLEAN	17	LK SAKAKAWEA 1	148	90		0614	1	2	0.0	RS		M
MCLEAN		LK SAKAKAWEA 2	148	90		0614	1	2	0.0	RS		M
MCLEAN	10	LK SAKAKAWEA 3	151	91		0613	2	4	0.0	RS		M
MCLEAN	16	LK SAKAKAWEA 5	148	90		0613	1	2	0.0	RS		M
MCLEAN	21	MALLARD ISLAND	147	84		0627	5	10	0.0	RS	IS	M
MERCER	32	HILLE GMA	146	87			1	2	0.0	RS		F
MERCER	32	LK SAKAKAWEA 4	146	88			1	2	0.0	RS		M
MERCER	32	REE BAY	146	88			1	2	0.0	RS		M
MERCER/MCLEAN	27	MISSOURI 1366	144	83	1366		0	3	0.0	R	BR	F
MERCER/MCLEAN	27	MISSOURI 1369	144	83	1369		0	4	0.0	R	BR	F
MERCER/MCLEAN	26	MISSOURI 1380	145	84	1380		0	1	0.0	R	BR	F
MORTON/BURLEIGH	33	MISSOURI 1287	136	79	1287		0	6	0.0	R	BR	F
MORTON/BURLEIGH	33	MISSOURI 1288.5	137	79	1288.5		0	5	0.0	R	BR	F
MORTON/BURLEIGH	33	MISSOURI 1292	137	79	1292		0	2	0.0	R	BR	F
MORTON/BURLEIGH	33	MISSOURI 1294	137	80	1294		0	1	0.0	R	BR	F
MORTON/BURLEIGH	33	MISSOURI 1296.5	137	80	1296.5		0	2	0.0	R	BR	F
MORTON/BURLEIGH	33	MISSOURI 1299.5	137	80	1299.5		0	2	0.0	R	BR	F
MORTON/BURLEIGH	33	MISSOURI 1300.5	137	80	1300.5		0	6	0.0	R	BR	F
MORTON/BURLEIGH	33	MISSOURI 1301.5	137	80	1301.5		0	2	0.0	R	BR	F
MORTON/BURLEIGH	33	MISSOURI 1302.5	137	80	1302.5		0	3	0.0	R	BR	F
MORTON/BURLEIGH	33	MISSOURI 1304	137	80	1304		0	2	0.0	R	BR	F
MORTON/BURLEIGH	33	MISSOURI 1306.5	138	80	1306.5		0	1	0.0	R	BR	F
MORTON/BURLEIGH	33	MISSOURI 1309	138	80	1309		0	7	0.0	R	BR	F
MORTON/BURLEIGH	33	MISSOURI 1310	138	81	1310		0	6	0.0	R	BR	F
MORTON/BURLEIGH	32	MISSOURI 1320	139	81	1320		0	1	0.0	R	BR	F
MORTON/BURLEIGH	32	MISSOURI 1321	139	81	1321		0	2	0.0	R	BR	F
MORTON/BURLEIGH	32	MISSOURI 1322	140	81	1322		0	2	0.0	R	BR	F
MORTON/BURLEIGH	32	MISSOURI 1324	140	81	1324		0	4	0.0	R	BR	F
MORTON/BURLEIGH	32	MISSOURI 1326	140	81	1326		0	1	0.0	R	BR	F
MORTON/BURLEIGH	32	MISSOURI 1327	140	81	1327		0	2	0.0	R	BR	F
MORTON/BURLEIGH	32	MISSOURI 1328	140	81	1328		0	2	0.0	R	BR	F
MORTON/EMMONS	37	MISSOURI 1277.5	135	79	1277.5		0	3	0.0	R	BR	F
MORTON/EMMONS	37	MISSOURI 1278	135	79	1278		0	3	0.0	R	BR	F
MORTON/EMMONS	37	MISSOURI 1279	136	79	1279		0	2	0.0	R	BR	F
MORTON/EMMONS	37	MISSOURI 1279.5	136	79	1279.5		0	6	0.0	R	BR	F
MORTON/EMMONS	37	MISSOURI 1282	136	79	1282		0	1	0.0	R	BR	F

NORTH DAKOTA cont.

COUNTY	MAP #	SPECIFIC SITE, QUAD NAME, TOWNSHIP/RANGE, RIVER MI				DATE	PAIRS	ADULTS	KM	HABITAT GEN/MICRO	OWNER
MORTON/EMMONS	37	MISSOURI 1282.5	136	79	1282.5		0	1	0.0	R BR	F
MORTON/EMMONS	37	MISSOURI 1283	136	79	1283		0	5	0.0	R BR	F
MORTON/EMMONS	37	MISSOURI 1284	136	79	1284		0	2	0.0	R BR	F
MORTON/EMMONS	37	MISSOURI 1285	136	79	1285		0	2	0.0	R BR	F
MOUNTRAIL	5	COTTONWOOD LAKE	157	92		0613	15	30	9.7	A AM	M
MOUNTRAIL	9	PALERMO SW	156	90		0617	0	2	0.0	A AM	S
MOUNTRAIL	8	REDMOND LAKES	157	89		0618	0	19	0.0	A AM	F
MOUNTRAIL		US 1G WPA				0610	4	8	2.4	A AM	F
MOUNTRAIL	10	VAN HOOK ARM	151	92		0612	8	17	0.0	RS	M
MOUNTRAIL	7	WEST PALERMO				0617	0	7	0.0	A AM	M
MOUNTRAIL	6	WHITE LAKE	157	91		0613	6	13	8.0	A AM	M
OLIVER/BURLEIGH	31	MISSOURI 1335.5	141	81	1335.5		0	4	0.0	R BR	F
OLIVER/BURLEIGH	31	MISSOURI 1338.5	142	81	1338.5		0	2	0.0	R BR	F
OLIVER/BURLEIGH	31	MISSOURI 1341.5	142	81	1341.5		0	1	0.0	R BR	F
OLIVER/BURLEIGH	31	MISSOURI 1343	142	81	1343		0	1	0.0	R BR	F
OLIVER/BURLEIGH	31	MISSOURI 1343.5	142	81	1343.5		0	4	0.0	R BR	F
OLIVER/MCLEAN	30	MISSOURI 1347.5	143	81	1347.5		0	1	0.0	R BR	F
OLIVER/MCLEAN	30	MISSOURI 1348.5	143	81	1348.5		0	6	0.0	R BR	F
OLIVER/MCLEAN	29	MISSOURI 1353.5	144	81	1353.5		0	5	0.0	R BR	F
OLIVER/MCLEAN	29	MISSOURI 1354.5	144	82	1354.5		0	1	0.0	R BR	F
OLIVER/MCLEAN	29	MISSOURI 1355.5	144	82	1355.5		0	3	0.0	R BR	F
OLIVER/MCLEAN	29	MISSOURI 1357	144	82	1357		0	1	0.0	R BR	F
OLIVER/MCLEAN	29	MISSOURI 1361	144	83	1361		0	1	0.0	R BR	F
OLIVER/MCLEAN	27	MISSOURI 1364	144	83	1364		0	2	0.0	R BR	F
PIERCE	47	LITTLE ANTELOPE	152	73		0611	0	4	0.0	A AM	M
RENVILLE	43	UPPERSOURIS NWR	159	85		0610	0	15	57.9	A AM	F
SHERIDAN	51	LONETREE WMA				0607	4	9	11.6	A AM/GS	S
SHERIDAN	49	MOESNER LAKE	150	77		0606	0	8	0.0	A AM	M
STUTSMAN	55	CHASE LAKE NWR	141	69		0615	4	16	9.7	A AM	F
STUTSMAN	58	JIM LAKE	143	64		0605	3	12	1.1	A AM	M
STUTSMAN	59	STINK LAKE	139	69		0607	0	1	4.8	A AM	M
WARD	44	ROBERTS LAKE	152	86		0604	0	7	0.0	A AM	M
WARD	44	SCHAEFER LAKE	153	86		0604	0	26	0.0	A AM	M
WARD	44	SIMONSON LAKE	153	86		0604	0	3	0.0	A AM	M
WARD	44	WARD COUNTY #1	153	87		0604	0	8	0.0	A AM	F
WILLIAMS	4	ALKALI LAKE				0625	4	11	14.0	A AM	M
WILLIAMS	3	HORSESHOE LAKE	159	103			0	2	0.0	A	

ESSENTIAL PIPING PLOVER HABITAT
-- NORTH DAKOTA --



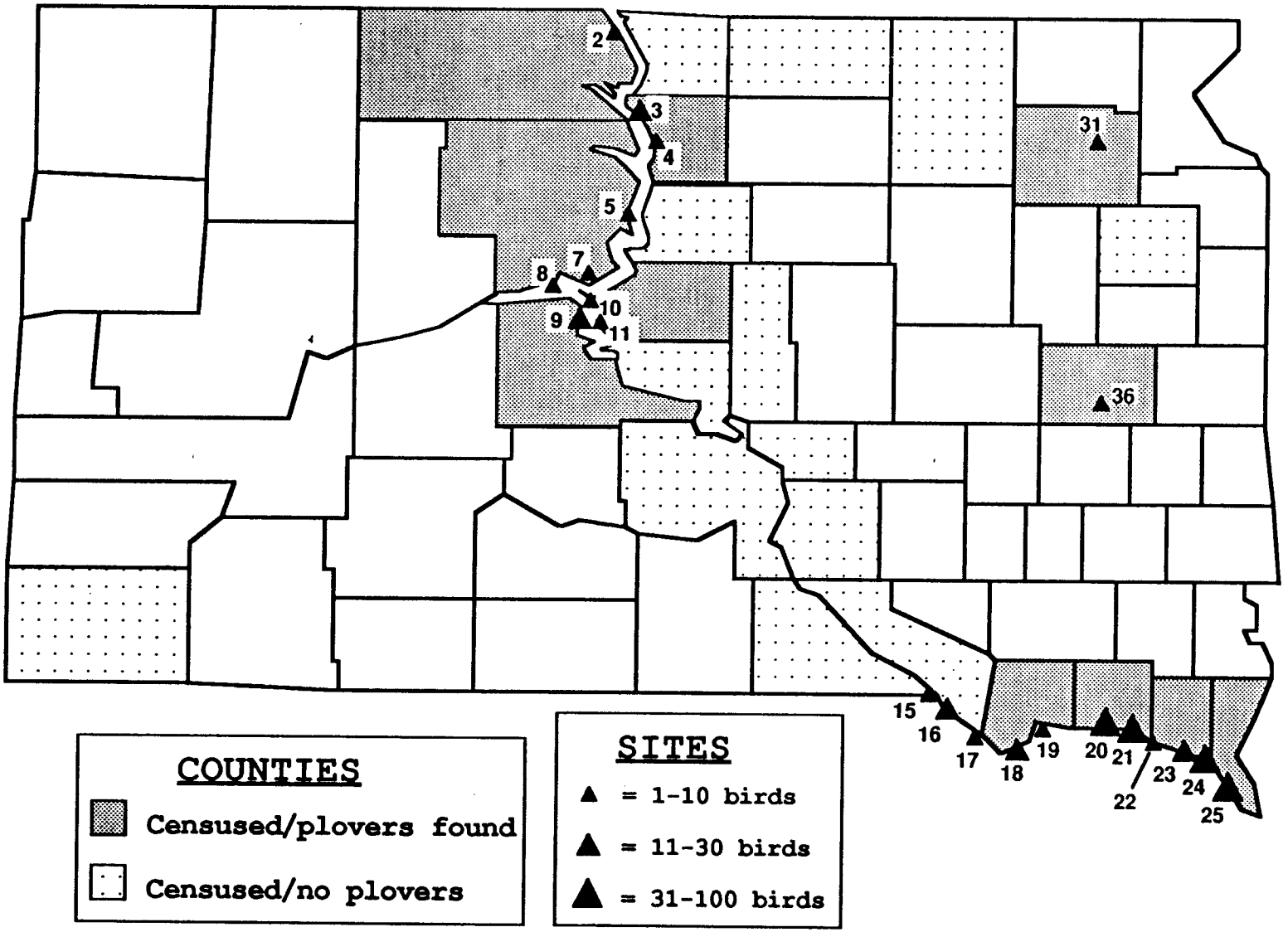
SOUTH DAKOTA

COUNTY	MAP #	SPECIFIC SITE, QUAD NAME, TOWNSHIP/RANGE, RIVER MI	DATE	PAIRS	ADULTS	HABITAT KM	HABITAT GEN/MICRO	HABITAT OWNER
BON HOMME	19	MISSRI R 832.0, SPRINGFIELD 92N 60W 832.0	0613	1	3	0.0	R BR/SG	
BON HOMME	19	MISSRI R 832.8, SPRINGFIELD 92N 60W 832.8	0613	1	2	0.0	R BR/SG	
BON HOMME	19	MISSRI R 833.1, SPRINGFIELD 92N 60W 833.1	0613	0	1	0.0	R BR/SG	
BON HOMME	19	MISSRI R 833.8, SPRINGFIELD 92N 60W 833.8	0613	0	1	0.0	R BR/SG	
BON HOMME	18	MISSRI R 838.0, SPRINGFIELD 92N 60W 838.0	0613	2	5	0.0	R BR/SG	
BON HOMME	18	MISSRI R 840.0, NIOBRARA 92N 60W 840.0	0613	5	10	0.0	R BR/SG	
BON HOMME	18	MISSRI R 843.0, NIOBRARA 92N 61W 843.0	0613	5	11	0.0	R BR/SG	
CAMPBELL/CORSON	2	MISSOURI R 1220, MAHTO NE 1220	0612	4	8	43.4	RS BR/SG	I/M
CHARLES MIX	17	MISSRI R 853.8, VERDEL 93N 62W 853.8	0613	1	2	0.0	R BR/SG	
CHARLES MIX	16	MISSRI R 866.7, MARTY 94N 64W 866.7	0613	2	4	0.0	R BR/SG	
CHARLES MIX	16	MISSRI R 867.4, MARTY 94N 64W 867.4	0613	1	2	0.0	R BR/SG	
CHARLES MIX	16	MISSRI R 869.5, MARTY 94N 64W 869.5	0613	6	12	0.0	R BR/SG	
CHARLES MIX	15	MISSRI R 871.5, MARTY 94N 65W 871.5	0613	0	1	0.0	R BR/SG	
CHARLES MIX	15	MISSRI R 875.0, FT RANDALL D 95N 65W 875.0	0613	1	3	0.0	R BR/SG	
CLAY	24	MISSRI R 768.4, BURBANK 91N 51W 768.4	0606	3	6	0.0	R BR/SG	
CLAY	24	MISSRI R 770.1, BURBANK 91N 51W 770.1	0606	6	13	0.0	R BR/SG	
CLAY	24	MISSRI R 770.3, BURBANK 91N 51W 770.3	0606	2	4	0.0	R BR/SG	
CLAY	24	MISSRI R 770.5, BURBANK 91N 51W 770.5	0606	2	5	0.0	R BR/SG	
CLAY	24	MISSRI R 771.2, MASKELL 91N 51W 771.2	0606	3	7	0.0	R BR/SG	
CLAY	24	MISSRI R 772.5, MASKELL 91N 51W 772.5	0606	4	8	0.0	R BR/SG	
CLAY	23	MISSRI R 775.0, MASKELL 91N 52W 775.0	0606	2	4	0.0	R BR/SG	
CLAY	23	MISSRI R 776.9, MASKELL 91N 52W 776.9	0606	1	2	0.0	R BR/SG	
CLAY	23	MISSRI R 778.5, VERMILLION 92N 52W 778.5	0606	3	6	0.0	R BR/SG	
CLAY	23	MISSRI R 781.4, MECKLING 92N 52W 781.4	0606	1	2	0.0	R BR/SG	
CLAY	22	MISSRI R 790.6, ST HELENA 92N 53W 790.6	0606	1	2	0.0	R BR/SG	
DAY	31	S WAUBAY LAKE, ROSLYN 122N 55W	0603	0	1	0.0	A	F/M
DEWEY/POTTER	5	MISSOURI R 1165, FOUR BEAR 1165	0702	4	9	14.5	RS BR/SG	I/M
DEWEY/STANLEY/S	7&8	MISSOURI R 1110, ARTICHOKE BUTT 1110	0626	3	6	40.2	RS BR/SG	I/M
KINGSBURY	36	LAKE THOMPSON, LAKE PRESTON 109N 55W	0520	1	2	0.0	A	M
STANLEY/SULLY/D	9&10	MISSOURI R 1100, NO HEART CR SW 1100	0612	8	21	16.1	RS BR/SG	I/M
SULLY/STANLEY	11	MISSOURI R 1088, IRONPOST SE 1088	0610	2	5	19.3	RS BR/SG	M
UNION	25	MISSRI R 756.8, ELK POINT 90N 50W 756.8	0606	1	2	0.0	R BR/SG	
UNION	25	MISSRI R 757.3, ELK POINT 90N 49W 757.3	0606	8	17	0.0	R BR/SG	
UNION	25	MISSRI R 759.0, ELK POINT 91N 50W 759.0	0606	9	18	0.0	R BR/SG	
UNION	24	MISSRI R 766.2, BURBANK 91N 50W 766.2	0606	5	10	0.0	R BR/SG	
WALWORTH	4	MISSOURI R 1185, MOREAU NE 1185	0706	2	4	16.1	RS BR/SG	I/M
WALWORTH	3	MISSOURI R 1188, MOBRIDGE 1188	0612	8	15	32.2	RS BR/SG	I/M
YANKTON	21	MISSRI R 797.0, ST HELENA 93N 54W 797.0	0606	6	12	0.0	R BR/SG	

SOUTH DAKOTA cont.

COUNTY	MAP #	SPECIFIC SITE, QUAD NAME, TOWNSHIP/RANGE, RIVER MI	DATE	PAIRS	ADULTS	HABITAT KM	HABITAT GEN/MICRO	OWNER
YANKTON	21	MISSRI R 797.1, ST HELENA 93N 54W 797.1	0606	1	2	0.0	R	BR/SG
YANKTON	21	MISSRI R 798.0, MENOMINEE 93N 54W 798.0	0606	3	7	0.0	R	BR/SG
YANKTON	21	MISSRI R 799.2, MENOMINEE 93N 54W 799.2	0606	0	1	0.0	R	BR/SG
YANKTON	21	MISSRI R 801.0, MENOMINEE 93N 55W 801.0	0606	3	6	0.0	R	BR/SG
YANKTON	20	MISSRI R 803.0, MENOMINEE 93N 55W 803.0	0606	0	1	0.0	R	BR/SG
YANKTON	20	MISSRI R 803.7, MENOMINEE 93N 55W 803.7	0606	3	6	0.0	R	BR/SG
YANKTON	20	MISSRI R 804.5, MENOMINEE 93N 55W 804.5	0606	1	3	0.0	R	BR/SG
YANKTON	20	MISSRI R 804.6, MENOMINEE 93N 55W 804.6	0606	7	15	0.0	R	BR/SG
YANKTON	20	MISSRI R 807.7, GAVINS PT DAM 93N 56W 807.7	0606	3	6	0.0	R	BR/SG

ESSENTIAL PIPING PLOVER HABITAT
-- SOUTH DAKOTA --



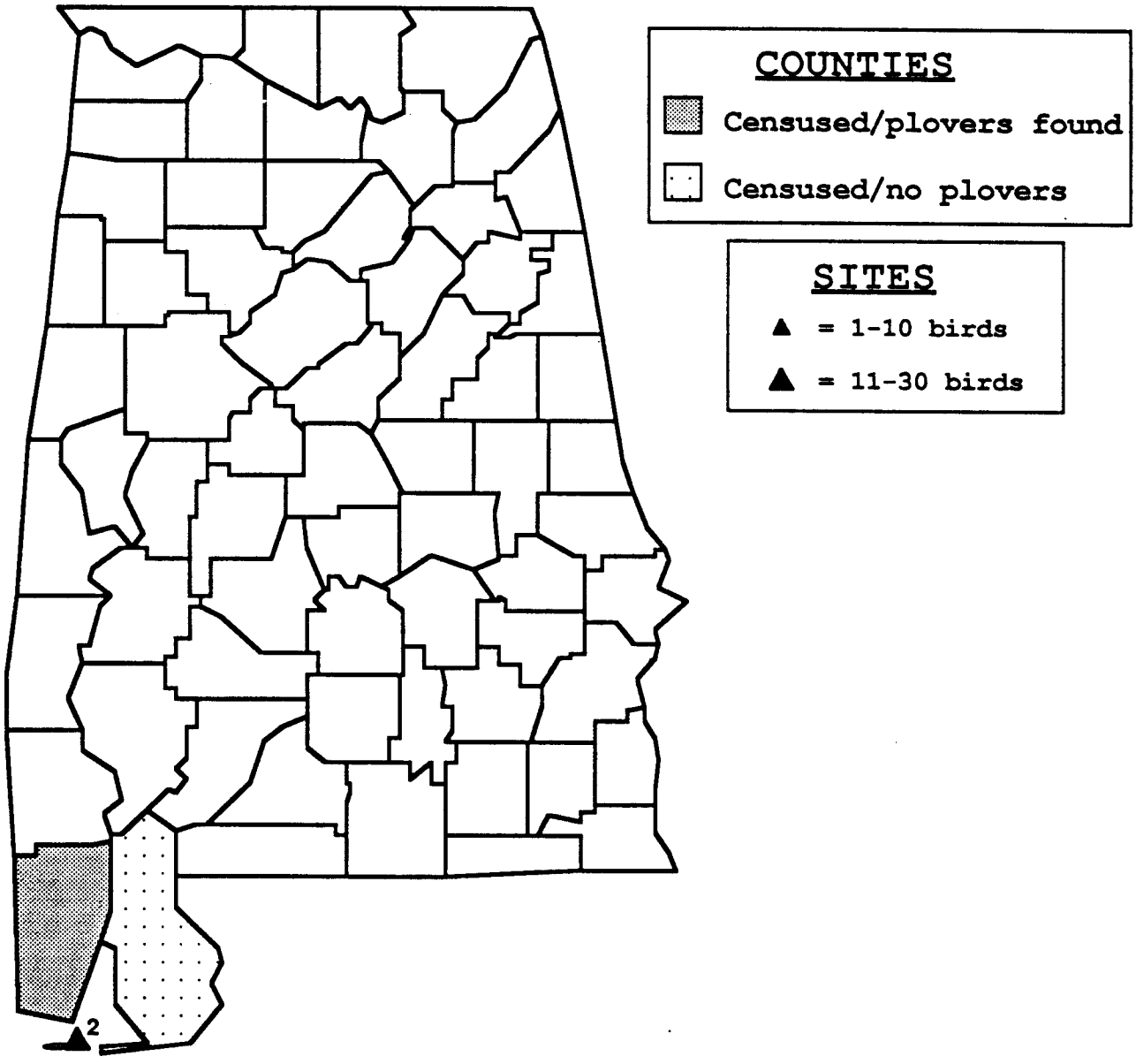
ESSENTIAL PIPING PLOVER HABITAT

WINTER SITES

ALABAMA

COUNTY	MAP #	SPECIFIC SITE, QUAD MAP NAME	DATE	ADULTS	KM	HABITAT GEN/MICRO	OWNER
MOBILE	2	LITTLE DAUPHIN ISLAND	0217	12	0.8	B CM/SF	F

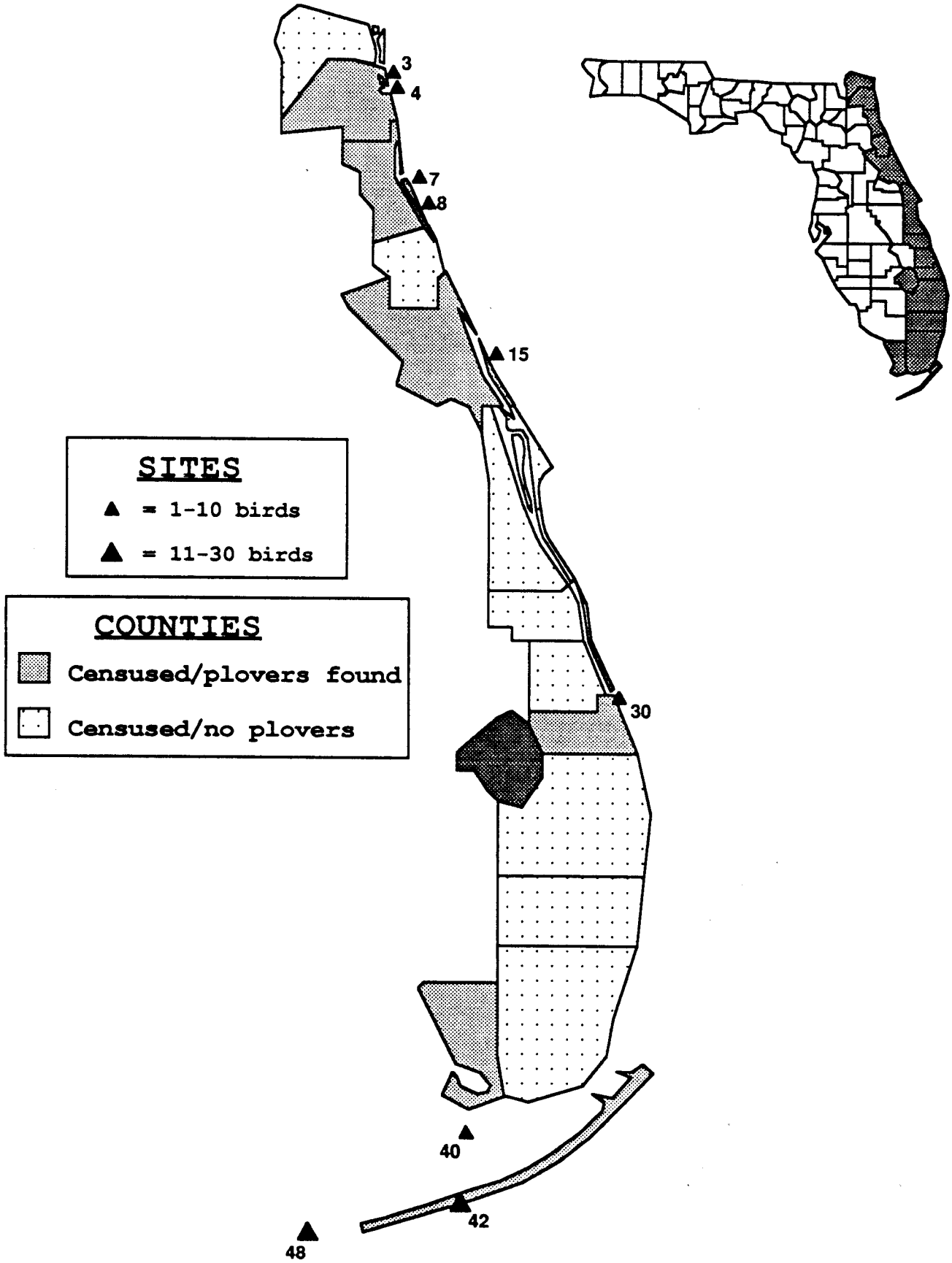
PIPING PLOVER WINTER HABITAT
-- ALABAMA --



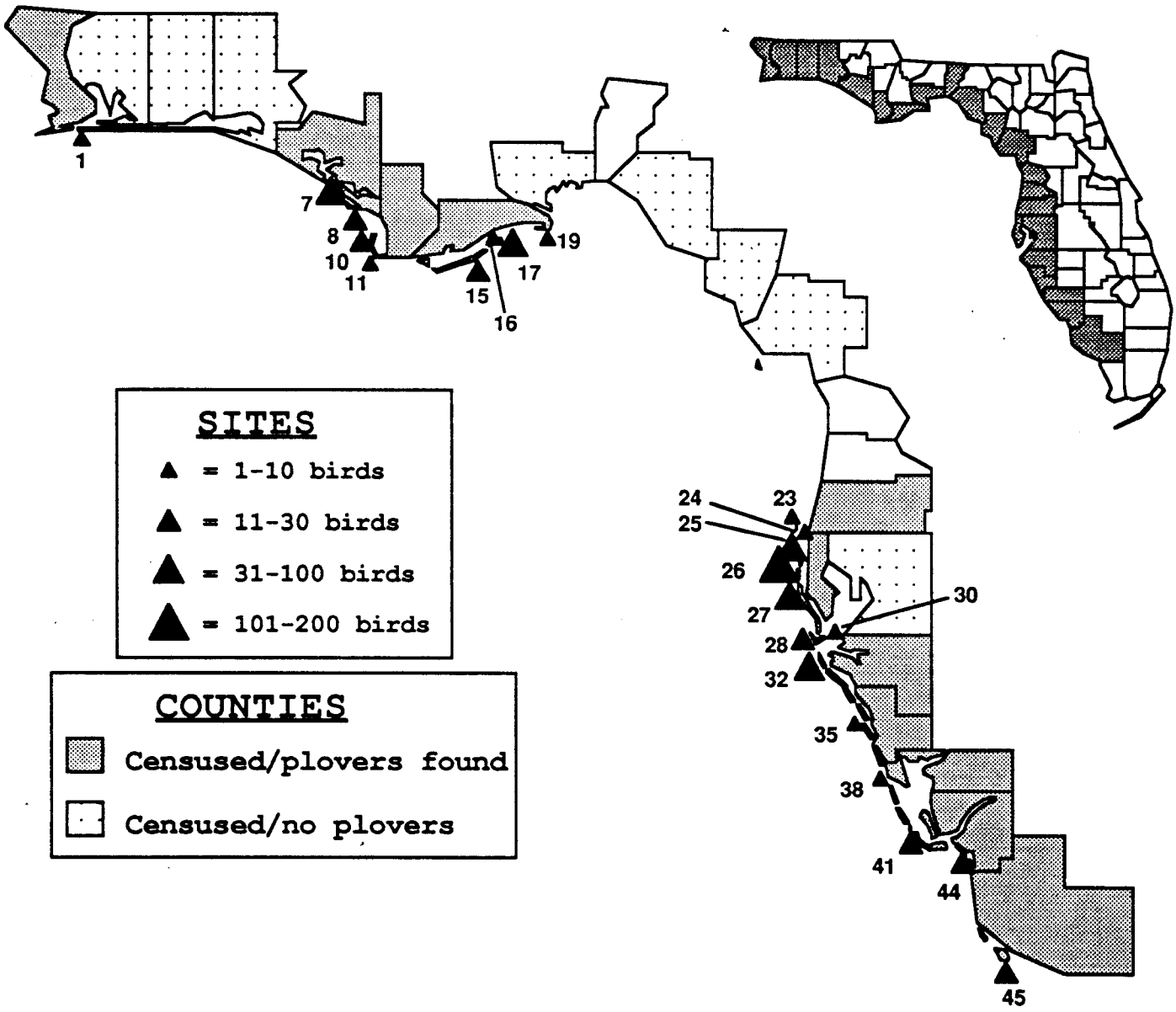
FLORIDA

COUNTY	MAP #	SPECIFIC SITE, QUAD MAP NAME	DATE	ADULTS	KM	GEN/MICRO	OWNER
BAY	G7	BAY POINT, MARRIOTT	0118	4	0.4	B CM	P
BAY	G8	CROOKED ISLAND EAST	0117	4	14.0	OB BB/CM	F
BAY	G8	CROOKED ISLAND WEST	0116	13	10.0	OB BB/CM	F
BAY	G7	SHELL ISLAND	0120	27	19.3	OB BB/SF	F
BAY	G7	ST. ANDREWS SRA	0126	2	5.1	O BB/SF	S
CHARLOTTE	G38	CHARLOTTE BEACH SRA	0131	2	1.6	O BB	S
COLLIER	G45	MARCO ISLAND		28	1.6	O BC	M
DUVAL	A4	LITTLE TALBOT, MAYPORT	0123	9	0.0	O BB	S
DUVAL	A4	WARDS BANK, MAYPORT	0120	8	3.2	B BB/SF	M
ESCAMBIA	G1	FORT PICKENS	0126	8	12.9	O BB	S
FRANKLIN	G19	ALLIGATOR POINT	0120	1	5.2	OB CM/SB	M
FRANKLIN	G16	CARRABELLE BEACH	0121	3	1.6	O CM/SB	M
FRANKLIN	G16	DOG ISLAND	0121	5	29.0	OB CM/IS	M
FRANKLIN	G17	LANARK REEF	0121	41	6.4	O BR/CM	S
FRANKLIN	G15	ST. GEORGE ISLAND	0114	9	3.2	O BB/SF	S
GULF	G11	CAPE SAN BLAS	0115	2	5.0	OB BB/CM	F
GULF	G10	ST. JOE PENINSULA	0115	17	24.0	O BB/SF	S
LEE	G44	FT. MYERS BEACH	0118	21	6.4	O BB/CM	M
LEE	G41	N. CAPTIVA ISLAND	0205	15	0.0	OB BB/CM	M
MANATEE	G32	ANNA MARIA ISLAND, BRADENTON BEACH	0117	45	32.2	OB BB/CM	M
MARTIN	A30	MARTIN COUNTY	0119	8	0.0	O BB	F/M
MONROE	A48	BOCA GRANDE KEY	0213	15	0.0	O CM/IS	F
MONROE	A40	CARL ROSS KEY, SANDY KEY	0121	5	0.5	B CM/SF	M
MONROE	A42	OHIO KEY SOUTH	0119	18	0.0	O IS	M/P
PASCO/PINELLAS	G23	ANCLOTE KEY SP	0115	5	0.6	O IS	S
PINELLAS	G27	CALADESI ISLAND SP	0115	12	4.0	O IS/SF	S
PINELLAS	G26	DUNEDIN CAUSEWAY, DUNEDIN	0116	4	4.0	B SB/SF	S
PINELLAS	G27	DUNEDIN PASS, DUNEDIN	0115	19	5.6	O CM/IS	S
PINELLAS	G24	FRED HOWARD PARK, TARPON SPRINGS	0117	1	1.6	O CM/IS	S
PINELLAS	G28	FORT DESOTO PARK, PASS-A-GRILLE	0119	19	11.3	OB CM/IS	S
PINELLAS	G26	HONEYMOON I #1, DUNEDIN	0115	83	3.2	B CM/IS	S
PINELLAS	G26	HONEYMOON I #2, DUNEDIN	0115	3	3.2	O IS/SF	S
PINELLAS	G26	HONEYMOON I #3, DUNEDIN	0115	16	0.0	B SF	S
PINELLAS	G27	SAND KEY	0116	10	5.6	O BB	M/S
PINELLAS	G30	SUNSHINE SKYWAY, PASS-A-GRILLE	0121	2	11.3	O CM/SB	S
PINELLAS	G25	THREE ROOKER BAY, DUNEDIN	0115	59	2.4	O BR/CM	S
SARASOTA	G35	MIDNIGHT PASS	0119	1	2.4	O CM	M
ST JOHNS	A8	ANASTASIA SRA, ST. AUGUSTINE	0117	1	6.4	O BB/SF	S
ST JOHNS	A7	ST AUGUSTINE/FORT-MATAN	0120	2	25.7	OB BB/CM	F/M
VOLUSIA	A15	SMYRNA DUNES PARK, NEW SMYRNA	0127	4	16.1	O BB/SF	M

PIPING PLOVER WINTER HABITAT
-- FLORIDA ATLANTIC --



PIPING PLOVER WINTER HABITAT
-- FLORIDA GULF --



LOUISIANA

COUNTY	MAP #	SPECIFIC SITE, QUAD MAP NAME	DATE	ADULTS	KM	HABITAT GEN/MICRO	OWNER
CAMERON	3	EAST JETTY/BROUSSAR, CAMERON	0126	5	11.3	O CM/SB	S
CAMERON	5	HACKBERRY BEACH, HACKBERRY BEACH	0202	3	10.5	O SB	M
CAMERON	2	HOLLY BEACH, WEST JETTY, HOLLY BEACH	0203	2	20.1	O SB	M
CAMERON	6	MERMENTAU SHIP, HACKBERRY BEACH	0123	39	26.5	O CM/SB	F/M
CAMERON	4	RUTHERFORD BEACH, GRAND BAYOU	0126	2	11.3	O SB	M
CAMERON	1	SMITHS BAYOU/HO, SMITH BAYOU	0209	14	16.9	O SB	M
LAFOURCHE	21	ELMERS ISLAND, CAMINADA PASS	0202	1	5.6	OB IS/SF	M
LAFOURCHE	19	FOURCHON BAY CHANNEL, BELLE PASS	0202	33	5.6	O CM/SB	M/S
LAFOURCHE	20	FOURCHON BEACH, BELLE PASS	0203	9	4.8	O SB/SF	P/S
ST BERNARD	25	BRETON ISLAND, BRETON ISLANDS	0116	88	5.6	O CM/IS	F
ST BERNARD	28	CHANDELEUR ISLAND, CHANDELEUR LT	0118	131	41.0	O CM/IS	F
ST BERNARD	27	CURLEW ISLAND, STAKE ISLANDS	0117	85	4.8	O SF	F
ST BERNARD	26	NORTH GRAND GOSIER, GRAND GOSIER ISLAND	0117	8	1.6	O IS/SF	F
ST BERNARD	26	SOUTH GRAND GOSIER, GRAND GOSIER ISLAND	0117	41	4.0	O SF	F
ST MARY	12	ATCHAFALAYA DEL PTAUFER NE	0204	27	3.2	OB SP	S
TERREBONNE	14	LAST ISLAND, WESTERN ISLAND	0201	43	4.8	O IS/SF	S
TERREBONNE	13	PT AU FER BEACH, PT AU FER	0205	12	15.3	O CM/SS	S
TERREBONNE	17	WEST TIMBALIER ISLAND, CAT ISLAND PASS	0207	89	10.5	O IS/SF	S
TERREBONNE	15	WESTERN EAST ISLAND, CENTRAL ISLAND	0201	86	7.2	O IS/SF	S
VERMILION	8	BIG CONSTANCE, BIG CONSTANCE LAKE	0131	8	12.9	O SB	F
VERMILION	10	CHENIERE AU TIG, CHENIERE AU TI	0201	18	4.8	O SB	M
VERMILION	9	FRESHWATER BAYO, CHENIERE AU TI	0131	5	4.8	O CM/SB	M
VERMILION	8	ROCKEFELLER NWR, ROLLOVER LAKE	0124	1	3.2	O SB	F

MISSISSIPPI

COUNTY	MAP #	SPECIFIC SITE, QUAD MAP NAME	DATE	ADULTS	KM	HABITAT GEN/MICRO	OWNER
HANCOCK	1	HANCOCK CO BEACH, WAVELAND	0118	8	12.9	O CM/SB	S
HARRISON	4	CAT ISLAND, CAT ISLAND	0114	26	27.5	O BB	P
HARRISON	7	DEER ISLAND, DEER ISLAND	0121	6	8.0	O CM/IS	S
HARRISON	3	HARRISON COUNTY BEACH, GULFPORT SOUTH	0116	2	0.0	O SB	S
HARRISON	2	PASS CHRISTIAN, BAY ST. LOUIS	0116	3	15.0	O CM/SB	M
HARRISON	5	WEST SHIP ISLAND, SHIP ISLAND		13	4.8	O BB	F
JACKSON	8	OCEAN SPRINGS BEACH, BILOXI	0115	1	11.3	O SB	S

PIPING PLOVER WINTER HABITAT
-- LOUISIANA --

SITES

▲ = 1-10 birds

▲ = 11-30 birds

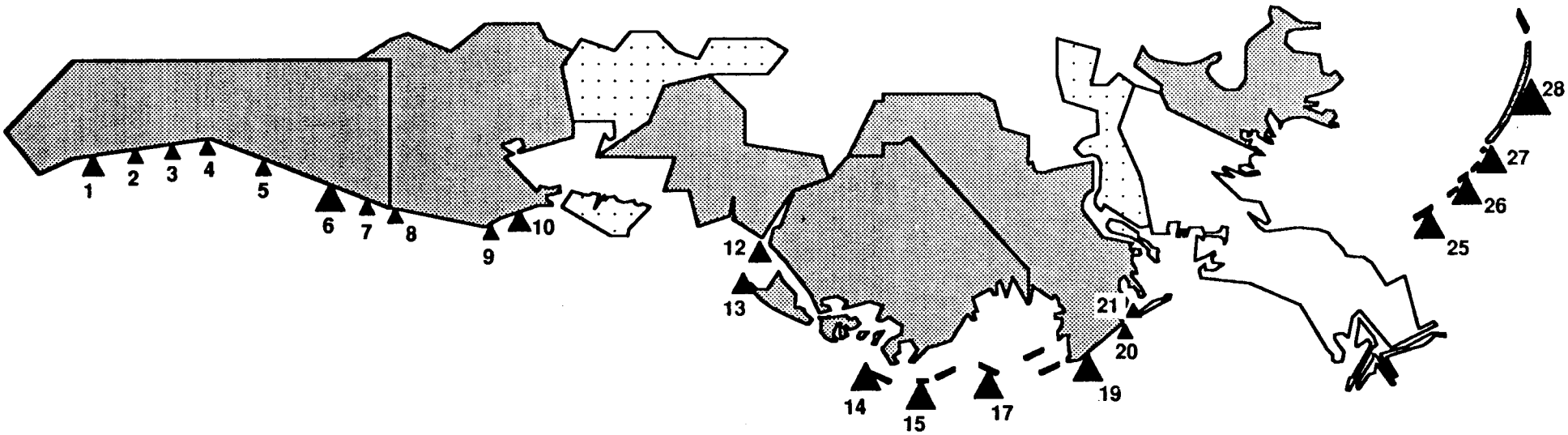
▲ = 31-100 birds

▲ = 101-200 birds

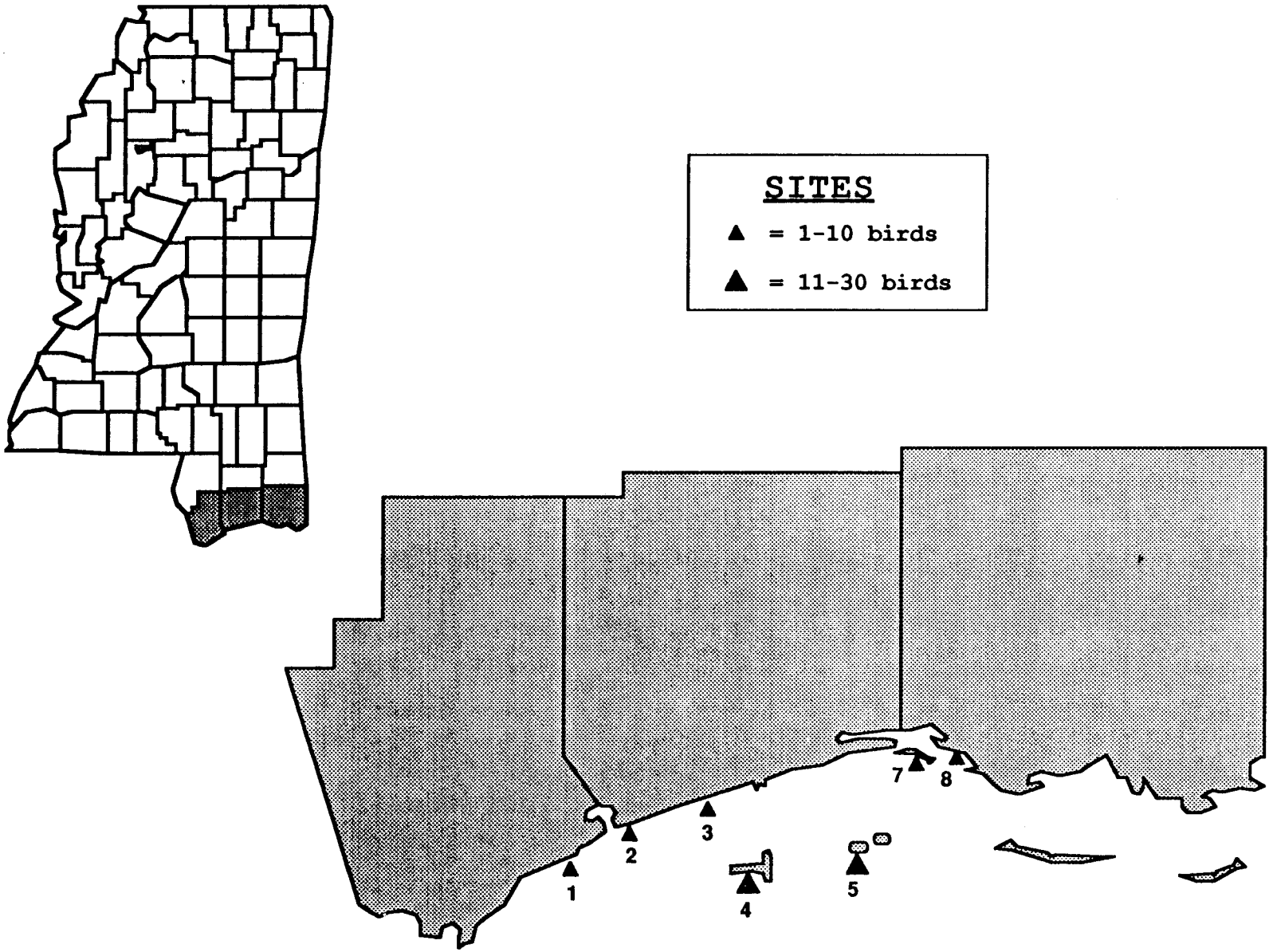
PARISHES

Censused/plovers found

Censused/no plovers



PIPING PLOVER WINTER HABITAT
-- MISSISSIPPI --



TEXAS

COUNTY	MAP #	SPECIFIC SITE, QUAD MAP NAME	DATE	ADULTS	KM	HABITAT GEN/MICRO	OWNER
ARANSAS	27	BIG BAYOU	0116	3	0.0	B CM/SF	M
ARANSAS	20	EAST SHORE, ARANSAS	0115	8	6.4	B CM/SF	F
ARANSAS	26	FULTON/INGLESID	0116	5	16.1	B BR/SG	M
ARANSAS	19	GULF INTRACOASTAL WATERWAY, ARANSAS	0114	16	0.5	B SF	F
ARANSAS	21	ST. CHARLES BAY	0114	6	5.6	B OR	M
ARANSAS	23	ST. JOSEPH ISLAND BAY	0117	209	41.2	B CM/SF	M
ARANSAS	22	ST. JOSEPH ISLAND BEACH	0117	1	30.6	O BB	M
BRAZORIA	10	BRAZOS/SOUTH BERN RIVER	0115	31	8.0	O IS/SF	M
BRAZORIA	8	FOLLETS ISLAND	0112	4	32.2	O BB	M
CALHOUN	18	CEDAR BAYOU	0116	5	0.6	B SF	F
CALHOUN	19	LIVE OAK POINT	0115	20	3.2	B SF	F
CALHOUN	18	MATAGORDA ISLAND, ARANSAS	0116	12	21.6	B CM/SF	F
CALHOUN	16	MATAGORDA ISLAND, BAY	0116	87	50.8	B CM/SF	M
CALHOUN	17	MATAGORDA ISLAND, BEACH	0116	12	61.1	O BB	M
CAMERON	53	BOCA CHICA	0113	4	16.1	O SB	M
CAMERON	53	BRAZOS ISLAND	0113	78	30.6	B CM/SF	M
CAMERON	53	BRAZOS ISLAND STATE PARK		2	0.0	O CM/SB	S
CAMERON	49	BUENA VISTA RANCH	0605	46	0.0	B BC	F
CAMERON	53	CLARK ISLAND		11	0.0	O BB/CM	M
CAMERON	51	LAGUNA ATASCOSA NWR	0115	15	0.0	B CM/SB	F
CAMERON	53	SOUTH BAY #1	0113	18	0.0	B CM/SF	M
CAMERON	53	SOUTH BAY #2	0113	15	0.0	B CM/SF	M
CAMERON	53	SOUTH BAY #3	0113	27	0.0	B CM/SF	M
CAMERON	53	VERDOLAGA LAKE	0113	7	0.0	B CM/SF	M
CAMERON	50	WEST SIDE PADRE ISLAND NORTH	0117	63	0.0	B CM/VM	M
CAMERON	52	WEST SIDE PADRE ISLAND SOUTH		19	0.0	B CM/VM	M
GALVESTON	6	BIG REEF-SAN LUIS	0112	6	48.3	O BB	M
GALVESTON	5	BIG REEF	0112	25	1.6	O SF	M
GALVESTON	4	BOLIVAR FLATS	0112	72	0.0	O SF	M
GALVESTON	2	HIGH ISLAND/ROLLOVER PASS	0112	5	85.3	O SB	F/S
GALVESTON	3	ROLLOVER PASS	0113	4	0.0	B CM	M
GALVESTON	4	ROLLOVER PASS/BOLIVER	0112	1	24.1	O BB	M
GALVESTON	7	SAN LUIS PASS	0112	40	1.6	B SB/SF	M
KENEDY	45	LAKE LAGUNA MADRE NE	0116	39	4.8	B VM	M
KENEDY	44	PADRE IS NS BEACH	0116	1	48.3	O BB	F
KENEDY	43	PENASCALA RINCON	0114	8	0.0	B CM	M
KLEBERG	38	PADRE ISLAND, BAYSIDE	0119	36	63.4	B SF	F

TEXAS

COUNTY	MAP #	SPECIFIC SITE, QUAD MAP NAME	DATE	ADULTS	KM	HABITAT GEN	HABITAT MICRO	OWNER
KLEBERG	39	PADRE ISLAND, BEACH	0119	41	59.5	O	BB	F
KLEBERG	37	SOUTH BIRD ISLAND	0128	3	11.3	B	CM/SP	F
MATAGORDA	13	MATAGORDA PENINSULA NORTH BAY	0114	12	44.5	B	CM/SF	M
MATAGORDA	12	MATAGORDA PENINSULA NORTH BEACH	0114	41	33.8	O	BB	M
MATAGORDA	14	MATAGORDA PENINSULA SOUTH BAY	0116	132	60.3	B	CM/SF	M
MATAGORDA	15	MATAGORDA PENINSULA SOUTH BEACH	0116	22	43.4	O	BB	M
MATAGORDA	11	SARGENT BEACH	0112	14	16.1	O	SB	F/M
NUECES	28	CORPUS CHRISTI BAYOU	0116	5	0.0	B	CM/SF	M
NUECES	29	DAGGER ISLAND NORTH	0114	10	0.0	B	IS/SF	M
NUECES	29	DAGGER ISLAND SOUTH	0116	15	24.1	B	CM/IS	M
NUECES	36	FLOUR BLUFF	0116	1	18.3	B	SF/VM	M
NUECES	35	GULF INTRACOASTAL WATERWAY NORTH OF JFK	0123	27	5.6	B	CM/SP	M
NUECES	29	GULF INTRACOASTAL WATERWAY, CORPUS CHRISTI CHANNEL NE	0112	29	3.9	B	SF	M
NUECES	28	HOG ISLAND	0116	10	0.0	B	CM/IS	M
NUECES	30	INGLESIDE POINT, PORT INGLESIDE	0113	10	4.5	B	CM/SF	M
NUECES	30	LA QUINTA ISLAND	0113	1	0.0	B	CM/IS	M
NUECES	31	MUSTANG ISLAND BAY	0119	16	25.7	B	CM/SF	M
NUECES	34	MUSTANG ISLAND BEACH	0119	265	40.2	O	BB	M
NUECES	29	PELICAN ISLAND	0112	10	4.8	B	CM/SF	M
NUECES	33	WARD ISLAND	0124	11	8.0	B	SF	M
REFUGIO	25	COPANO BAY BRIDGE NORTH	0114	9	1.6	B	CM	M
SAN PATRICIO	28	ARANSAS PASS CAUSEWAY	0119	1	9.7	B	CM/SF	M
SAN PATRICIO	32	INDIAN POINT	0118	10	6.4	B	SB	M
WILLACY	48	LOS BANCOS NE	0119	1	0.0	O	BB	M
WILLACY	47	PORT MANSFIELD NORTH BAY	0116	52	0.0	B	VM	F
WILLACY	47	PORT MANSFIELD PASS	0119	117	19.3	B	VM	M
WILLACY	47	PORT MANSFIELD SOUTH BAY	0119	78	0.0	B	VM	M