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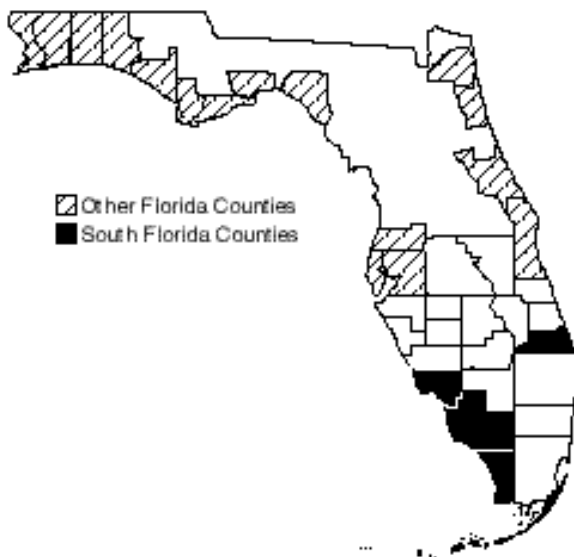
# Piping Plover

## *Charadrius melodus*

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<b>Federal Status:</b>	Threatened (Dec. 11, 1985)
<b>Critical Habitat:</b>	None Designated
<b>Florida Status:</b>	Threatened
<b>Recovery Plan Status:</b>	Contribution (May 1999)
<b>Geographic Coverage:</b>	South Florida

Figure 1. Florida distribution of the piping plover



The piping plover (*Charadrius melodus*) is a small, migratory shorebird that breeds only in three geographic regions of North America: on sandy beaches along the Atlantic Ocean, on sandy shorelines throughout the Great Lakes, and on riverine systems and prairie wetlands of the Northern Great Plains. The Great Lakes population is listed as endangered, whereas the Atlantic Coast and Great Plains populations are listed as threatened.

Though this species does not breed in Florida, individuals from the three breeding populations winter in Florida. The Atlantic Coast birds use Florida's Atlantic and Gulf of Mexico coastlines in the winter. Until recently, the Great Lakes and Great Plains populations were observed along the Gulf Coast shoreline. In 1997, piping plovers from the Great Lakes population were sighted in Georgia. Birds from all three breeding populations have been observed in the Florida Keys.

Early 20th century accounts indicate shorebird harvesting for the millinery trade was the cause of the first known major decline of the species. Since then, many factors contributed to the continued decline of the species. Habitat destruction, human disturbance of nesting and wintering birds, and predation were the main factors affecting the species when it was listed in 1985. At the time of listing, there were less than 2,500 breeding pairs estimated in the U.S. and Canada.

Piping plovers are inconspicuous due to their coloring (sand-colored above and bright white underneath) and behavior. In favored roosting, feeding, and breeding areas, piping plovers tend to spend more time walking or running than flying. Territoriality within breeding sites is well documented and has also been observed at wintering sites.

This account represents South Florida's contribution to the rangewide recovery plan for the piping plover (FWS 1988, 1996).

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### Description

Piping plovers are one of five commonly occurring North American species of belted plovers. They have an overall body length of 17 to 18 cm (National Geographic Society

1983, Haig 1992) and weigh between 46 g and 64 g (average 55 g) (Wilcox 1959, Haig 1986). Wing lengths range from 11.0 to 12.7 cm, the tarsi range from 2.1 to 2.4 cm, and culmen lengths vary from 1.0 cm to 1.4 cm (Wilcox 1959, Haig 1986). Throughout the year, adults have sand-colored upper body parts, white undersides, and orange legs. During the breeding season, adults acquire a black forehead, a single black breast band, and orange bills with black tips (Bent 1929, Graul 1973, Johnsgard 1981). In general, males have brighter bands than females, and inland birds have more complete bands than East Coast birds (Moser 1942, Wilcox 1959, Haig and Oring 1987). Postbreeding birds lose the black markings and orange on their bill, but are easily distinguished from snowy plovers (*Charadrius alexandrinus*) and collared plovers (*C. collaris*) by their slightly larger size and orange legs (Haig 1987a). Fledglings have flesh-colored legs and black bills (Wilcox 1959) and immature plumage is similar to adult non-breeding plumage. Juveniles acquire adult plumage in spring following the hatching year (Haig 1987b).

The piping plover is similar to other ringed plovers in size and body shape; however, the very pale color of its upper parts, its orange legs, and the complete white band across the upper tail coverts are diagnostic characteristics (Haig 1992).

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### Taxonomy

Described as a race of *Charadrius hiaticula* (Wilson and Bonaparte [n.d.]), the taxonomy of piping plovers has undergone a number of revisions (Wilson and Bonaparte [n.d.], AOU 1945, 1957). Ord was the first to consider piping plovers a separate species, but it was not until the fourth edition of the AOU Checklist that the binomial, *Aegialitis meloda*, was changed to *Charadrius melodus* (Ridgway 1919, AOU 1931, Moser 1942, Wilcox 1959). In addition to changes in the binomial, ornithologists have argued for over 100 years about acceptance of two subspecies: *C. m. melodus* (Atlantic birds) and *C. m. circumcinctus* (inland birds). The first two editions of the AOU Checklist listed the two forms, the third and fourth listed one form (AOU 1886, 1895, 1910, 1931). Moser's argument that breast bands differed between inland and coastal birds facilitated changing back to two forms in the 1945 supplement of the checklist. Wilcox (1959) reported a variety of breast band forms from birds on Long Island. Subsequent morphological measurements of Atlantic Coast and inland birds did not indicate there was a significant difference between birds from different regions (Moser 1942, Griscom and Snyder 1955, Wilcox 1959). Additionally, electrophoretic samples collected by Haig and Oring (1988a) from piping plovers in Saskatchewan, Manitoba, North Dakota, Minnesota, and New Brunswick, did not indicate genetic differences among local or regional populations. The subspecies designation was only included in the AOU (1957) Checklist (AOU 1983). Recent studies indicated the separation of the species into subspecies is not supported (Haig and Oring 1988a, Haig 1992).

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**Piping plover.**

*Original photograph courtesy of Theodore H. Below.*



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**Distribution**

The piping plover has a broad distribution within North America (Bell 1978, Johnsgard 1981, AOU 1983, Dinsmore 1983, Haig 1985, Haig and Oring 1985, FWS 1996). Historically, breeding occurred in three geographic regions: (1) the Northern Great Plains of the U.S. and Canada, from Alberta to Manitoba south to Kansas; (2) beaches along the Great Lakes; and (3) Atlantic coastal beaches from Newfoundland to North Carolina.

Currently, the species' range remains similar to historic range accounts except that breeding sites in the Great Lakes have almost disappeared (Cairns and McLaren 1980, Russell 1983, Haig and Oring 1985). Piping plovers are no longer known to breed in Illinois, Indiana, Ohio, Pennsylvania, and Lake Ontario (Haig 1992).

Historical winter sites were not well described, although piping plovers were generally seen along Gulf of Mexico beaches, southern U.S. Atlantic beaches from North Carolina to Florida, in eastern Mexico, and numerous islands scattered throughout the Caribbean (Ridgway 1919, Bent 1929, Nicholls and Baldassarre 1990a). The complete winter distribution of the piping plover remains to be determined, although specific Gulf and Atlantic coastal sites are becoming better recognized for their importance to wintering birds (Haig and Oring 1985, 1987; Haig 1986; Nicholls and Baldassarre 1990a; Sprandel *et al.* 1997).

Some birds, however, may winter beyond North America. Nicholls (1989) documented small numbers of birds in the Bahamas, Bermuda, Puerto Rico, Virgin Islands, and Yucatan between 1985 and 1988. Haig and Oring (1985) also reported that winter birds have been recorded in the Bahamas, Barbados, Bermuda, Cuba, Dominican Republic, Ecuador, Haiti, Jamaica, Mexico, Netherlands-Antilles, Puerto Rico, U.S. Virgin Islands, and the West Indies by various observers between 1929 and 1984. The broad range of the sightings and

the limited number observed indicates that a substantial number of piping plovers may use winter sites outside the U.S.

In 1991, 10 nations participated in an international census of wintering and breeding habitat of the piping plover (Haig and Plissner 1992). The number of birds identified during the winter census (3,451 individuals) comprised 63 percent of those noted during the breeding census (5,482 individuals). In general, birds from the Great Lakes/Northern Great Plains populations tended to winter in the Gulf of Mexico, while those from the Atlantic Coast population wintered along the coastline further to the south. Though some crossover of these populations did occur, the moratorium on banding Atlantic Coast birds affected identifying the actual amount of intermixing (Haig and Plissner 1993). However, piping plovers from the Great Lakes population were sighted in Georgia in 1997.

A second international census was conducted in 1996; the winter census (2,515 birds) comprised 43 percent of the breeding census (5,913 birds). As in 1991, the greatest numbers of wintering birds are concentrated primarily along the western Gulf of Mexico, particularly the south Texas coast. Typically, wintering birds located in Texas have been observed with 400+ in 1984 (Haig and Oring 1985), 834 from 22 sites in 1987 (Nicholls and Baldassarre 1990a), 1,904 birds located at 64 sites in 1991 (Haig and Plissner 1992, 1993), and 1,333 birds censused at 32 sites in 1996 (Plissner and Haig 1997).

In Florida, Nicholls and Baldassarre (1990a) found 375 birds at 39 sites in a winter survey conducted between December 1986 and March 1987. During the 1991 international winter census of piping plovers, 551 birds were seen on both the Atlantic and Gulf coasts (70 and 481 birds, respectively) (Haig and Plissner 1992). Sprandel *et al.* (1997) found 229 birds at 25 sites during a winter survey conducted between November 1993 and March 1994. For the 1996 international winter census, a total of 333 to 375 birds were counted on both coasts of Florida (18 to 24 on the Atlantic and 315 to 351 on the Gulf). The lower numbers of piping plovers between the two census intervals could be associated with fewer birds and/or a reduced censusing effort.

Florida counties where wintering piping plovers are usually seen include Bay, Brevard, Collier, Miami-Dade, Duval, Escambia, Franklin, Gulf, Hillsborough, Lee, Martin, Monroe, Okaloosa, (possibly) Palm Beach, Pasco, Pinellas, Santa Rosa, (possibly) Sarasota, St. Lucie, St. Johns, Taylor, Volusia, Wakulla, and Walton (Stevenson and Anderson 1994, Nicholls 1996) (Figure 1).

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## Habitat

At sites on the Gulf of Mexico and Atlantic coasts, piping plover wintering habitat includes beaches, mudflats, and sandflats, as well as barrier island beaches and spoil islands (Haig 1992). These birds may also be seen on ocean beaches and sand or algal flats in protected bays (Wilkinson and Spinks 1994). Nicholls and Baldassarre (1990b) surmise that environmental heterogeneity may be an important factor in winter piping plover distribution. On the Atlantic Coast, they found that piping plovers were most often found foraging in areas adjacent to large inlets and passes. On the Gulf Coast, preferred foraging areas were associated with wider beaches, mudflats, and small inlets.

More roosting sites for wintering birds need to be identified and described before conclusions can be made regarding their habitat associations (Nicholls

1996). Climo's (1998) landscape-level analysis of suitable wintering habitat indicates piping plovers selected landscapes or sites on the Gulf Coast that provided the greatest extent of open water, such as sand spits and barrier islands. Piping plovers seem to prefer landforms that provide tidal flats for foraging and open beaches for roosting within close proximity of each other. Johnson and Baldassarre (1988) observed that wintering piping plovers use sandflats and mudflats for feeding, whereas, sandy beaches are used for resting and probably roosting.

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## Behavior

### Reproduction and Demography

Although piping plovers are only winter residents in Florida, an overview of their reproductive behavior is provided herein. Courtship rituals in piping plovers involve aerial displays by the male over his territory. These flights decrease after a mate has been secured and egg-laying is initiated. The male also exhibits a tilt display during courtship. He stands with head down and body at a 30 degree angle, and the female then stands beneath his tail (Haig 1992). Male piping plovers also perform nest-scraping displays, which involve excavation of prospective scrapes while vocalizing. Copulation follows a complex display involving tilting and posturing as the male approaches his mate. After copulation, both birds may "stone toss" small shells or stones into the prospective nest scrape, thus lining the nest with shells or stones (Wilcox 1959, Haig 1992). The male may also engage in this behavior early in the season, at which time it is usually associated with the tilt display (Haig 1992).

The pair bond established during courtship is maintained throughout the nesting season. Some birds change mates following nest losses. However, those that change mates produce fewer fledglings than those that retain their original mates. There is no evidence that pair bonds extend beyond the nesting season (Haig 1992).

Piping plover pairs generally raise one brood per year, with both sexes incubating the eggs. Females may renest several times, if their nests are destroyed. Nests are usually no closer than 30 m from the nearest neighbor and are usually more than 61 m (Wilcox 1959). The most common size of a clutch is four eggs. Eggs are laid every other day until the clutch is complete. Incubation most likely begins with the laying of the third egg or when the clutch is complete; most shorebirds with precocial young have synchronous hatching (Wilcox 1959). Incubation lasts between 27 and 31 days (Wilcox 1959).

Both parents brood the chicks, although the female may desert the brood within five to 10 days after hatching. Brooding is infrequent after 21 days posthatching and the young generally remain within the territory of the male parent (Wilcox 1959, Haig 1992). As in most shorebirds, the young are cryptically colored; they drop to the ground and become motionless when threatened.

Piping plovers may maintain family groups (made up of at least the male and chicks) and chicks are cared for and fed through fledging and sometimes until fall migration (Haig 1992). Fledglings leave the breeding grounds slightly later than adults (Patterson *et al.* 1990). Chicks fledge at different rates in different locations with a range of 21 to 35 days post hatching.

There is little information on immature postbreeding season movements or behavior. Site fidelity in adults varies, but is generally high (Wilcox 1959; Haig and Oring 1988a, 1988b; Haig 1992).

The piping plover is reported to be long-lived. During his 20-year banding study of piping plovers in the northeast, Wilcox (1959) found several birds that were at least 11 years of age at the end of his study. Clapp *et al.* (1982) noted that a 14-year-old bird was caught and released in the vicinity of its banding site in 1963. The average lifespan of the piping plover is less than 5 years (Wilcox 1959). Based on the resightings of 103 adults and 61 chicks color-banded between 1985 and 1988, the mean annual survival rate is estimated to be 0.74 for birds greater than 1 year old and 0.48 for chicks from the Atlantic Coast population (FWS 1996).

### Foraging

The piping plover feeds primarily on marine, freshwater, and terrestrial invertebrates. A variety of invertebrates from the Mollusca, Annelida, Arthropoda, Crustacea, and Nematoda phyla have been found in fecal samples from Gulf of Mexico winter birds (Nicholls 1989). Foraging behavior consists of short pecks and runs, as well as “foot trembling” (vibrating one foot against wet sand, possibly in order to bring invertebrates to the surface or startle insects on the surface). Birds may also forage near nests in drier sand (Haig 1992, Nicholls 1996).

Piping plovers do not forage cooperatively, but may forage in small groups. Foraging also occurs at any time of day and may be influenced by tidal stage and other environmental factors (Haig 1992). Nocturnal foraging behavior of adults and chicks has been documented (Burger 1991, Staine and Burger 1994).

Piping plovers on their wintering grounds spend a greater portion of their time foraging in fall and winter than in the spring (Johnson and Baldassarre 1988). Greater energy requirements in winter weather may affect the duration or rate of foraging, although tidal stage, prey availability, breeding cycle stage, weather, and levels of human disturbance also influence the amount of foraging (Johnson and Baldassarre 1988, Haig 1992). In fact, tidal stage may influence piping plover behavior in all stages of its life cycle (Staine and Burger 1994).

### Migration

Piping plover migration patterns are not well documented. Fall migration southward extends from late July through September, whereas migration north to the breeding grounds occurs from late February to early April (Haig 1992). Birds from the Great Lakes/Great Plains regions tend to stage on Texas beaches prior to moving north; a staging area has not been identified for the Atlantic Coast birds.

Specific routes of the Great Lakes/Great Plains birds are poorly understood, but it appears that the birds may fly nonstop to the Gulf Coast (Haig and Plissner 1993). Color-banded plovers have been observed at several sites in North Carolina and Florida, indicating their use by migrating and wintering birds (McConnaughey *et al.* 1990, FWS 1996). Generally, males arrive at the breeding grounds first in the spring, whereas females are the first to leave the breeding sites in the fall (Haig 1992).

**Relationship to Other Species**

Piping plovers may nest in tern colonies (*Sterna* spp.) or in close proximity to other shorebirds, such as the American avocet (*Recurvirostra americana*). Predators that take piping plover eggs include gulls, crows, raccoon (*Procyon lotor*), red fox (*Vulpes fulva*), opossum (*Didelphis marsupialis*), and skunks (MacIvor *et al.* 1990, Flemming 1991). In addition, rats (*Rattus* spp.) and house mice (*Mus musculus*) may be egg predators (Wilcox 1959, Dyer 1993). Adults may be taken by falcons and great horned owls (*Bubo virginianus*). Arctic terns (*S. paradisaea*) are aggressive toward piping plovers; the death of one individual from such an encounter has been reported (Flemming 1991).

Dunlins (*Calidris alpina*), western sandpipers (*C. mauri*), sanderlings (*C. alba*), least sandpipers (*C. minutilla*), semipalmated plovers (*C. semipalmatus*), snowy plovers, and black-bellied plovers (*Pluvialis squatarola*) as well as some colonial waterbirds, occupy the same winter habitats as piping plovers (Haig 1992, Sprandel *et al.* 1997). Wintering piping plovers are rarely found alone and are most often found within 1 km of four of the first five species listed above (Nicholls and Baldassarre 1990b).

**Status and Trends**

Historical piping plover population data are mainly qualitative. There is no estimate of total population size available prior to 1980. Historic data for the Atlantic Coast population indicates a decline since at least 1955 (Haig and Oring 1985, Wilkinson and Spinks 1994). Uncontrolled hunting and egg collecting were the primary cause of piping plover decline along this region prior to the passage of the Migratory Bird Treaty Act in 1918 (Dyer 1993, FWS 1996). The population rebounded somewhat from this decline until after World War II, when human development and dune stabilization in breeding areas increased in the Northeast (Raithel 1984, Haig and Oring 1985). Other regions (*e.g.*, the Great Lakes) have suffered significant declines (Haig and Oring 1985). The Northern Great Plains population was declining as a result of severe drought and incompatible water management practices (Haig 1992).

In 1985, breeding pair counts for the U.S. population of piping plovers ranged between 930 and 1,650. Total breeding pair counts varied from 1,649 to 1,939 (Haig and Oring 1985). A 1987 to 1991 census indicated the total number of pairs ranged from 2,065 to 2,334 with 1,266 to 1,589 pairs occurring in the U.S. (Haig 1992). The Atlantic Coast population ranged from 790 to 987 pairs for this period; whereas, from 1992 to 1997, the population ranged from 1,026 to 1,391 pairs (FWS 1998) (Table 1).

**Table 1. Piping plover breeding pair estimates<sup>1</sup>**

Year	Great Lakes	Great Plains	Atlantic Coast	Total
1986	16		790	
1987	16	1,258-1,326	790	2,064-2,132
1988	14	1,271	886	2,171
1989	15	1,007-1,064	957	1,979-2,036
1990	12	862	980	1,854
1991	17	1,372	987	2,376
1992	16		1,026	
1993	18		1,113	
1994	19		1,150	
1995	21		1,349	
1996	23	1,297	1,348	2,668
1997	23		1,391	
1998	24		1,372	1,396

<sup>1</sup> Breeding pair population estimates taken from Haig 1992; FWS 1996, 1998.

In Florida, wintering piping plovers have been extirpated from entire counties over the past 50 years. Museum records and Christmas Bird Count data indicate piping plovers regularly wintered in Bay, Brevard, Broward, Collier, Miami-Dade, Duval, Franklin, Gulf, Hillsborough, Indian River, Lee, Monroe, Nassau, Orange, Pinellas, St. Johns, St. Lucie, Sarasota, Taylor, Volusia, and Wakulla counties. During the 1991 and 1996 winter census, there were no records of piping plovers for Brevard, Broward, Miami-Dade, Hillsborough, Indian River, Nassau, Palm Beach, St. Lucie, Sarasota, and Wakulla counties; piping plovers were recorded in Martin and Monroe counties during the 1996 census (Howell 1932; FWS 1988, 1996; Nicholls 1989; Plissner and Haig 1997).

The significant alteration of sandy beaches and other littoral habitats due to recreational or commercial developments and dune stabilization in the Great Lakes region, Atlantic Coast beaches, and Gulf of Mexico winter sites is partly responsible for the decline of the species (Bent 1929, Russell 1983, Master and French 1984, Haig 1985, Haig and Oring 1985, FWS 1988, Burger 1991, Dyer 1993). As of the 1991 census, numbers of piping plovers declined to such levels that destruction of any part of their breeding or wintering habitat would significantly affect the species. Population viability analysis (PVA) modeling of the piping plover shows that extinction probabilities are sensitive to changes in survival rates (FWS 1996). PVA modeling results show a 4 percent extinction probability over 100 years for a 2,000-pair population based on survival rates of 0.74 for birds greater than 1 year old and 0.48 for chicks. When declines in adult (5 percent) and chick (10 percent) survival rates were modeled, the extinction probability increased to 32 percent (FWS 1996). Such declines in survival rates could occur due to the continued degradation and alteration of wintering habitat.

The Final Rule designating piping plover populations as endangered or threatened identified habitat disturbance and destruction, and human disturbance of nesting individuals as the greatest threats to the species (50 FR 50733). Human disturbance continues to be a major impediment to recovery at both breeding and wintering sites. Many of the remaining breeding and wintering locations available to plovers are plagued by various forms of human disturbance, which may include pedestrian recreationists, their pets, and off-road vehicle enthusiasts (FWS 1988, 1996; Haig 1992; Melvin *et al.* 1994; Staine and Burger 1994).

Human disturbance reduces the amount of time breeding plovers spend foraging (Burger 1991, Staine and Burger 1994), which could affect reproductive success as well as the ability of an individual to survive migration and winter (Burger 1991). Vehicle mortalities are an issue in the northeastern breeding areas. Melvin *et al.* (1994) described 14 vehicle mortality incidents in their study area; they believe that this is a larger problem than has previously been acknowledged. Human disturbance may also be a problem for wintering plovers. Recreational activity levels, including pedestrians and off-road vehicles, were higher on beaches without wintering piping plovers than on those that had wintering plovers (Nicholls 1989). It is important to note the type of human activity as well as the amount and duration of the activity when studying the effects of disturbance on wintering and breeding birds. Each of these types of activities has a different detrimental effect on piping plovers. In addition to human disturbance, predation continues to be a problem in some areas. Predator exclosure cages placed over the nests appear to be ameliorating this threat in the Atlantic Coast and Great Lakes areas (Haig and Plissner 1993).



Shoreline stabilization and erosion control efforts concurrent with urban development have dramatically reduced historic piping plover nesting habitat in Maine, Rhode Island, and the Great Lakes. A quantitative analysis of the effects of these types of activities in Canada has not been performed. Dune maintenance to protect roadways may also impact nesting plovers in New Jersey and Massachusetts. Water management practices (*e.g.*, reservoir construction, channelization, and modification of river flows) have eliminated many nesting sites along the Missouri and Platte Rivers in North and South Dakota, Iowa, and Nebraska (FWS 1988, 1996; Nicholls and Baldassarre 1990b; Loegering and Fraser 1991; Haig 1992).

Environmental contaminants do not appear to be adversely affecting piping plover populations, although high levels of selenium have been documented on the Missouri River and the Platte River (FWS 1991, 1993; Ruelle 1993). Oil spills pose a threat to piping plovers throughout their life cycle (FWS 1996). Dinsmore (1983) reviewed the impact of surface mining on piping plovers and concluded that there was potential for habitat destruction as well as enhancement in mining areas.

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## Management

Prior recovery plans prepared for piping plovers breeding on the Great Lakes and Northern Great Plains and the Atlantic Coast have outlined those tasks necessary to promote recovery of this species. The Great Lakes and Northern Great Plains Recovery Plan identified six major tasks that needed to be accomplished in order to facilitate recovery of the interior piping plover population. These tasks focused on determining the distribution and population trends of the piping plover; determining the habitat requirements and habitat status of the birds; protecting, enhancing, and increasing piping plover populations in this region; and preserving and enhancing habitat for the species. The Atlantic Coast Population Revised Recovery Plan recommended managing breeding piping plovers and habitat to maximize survival and recovery of the species; monitoring and managing wintering and migratory areas to maximize survival and recruitment to the breeding population; protecting essential wintering habitat by preventing degradation and disturbance of these sites; scientific investigations of factors that will facilitate recovery; developing and implementing a public information and education program; and reviewing the recovery progress annually and revising recovery efforts as appropriate (FWS 1988, 1996).

Both recovery plans concentrate on habitat protection and enhancement as a major factor in piping plover recovery nationwide. Habitat protection and enhancement could include maintenance of natural coastal formation processes, actual physical manipulation of the sites, predator control, minimization of human disturbance, and control of off-road vehicle access (FWS 1988, 1995; Patterson *et al.* 1990; Dyer 1993; Haig and Plissner 1993; Sidle and Kirsch 1993; Cox *et al.* 1994).

Piping plovers spend 7 to 8 months associated with their wintering areas (Haig and Oring 1985). The factors listed above can substantially affect their survival and recovery. Aside from piping plovers, wintering areas are also used by many other shorebirds.

In Florida, the focus of piping plover management has been the protection of specific wintering sites. The GFC can provide short-term protection by

designating such sites as “critical wildlife areas,” a designation that affords some protection from disturbance and destruction with limited enforcement opportunities. At least one important wintering site in Collier County, Florida, has been designated as a critical wildlife area.

Another method for conserving piping plover populations is through land acquisition. A small key on the western end of the Seven-mile bridge in the lower Florida Keys, known as Ohio Key, is one such site that has been acquired by the FWS.

Additional surveys to locate other important wintering areas and analyze the essential components of those areas are needed. Once located, mechanisms to protect and enhance those areas must be implemented, such as the regulatory process under section 7 of the Endangered Species Act (Sidle *et al.* 1991).

The Atlantic Coast Revised Recovery Plan projects recovery by 2010 with the implementation of all the identified recovery actions. The Great Lakes and Northern Great Plains Recovery Plan does not identify a projected date for reclassification of the Great Lakes population to threatened status or recovery of the Great Plains population.

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# Recovery for the Piping Plover

*Charadrius melodus*

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**Recovery Objective: DELIST.**

**South Florida Contribution: ASSIST** in the long-term maintenance of wintering habitat, sufficient in quantity, quality, and distribution to maintain survival rates for a 2,000-pair population.

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## Recovery Criteria

The objective of this recovery plan is to support and contribute to the recovery of all populations of the piping plover through fulfillment of Criterion 5 in the Atlantic Coast Piping Plover Revised Recovery Plan (FWS 1996). This criterion identifies the need to maintain wintering habitat sufficient in quantity and quality to maintain survival of the Atlantic Coast population of piping plovers. Florida provides only wintering habitat, so no objectives related to reproductive success may be identified. Once wintering ecological needs are identified, measurable criteria may be defined for wintering populations of the piping plover in Florida.

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## Species-level Recovery Actions

- S1. Determine the distribution and abundance of wintering piping plovers in Florida by surveying beaches and other suitable habitat to determine additional wintering sites.** Only 63 percent of the known adult population has ever been accounted for during the winter period. Suitable habitat should be surveyed in a manner consistent with the Atlantic Coast Piping Plover Revised Recovery Plan (FWS 1996).
- S2. Protect and enhance the wintering population in Florida by managing human use of beaches important to piping plovers.** Human disturbance disrupts foraging and loafing patterns of wintering plovers. In addition, other human uses may limit suitable habitat for plovers by rendering some areas unusable. The effects of human activities on piping plovers have been investigated, but are not entirely understood.
- S3. Conduct research on the wintering ecology of piping plovers in Florida.**
  - S3.1. Investigate the wintering ecology of piping plovers.** Research on the Texas coast will provide valuable information on piping plover wintering ecology. However, the Texas coastal system is complex, and habitat selection and use may be somewhat different from other areas along the Atlantic and Gulf Coasts. Possible research sites include: Ohio Key/Woman's Key/Boca Grande Key in the Florida Keys; Marco Island/Sand Dollar Island in Collier County; and Estero Island, Cayo Costa State Park, North Captiva Island, Bunches Beach in Lee County.

- S3.2. Determine the spatial and temporal use of wintering habitat.** Analysis of data from aerial photographs using computerized GIS may provide insight about the relative importance of the juxtaposition of roosting and foraging habitat (*i.e.*, how far will plovers travel between foraging and roosting sites). Time budget analyses and observations of marked birds may also yield more information on the spatial and temporal (tidal, year-to-year, wind-influenced) use of habitat, whether or not there are prime and alternate feeding and roosting sites, and importance of sites during weather and tidal extremes.
- S3.3. Investigate the effects of human disturbance on wintering plovers.** The degree to which human disturbance and off-road vehicles affect the distribution, habitat use, energetics, and survival of wintering piping plovers needs further study; investigation of the mechanisms by which human activities affect the birds is also needed.
- S4. Monitor known and potential wintering sites.** Recent wintering surveys have identified many new wintering sites, but there is a need for better information about spatial and temporal use patterns, habitat trends, and threats. This can be advanced through a continuing monitoring program.
- S4.1. Monitor abundance and distribution of known wintering plovers through periodic wintering surveys.** A comprehensive rangewide survey (*i.e.*, International Census) of wintering sites patterned after Haig and Plissner (1993) should be conducted at intervals of not more than 5 years to assess population trends, discover additional wintering sites, and determine relative site importance. Major wintering sites along both the Atlantic and Gulf coasts should be surveyed annually to provide additional information on site importance and to assess population fluctuations on a site-by-site basis.
- S4.2. Monitor human use of piping plover wintering sites.** Develop a program to monitor human use of important wintering piping plover sites. This information will assist agencies in determining the appropriate management of these sites.
- S5. Implement public information and education programs.** The Atlantic Coast Piping Plover Revised Recovery Plan (FWS 1996) and the Great Lakes and Northern Great Plains Recovery Plan (FWS 1988) identify the need for an education program and describes strategies for disseminating this information. This education program should be implemented in South Florida focusing on wintering habitat. Expanded efforts to increase public awareness of protection needs of piping plovers, other rare beach species, and the beach ecosystem are needed.
- S5.1. Develop piping plover information and education materials specific to Florida and wintering populations.** These materials should be designed to reach new target audiences, take advantage of advancing media, and stimulate continuing public interest and awareness. In addition, all materials must be kept reasonably current regarding the status of the species and protection efforts. At present, there is a need to integrate more information about the role of piping plover conservation efforts in protection of the beach ecosystem and the plight of other rare beach-dwelling species into plover informational and educational materials.
- S5.2. Establish a network for distribution of information and education materials.** While development of information and educational materials is a major task, distribution of these materials to target audiences requires an even larger commitment of time and other resources.



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## Habitat-level Recovery Actions

- H1. Protect essential wintering habitat by preventing habitat degradation and disturbance.** All known wintering areas are currently considered essential to piping plover conservation. Recovery of the three breeding populations is contingent on availability of wintering habitat for more than double the current number of piping plovers (FWS 1996). As information needed to accurately estimate carrying capacity of wintering habitat becomes available in the future, it may be possible to identify habitat that is not considered essential to plover conservation, but, for now, all known wintering sites are considered essential habitat and should be protected.
- H1.1. Protect habitat from direct and indirect impacts of shoreline stabilization, navigation projects, and development.** Coastal development projects should be carefully assessed with regard to this species. Recommendations from the FWS (under the Endangered Species Act and the Fish and Wildlife Coordination Act) and/or State agencies should focus on avoiding or minimizing adverse effects to wintering habitat. Where adverse effects cannot be avoided, agencies should document potential impacts so that cumulative effects on this species' habitat can be assessed.
- H1.2. Utilize the section 7 consultation process to minimize the effects of Federal actions (beach renourishment, coastal armoring) on piping plover wintering habitat.** Apprise resource and regulatory agencies of population status and threats to wintering piping plovers and their habitats. Periodic workshops should be held to inform resource management and regulatory agencies about threats, research and management needs, *etc.* A coordinated approach to conservation of plover wintering areas should be encouraged.
- H1.3. Protect wintering habitat from disturbance by recreationists and their pets.** More information about the mechanisms and effects of disturbance on wintering plovers and their habitat is needed. As information becomes available, it should be incorporated into conservation efforts since wintering sites in Florida currently face their greatest threats from human disturbance.
- H1.4. Protect piping plovers and their wintering habitat from contamination and degradation due to oil or chemical spills.** Contamination from oil or chemical spills or leaks poses a significant threat to wintering piping plovers. Efforts must be made to minimize the likelihood of such events in the vicinity of plover wintering areas. Oil/chemical spill emergency response plans should provide for protection of known plover wintering areas, as should State plover, shorebird, or coastal ecosystem protection plans. In the event of a spill in the vicinity of a known piping plover wintering area, surveys should be conducted and efforts should be made to prevent oil/chemicals from reaching plover use areas, and restoration efforts should begin expeditiously. If piping plovers or their habitats are damaged by an oil/chemical spill or leak, appropriate claims should be filed under the Natural Resource Damage Assessment regulations to recover damages and undertake relevant restoration work.
- H1.5. Provide for long-term protection of wintering habitat, including agreements with landowners and habitat acquisition.** Wintering areas deemed important (essential) should be protected through management plans and/or written agreements. Conservation easements and acquisition of wintering sites should be considered. Priority should be afforded to important sites facing the most imminent threats of permanent habitat loss or degradation.

- H1.6. Compile management guidelines for wintering piping plovers.** Use the information and data obtained under **S3** and **H2** to develop management guidelines that can be used by Federal, State, and local governments as well as private entities to implement conservation actions for wintering piping plovers.
- H2. Conduct research on wintering habitat.**
- H2.1. Characterize wintering habitat.** Research is needed to identify winter foraging and roosting habitat characteristics in Florida. Features should be identified on both the local (*e.g.*, substrate type) and landscape level (*e.g.*, the availability or diversity of microhabitats in coastal complexes). Information on habitat characteristics and use will help in locating new and protecting existing wintering sites.
- H2.2. Identify factors limiting the quantity and quality of habitat or its use by piping plovers at specific wintering sites.** Potential direct and indirect threats to wintering plovers and their habitat have been identified, but a better understanding of the exact mechanisms and degree of impacts on the birds is needed. Some of this information will be obtained through formal scientific investigations (discussed in **S3** of species-level recovery actions), but much information can and should be acquired through monitoring the response of habitat and birds to various factors, including natural coastal formation processes, dredging and other channel maintenance, beach renourishment, and recreational activities. Careful documentation of all observations is a key component of such monitoring. Opportunities to incorporate monitoring into plans for Federal activities subject to section 7 of the Endangered Species Act, such as dredging and discharges regulated by the COE, should be sought. For example, a 1994 biological opinion regarding the reopening of Packery Channel, between Mustang and North Padre Islands, Texas, recommended that the COE conduct pre- and post-project monitoring of the area's tidal amplitude, size of intertidal flats, salinity, vegetation, and invertebrate populations.
- H2.3. Evaluate impacts of artificial inlet closure and other beach stabilization projects on piping plover wintering habitat suitability.** Piping plovers nest and forage in storm-maintained habitats, including sandspits, overwashes, and blowouts, and the species' survival and recovery as well as the well-being of other early succession beach-dwelling species is dependent on the maintenance and perpetuation of these habitat characteristics. Beach stabilization projects, such as renourishment and coastal armoring are sometimes implemented despite their deleterious effects on plovers and sea turtles. Additional information is needed to more fully determine the type, extent, and duration of impacts from these types of coastal modifications and to facilitate more complete analysis of impacts on wintering piping plovers. Such studies should also seek to define possible project modifications that will minimize adverse impacts on piping plovers, other Federally threatened species, and the beach ecosystem. Studies may also facilitate creation and enhancement of wintering habitat to mitigate unavoidable adverse effects of artificial beach stabilization.
- H3. Monitor and manage wintering and migration areas to maximize survival and recruitment into the breeding population.** The probability of persistence of Atlantic Coast and Great Plains piping plover populations are highly sensitive to changes in survival rates. Since piping plovers spend 55 to 80 percent of their annual cycle associated with wintering areas, factors that affect their well-being on the wintering grounds can substantially affect their survival and recovery. Piping plover wintering areas are also used by many other shorebirds; their protection will contribute to the conservation of a richly diverse and important ecosystem.

- H4. The Recovery Team recommends integrating the monitoring and protection tasks specified below into a State action plan for the piping plover.** A State action plan that includes all shorebirds or entire coastal systems may be an effective vehicle for piping plover protection. The State action plan should identify several specific needs: (1) monitoring--a program to monitor the size of the wintering population of piping plovers should be developed. This monitoring program could be derived from several index beaches or areas to provide a qualitative measure of population fluctuations; (2) identification of protection and management needs--management plans should be developed and implemented for wintering beaches that have special management needs or special management conflicts; (3) education needs--the need for meetings or workshops to train personnel from regulatory agencies on the needs of piping plovers on their wintering grounds should be conducted in Florida. For example, a 1991 workshop was held in North Carolina specifically for representatives of the regulatory agencies to inform them of the plover's habitat needs and ecology, and requirements to protect and consult on this species; (4) recognition of important sites--a mechanism for providing special recognition or designation of sites that are critical for the survival and recovery of piping plovers should be developed and implemented.

