



United States Department of the Interior



FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960
May 22, 2013

Eric P. Summa
Chief, Environmental Branch (PD-E)
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Summa:

This document transmits the U.S. Fish and Wildlife Service's (Service) Programmatic Piping Plover Biological Opinion (P³BO) for the effects of U.S. Army Corps of Engineers (Corps) planning and regulatory shore protection activities on the non-breeding piping plover (*Charadrius melodus*) and its designated Critical Habitat in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 et seq.). The current status of the federally listed piping plover is threatened, and the Service designated Critical Habitat for wintering piping plovers on July 10, 2001. This P³BO is for the North Florida Ecological Services Office (NFESO) and the South Florida Ecological Services Office (SFESO) areas of responsibility (AORs). You requested formal consultation by letter of May 7, 2013.

This P³BO is based on the information provided in the Corps May 7, 2013, letter, the Statewide Programmatic Biological Assessment of February 17, 2011, subsequent meetings between Corps and Service personnel, and other sources of information. We have assigned Consultation Code 04EF1000-2013-F-0124 to this consultation. A complete administrative record of this consultation is on file at the NFESO. Each project proposing to utilize this P³BO will undergo an evaluation process by the Corps to determine if it properly fits within this programmatic approach. If it is determined that the minimization measures, Reasonable and Prudent Measures, and Terms and Conditions in the P³BO are applicable to the project, the Service will concur within 30 days and it will be covered by this programmatic consultation. The Corps will consult separately on individual projects that do not fit within this programmatic approach unless the Service grants an exception in accordance with the Incidental Take Statement in the P³BO.

This consultation includes the following proposed activities conducted in the AORs of the NFESO and the SFESO:

1. Operations and maintenance dredging activities of navigational channels and sand placement on the sandy beach and dune (including up to or over hardened structures), the swash zone, and the nearshore regions associated with both shore protection projects and maintenance dredging;
2. Sand placement as an associated authorization of sand extraction from the outer continental shelf by the Bureau of Ocean Energy Management (BOEM);
3. Sand by-passing/back-passing; and
4. Groins and jetty repair, or replacement.

For Civil Works activities, the Corps specified during the consultation process that "fish and wildlife enhancement" activities beyond mitigation of project impacts must be authorized as a project purpose, be authorized as a project feature, or be otherwise approved through Corps headquarters (Engineer Regulation ER 1105-2-100 Appendix G, Amendment #1, 30 June 2004). At the present time, no beach fill placement or shore protection activity in Florida has fish and wildlife enhancement as a project purpose or project feature. Since adding fish and wildlife enhancement as a project purpose or feature is not a budgetary priority [ER 1105-2-100 22 Apr 2000, Appendix C, part C-3b.(3)], the Corps does not expect to receive authorization and funding for it. However, the Corps proposes to implement the following Conservation Measures to reduce impacts on piping plovers for all projects (those in both non-optimal and optimal piping plover habitat) included in this consultation with the potential to affect piping plovers or their critical habitat:

1. Adhere to appropriate seasonal windows to the maximum extent practicable;
2. Implement survey guidelines for non-breeding shorebirds when appropriate. For Corps Civil Works projects, the "surveys" must be limited to the term of the construction unless they are otherwise authorized and funded by Congress;

[Note: The term of the construction is considered to be the time in which the construction contractor is working on the beach. This usually starts soon after the "notice to proceed" and ends when the contractor finishes placing sand or finishes conducting other shore protection activities on/near the beach.]

3. Pipeline alignment and associated construction activities may be modified to reduce impacts to foraging, sheltering, and roosting;
4. Avoid impacts to the primary constituent elements (PCEs) of piping plover Critical Habitat to the maximum extent practicable;
5. The Corps or Applicant will evaluate the project area prior to consultation for the presence of piping plover PCEs as a basis for making their initial determination of effect;
6. The Corps will work with the Service to develop shore protection design guidelines and/or mitigation measures that can be utilized during future project planning to protect and/or enhance high value piping plover habitat locations (*i.e.*, washover fans). For Corps Civil Works projects, "enhancement" must be limited to the extent authorized and funded as a project feature or project purpose;
7. The Corps will attempt to time the construction of Civil Works sand placement and dredging projects to prevent two adjacent beaches or inlets from being constructed in the same year;

8. The Corps Civil Works program will work with the Florida Department of Environmental Protection (FDEP) to consider the value and context of inlet habitat features (*i.e.*, emergent spits, sand bars, etc.) within each inlet's management plan and adjust future dredging frequencies, to the maximum extent practicable and consistent with applicable law, so that adjacent habitats are made available and total habitat loss would not occur at one time within a given inlet complex; and
9. The Corps Civil Works program will consider placing dredged materials in the nearshore region as an alternative to beach placement to minimize effects to piping plovers and their habitat.

With the implementation of these Conservation Measures, the Corps has determined the proposed activities may affect, but are not likely to adversely affect the piping plover in areas not identified as Optimal Piping Plover Areas. Optimal Piping Plover Areas are defined as having documented use by piping plovers, and they include coastal habitat features that function mostly unimpeded. Optimal Piping Plover Areas include:

1. Designated piping plover Critical Habitat Units (see Appendix A);
2. All Federal, State, and County publicly owned land where coastal processes are allowed to function, mostly unimpeded, that have any of the following features in the Action Area:
 - a. Located within 1 mile of an inlet;
 - b. Emergent nearshore sand bars;
 - c. Washover fans;
 - d. Emergent bayside and Ocean/Gulf-side shoals and sand bars;
 - e. Bayside mudflats, sand flats, and algal flats; or
 - f. Bayside shorelines of bays and lagoons.

[Publicly owned land where coastal processes are allowed to function, mostly unimpeded, generally does not include public lands that are solely state-owned water bottoms, street ends, parking lots, piers, beach accesses, or shoreline developed for commercial or residential purposes. It generally does include public lands consisting of parks, preserves, and natural undeveloped shoreline and dunes.]; and

3. The following additional areas are also considered optimal piping plover habitat (FDEP Range Monuments provided in parentheses):
 - a. Charley Pass, south of Critical Habitat Unit FL-23 on North Captiva Island, Lee County (R-75.5 and R-83);
 - b. Stump Pass and the beaches adjacent to it, Charlotte County (R-15.5 to R-33);
 - c. Palmer Point Park, Sarasota County (R-77 to R-83);

- d. St. Lucie Inlet and associated shoals, Martin County (R-42 to R-78);
- e. Crandon Park, Miami-Dade County (R-89 to R-101); and
- f. Sanibel Island, Lee County (R-109 to R-174).

The Service concurs with this determination as it applies to projects in non-optimal habitat, and the Corps will reinitiate consultation if they are unable to implement the Conservation Measures as described above. No additional consultation is required for projects located in habitat determined to be non-optimal for piping plovers. The attached P³BO addresses projects located in optimal piping plover habitat, as defined above.

As with the Service's Statewide Programmatic Biological Opinion (SPBO), the Corps and the Service will meet annually during the fourth week of August to review the proposed activities, assess new data, identify information needs, and scope methods to address those needs, including, but not limited to, evaluations and monitoring specified in this P³BO, reviewing results, formulating or amending actions that minimize take of listed species, and monitoring the effectiveness of those actions. This programmatic consultation will be reviewed every 5 years. If new information concerning the projects or the piping plover arises, this consultation will be reviewed sooner than 5 years. Reinitiation of formal consultation is required 10 years after the issuance of this P³BO.

We are available to meet with agency representatives to discuss this consultation. If you have any questions, please contact Dawn Jennings at the NFESO (904-731-3103) or Craig Aubrey in the SFESO (772-469-4309).

Sincerely yours,



Larry Williams
State Supervisor

**SHORE PROTECTION ACTIVITIES IN THE GEOGRAPHICAL REGION
OF THE NORTH AND SOUTH FLORIDA ECOLOGICAL SERVICES FIELD OFFICES**

Programmatic Piping Plover Biological Opinion

May 22, 2013

Prepared by:

U.S. Fish and Wildlife Service



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ACRONYMS AND ABBREVIATIONS

Act	Endangered Species Act
AOR	Area of Responsibility
BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulations
Corps	U.S. Army Corps of Engineers
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FWC	Florida Fish and Wildlife Conservation Commission
FR	Federal Register
MBTA	Migratory Bird Treaty Act
NFESO	U.S. Fish and Wildlife Service's North Florida Ecological Services Office
P ³ BO	Programmatic Piping Plover Biological Opinion
PCE	Primary Constituent Elements
Service	U.S. Fish and Wildlife Service
SFESO	U.S. Fish and Wildlife Service's South Florida Ecological Services Office
SPBO	Statewide Programmatic Biological Opinion
USGS	U.S. Geological Survey

CONSULTATION HISTORY

<u>1980s and 1990s</u>	Beach nourishment projects in Florida began to occur frequently in the late 1980s and early 1990s.
<u>April 19, 2011</u>	The Service issued the original SPBO concerning planning and regulatory sand placement projects in Florida and their effects on nesting sea turtles.
<u>August 22, 2011</u>	The Service issued their revised SPBO. The SPBO did not include take for the non-breeding piping plover or its designated Critical Habitat. Consultation for plovers was conducted on a case-by-case basis.
<u>October 30, 2012</u>	The Service and the Corps held the first annual meeting on the progress of the SPBO. The agencies discussed outstanding piping plover issues, including the proposed terms and conditions. The agencies agreed to conduct a separate re-initiation of consultation for piping plovers limited to peninsular Florida to programmatically address take of piping plovers.
<u>May 7, 2013</u>	The Corps sent a letter to the Service formally requesting a Programmatic Piping Plover Biological Opinion.
<u>Other Collaboration</u>	Numerous telephone conversations and e-mails were conducted between the Corps and the Service concerning the content of the P ³ BO and initiation of consultation.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The proposed action includes activities associated with the placement of compatible sediment on beaches or in the nearshore region of Optimal Piping Plover Areas. Optimal Piping Plover Areas are defined as having documented use by piping plovers, and include coastal habitat features that function mostly unimpeded. Below is a list of currently known Optimal Piping Plover Areas:

1. Designated piping plover Critical Habitat Units (see Appendix A);
2. All Federal, State, and County publicly owned land where coastal processes are allowed to function, mostly unimpeded, that have any of the following features in the Action Area:
 - a. Located within 1 mile of an inlet;
 - b. Emergent nearshore sand bars;
 - c. Washover fans;
 - d. Emergent bayside and Ocean/Gulf-side shoals and sand bars;
 - e. Bayside mudflats, sand flats, and algal flats; or

- f. Bayside shorelines of bays and lagoons.

[Publicly owned land where coastal processes are allowed to function, mostly unimpeded, generally does not include public lands that are solely State-owned water bottoms, street ends, parking lots, piers, beach accesses, or shoreline developed for commercial or residential purposes. It generally does include public lands consisting of parks, preserves, and natural undeveloped shoreline and dunes.]; and

3. The following additional areas are also considered optimal piping plover habitat (FDEP Range Monuments provided in parentheses):
 - a. Charley Pass, south of Critical Habitat Unit FL-23 on North Captiva Island, Lee County (R-75.5 and R-83);
 - b. Stump Pass and the beaches adjacent to it, Charlotte County (R-15.5 to R-33);
 - c. Palmer Point Park, Sarasota County (R-77 to R-83);
 - d. St. Lucie Inlet and associated shoals, Martin County (R-42 to R-78);
 - e. Crandon Park, Miami-Dade County (R-89 to R-101); and
 - f. Sanibel Island, Lee County (R-109 to R-174).

ACTION AREA

The Action Area includes sandy beaches; emergent bayside and Ocean/Gulf-side shoals and sand bars; bayside mudflats, sand flats, and algal flats; bayside shorelines of bays and lagoons; and emergent nearshore sand bars of the Atlantic Coast (Nassau County to Miami-Dade County) and the Gulf Coast (Monroe County to Taylor County) of Florida (Figures 1 and 2). The proposed action includes the replacement and rehabilitation of groins utilized as design components of beach projects for longer retention time and stabilization of associated sediment placed on the beach. This P³BO includes both Corps Regulatory and Civil Works activities. Both Corps Regulatory and Civil Works activities may include the involvement of other Federal agencies, such as the Department of Defense, BOEM, and the Federal Emergency Management Agency. The activities covered in the P³BO encompass the following:

1. Operations and maintenance dredging activities of navigational channels and sand placement on the sandy beach and dune (including up to or over hardened structures), the swash zone, and the nearshore regions associated with both shore protection projects and maintenance dredging;
2. Sand placement as an associated authorization of sand extraction from the outer continental shelf by the BOEM;
3. Sand by-passing/back-passing; and
4. Groins and jetty repair, or replacement.

The history of shore protection activities throughout the Atlantic and Gulf Coasts of Florida is extensive and consists of a myriad of actions performed by local, State, and Federal entities. Future sand placement actions addressed in this P³BO may include maintenance of these existing projects or beaches that have not experienced a history of sand placement activities. Maintenance

dredging activities include dredging of both deep draft harbors and shallow draft inlets when these activities affect optimal piping plover habitat.

STATUS OF THE SPECIES/CRITICAL HABITAT

Species/Critical Habitat description

The piping plover is a small, pale sand-colored shorebird, about 7 inches long with a wingspan of about 15 inches (Palmer 1967). Cryptic coloration is a primary defense mechanism for piping plovers where nests, adults, and chicks all blend in with their typical beach surroundings. Piping plovers on wintering and migration grounds respond to intruders (*e.g.*, pedestrian, avian and mammalian) usually by squatting, running, and flushing (flying).

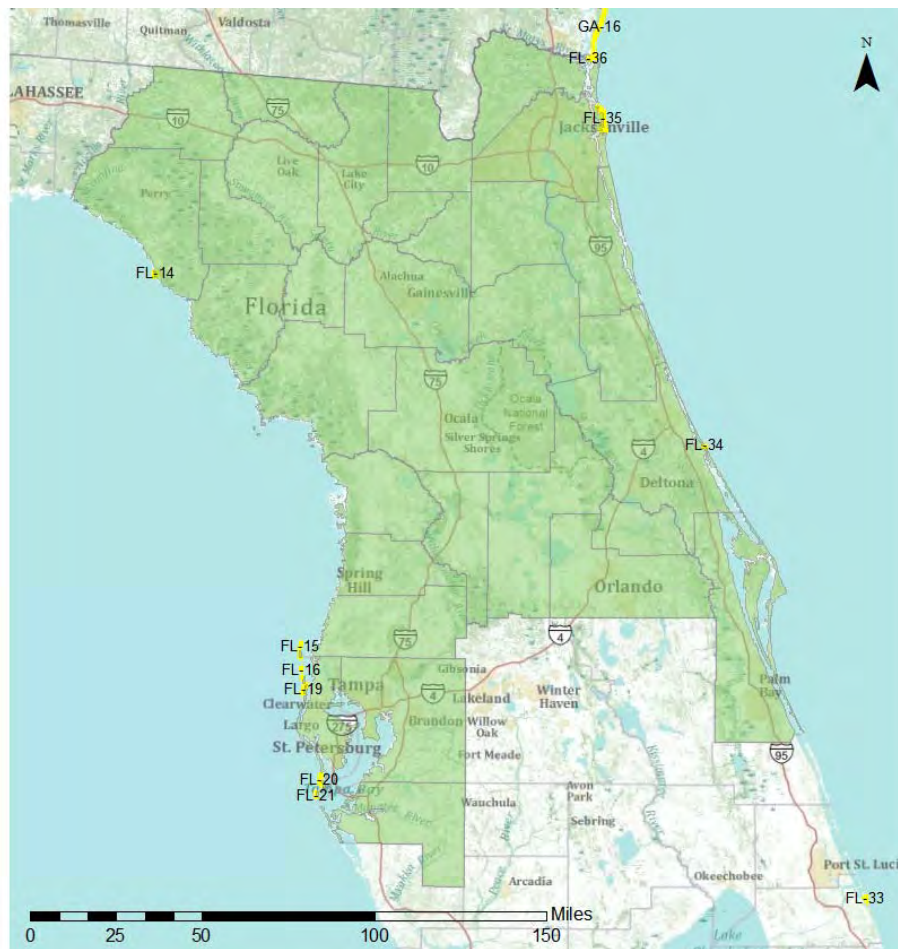


Figure 1 Piping plover designated Critical Habitat in the North Florida Ecological Services Field Office's area of responsibility.

On January 10, 1986, the piping plover was listed as endangered in the Great Lakes watershed and threatened elsewhere within its range, including migratory routes outside of the Great Lakes watershed and wintering grounds (Service 1985). Piping plovers were listed principally because of habitat destruction and degradation, predation, and human disturbance. Protection of the species under the Act reflects the species' precarious status range-wide.

Three separate breeding populations have been identified, each with its own recovery criteria: the northern Great Plains (threatened), the Great Lakes (endangered), and the Atlantic Coast (threatened). The piping plover winters in coastal areas of the U.S. from North Carolina to Texas, and along the coast of eastern Mexico and on Caribbean islands from Barbados to Cuba and the Bahamas (Haig and Elliott-Smith 2004). Piping plovers in the Action Area include individuals from all three breeding populations. Piping plover subspecies are phenotypically indistinguishable, and most studies in the nonbreeding range report results without regard to breeding origin. Although a recent analysis shows strong patterns in the wintering distribution of piping plovers from different breeding populations, partitioning is not complete and major information gaps persist.



Figure 2 Piping plover designated Critical Habitat in the South Florida Ecological Services Field Office's area of responsibility.

The Service has designated Critical Habitat for the piping plover on three occasions. Two of these designations protected different piping plover breeding populations. Critical Habitat for the Great Lakes breeding population was designated May 7, 2001 (66 Federal Register [FR] 22938, Service 2001a), and Critical Habitat for the northern Great Plains breeding population was designated September 11, 2002 (67 FR 57637, Service 2002). The Service designated Critical Habitat for wintering piping plovers on July 10, 2001 (66 FR 36038, Service 2001b). Wintering piping plovers may include individuals from the Great Lakes and northern Great Plains breeding populations as well as birds that nest along the Atlantic Coast. The three separate designations of piping plover Critical Habitat demonstrate diversity of PCEs between the two breeding populations as well as diversity of PCEs between breeding and wintering populations.

Designated wintering piping plover Critical Habitat originally included 142 areas (the rule states 137 units; this is an error) encompassing approximately 1,793 miles of mapped shoreline and 165,211 acres of mapped areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas.

The PCEs for piping plover wintering habitat essential for the conservation of the species are those habitat components that support foraging, roosting, and sheltering, and the physical features necessary for maintaining the natural processes that support these habitat components. The PCEs are found in geographically dynamic coastal areas that support intertidal beaches and flats (between annual low tide and annual high tide), and associated dune systems and flats above annual high tide (Service 2001a). PCEs of wintering piping plover Critical Habitat include sand or mud flats, or both, with no or sparse emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting piping plovers (Service 2001a). Important components of the beach/dune ecosystem include surf-cast algae, sparsely vegetated back beach and salterns, spits, and washover areas. Washover areas are broad, unvegetated zones, with little or no topographic relief, that are formed and maintained by the action of hurricanes, storm surge, or other extreme wave action. The units designated as Critical Habitat are those areas that have consistent use by piping plovers and that best meet the biological needs of the species. The amount of wintering habitat included in the designation appears sufficient to support future recovered populations, and the existence of this habitat is essential to the conservation of the species. Additional information on each specific unit included in the designation can be found at 66 FR 36038 (Service 2001a).

Life history

Piping plovers live an average of 5 years, although studies have documented birds as old as 11 (Wilcox 1959) and 15 years. Plovers are known to begin breeding as early as 1 year of age (MacIvor 1990; Haig 1992); however, the percentage of birds that breed in their first adult year is unknown. Piping plover breeding activity begins in mid-March when birds begin returning to their nesting areas (Coutu et al. 1990; Cross 1990; Goldin et al. 1990; MacIvor 1990; Hake 1993). Piping plovers generally fledge only a single brood per season, but may re-nest several times if previous nests are lost. The reduction in suitable nesting habitat due to a number of

factors is a major threat to the species, likely limiting reproductive success and future recruitment into the population (Service 2009).

Plovers depart their breeding grounds for their wintering grounds between July and late August, but southward migration extends through November. More information about the three breeding populations of piping plovers can be found in the following documents:

- a. Piping Plover, Atlantic Coast Population: 1996 Revised Recovery Plan (Service 1996);
- b. 2009 Piping Plover (*Charadrius melodus*) 5-Year Review: Summary and Evaluation (Service 2009);
- c. 2003 Recovery Plan for the Great Lakes Piping Plover (*Charadrius melodus*) (Service 2003);
- d. Questions and Answers about the Northern Great Plains Population of Piping Plover (Service 2002).

Piping plovers use habitats in Florida primarily from July 15 through May 15. Below (2010) surveyed plovers north of Marco Island, Florida, and found plovers color-banded during the surveys to have very high wintering site fidelity. Both spring and fall migration routes of Atlantic Coast breeders are believed to occur primarily within a narrow zone along the Atlantic Coast (Service 1996). The pattern of both fall and spring counts at many Atlantic Coast sites demonstrates that many piping plovers make intermediate stopovers lasting from a few days up to 1 month during their migrations (Noel and Chandler 2005; Stucker and Cuthbert 2006). Some midcontinent breeders travel up or down the Atlantic Coast before or after their overland movements (Stucker and Cuthbert 2006). Use of inland stopovers during migration is also documented (Pompei and Cuthbert 2004). The source breeding population of a given wintering individual cannot be determined in the field unless it has been banded or otherwise marked. Information from observation of color-banded piping plovers indicates that the winter ranges of the breeding populations overlap to a significant degree. While piping plover migration patterns and needs remain poorly understood, and occupancy of a particular habitat may involve shorter periods relative to wintering, information about the energetics of avian migration indicates that this might be a particularly critical time in the species' life cycle.

Review of published records of piping plover sightings throughout North America by Pompei and Cuthbert (2004) found more than 3,400 fall and spring stopover records at 1,196 sites. Published reports indicated piping plovers do not concentrate in large numbers at inland sites and they seem to stop opportunistically. In most cases, reports of birds at inland sites were single individuals.

Piping plovers migrate through and winter in coastal areas of the U.S. from North Carolina to Texas and in portions of Mexico and the Caribbean. Data based on four rangewide mid-winter (late January to early February) population surveys, conducted at 5-year intervals starting in 1991, show that total numbers have fluctuated over time, with some areas experiencing increases and others decreases. Regional and local fluctuations may reflect the quantity and quality of suitable foraging and roosting habitat, which vary over time in response to natural coastal formation processes as well as anthropogenic habitat changes (*e.g.*, inlet relocation, dredging of

shoals and spits). Fluctuations may also represent localized weather conditions (especially wind) during surveys, or unequal survey coverage. For example, airboats facilitated first-time surveys of several central Texas sites in 2006 (Elliott-Smith et al. 2009). Similarly, the increase in the 2006 numbers in the Bahamas is attributed to greatly increased census efforts; the extent of additional habitat not surveyed remains undetermined (Elliott-Smith et al. 2009). Changes in wintering numbers may also be influenced by growth or decline in the particular breeding populations that concentrate their wintering distribution in a given area. Opportunities to locate previously unidentified wintering sites are concentrated in the Caribbean and Mexico (Elliott-Smith et al. 2009). Further surveys and assessment of seasonally emergent habitats (*e.g.*, seagrass beds, mudflats, oyster reefs) within bays lying between the mainland and barrier islands in Texas are also needed.

Midwinter surveys may underestimate the abundance of nonbreeding piping plovers using a site or region during other months. In late September 2007, 104 piping plovers were counted at the south end of Ocracoke Island, North Carolina (National Park Service 2007), where none were seen during the 2006 International Piping Plover Winter Census (Elliott-Smith et al. 2009). Noel et al. (2007) observed up to 100 piping plovers during peak migration at Little St. Simons Island, Georgia, where approximately 40 piping plovers wintered in 2003 to 2005. Differences among fall, winter, and spring counts in South Carolina were less pronounced, but inter-year fluctuations (*e.g.*, 108 piping plovers in spring 2007 versus 174 piping plovers in spring 2008) at 28 sites were striking (Maddock et al. 2009). Even as far south as the Florida Panhandle, monthly counts at Phipps Preserve in Franklin County ranged from a midwinter low of 4 piping plovers in December 2006, to peak counts of 47 in October 2006 and March 2007 (Smith 2007). Pinkston (2004) observed much heavier use of Texas Gulf Coast (ocean-facing) beaches between early September and mid-October (approximately 16 birds per mile) than during December to March (approximately 2 birds per mile).

Local movements of non-breeding piping plovers may also affect abundance estimates. At Deveaux Bank, one of South Carolina's most important piping plover sites, 5 counts at approximately 10-day intervals between August 27 and October 7, 2006, oscillated from 28 to 14 to 29 to 18 to 26 (Maddock et al. 2009). Noel and Chandler (2008) detected banded Great Lakes piping plovers known to be wintering on their Georgia study site in 73.8 ± 8.1 percent of surveys over 3 years.

Abundance estimates for non-breeding piping plovers may also be affected by the number of surveyor visits to the site. Preliminary analysis of detection rates by Maddock et al. (2009) found 87 percent detection during the midwinter period on core sites surveyed three times a month during fall and spring and one time per month during winter, compared with 42 percent detection on sites surveyed three times per year (Cohen 2009).

Gratto-Trevor et al. (2009) found strong patterns (but no exclusive partitioning) in winter distribution of uniquely banded piping plovers from four breeding populations (Figure 3).

All eastern Canada and 94 percent of Great Lakes birds wintered from North Carolina to southwest Florida. However, eastern Canada birds were more heavily concentrated in North Carolina, and a larger proportion of Great Lakes piping plovers were found in South Carolina and Georgia. Northern Great Plains populations were primarily seen farther west and south, especially on the Texas Gulf Coast. Although the great majority of Prairie Canada individuals were observed in Texas, particularly southern Texas, individuals from the U.S. Great Plains were more widely distributed on the Gulf Coast from Florida to Texas.



Figure 3 Distribution and range of *C. m. melodus*: Great Lakes DPS of *C. m. circumcinctus*, Northern Great Plains DPS of *C. m. circumcinctus* (base map from Elliott-Smith and Haig 2004 by permission of Birds of North America Online, <http://bna.birds.cornell.edu/bna>, maintained by the Cornell Lab of Ornithology). Note that this map is a conceptual presentation of subspecies and DPS ranges, and is not intended to convey precise boundaries.

The findings of Gratto-Trevor et al. (2009) provide evidence of differences in the wintering distribution of piping plovers from these four breeding areas. However, the distribution of birds by breeding origin during migration remains largely unknown. Other major information gaps include the wintering locations of the U.S. Atlantic Coast breeding population (banding of U.S. Atlantic Coast piping plovers has been extremely limited) and the breeding origin of piping plovers wintering on Caribbean islands and in much of Mexico.

Banded piping plovers from the Great Lakes, Northern Great Plains, and eastern Canada breeding populations showed similar patterns of seasonal abundance at Little St. Simons Island, Georgia (Noel et al. 2007). However, the number of banded plovers originating from the latter two populations was relatively small at this study area.

This species exhibits a high degree of intra- and interannual wintering site fidelity (Nicholls and Baldassarre 1990a; Drake et al. 2001; Noel and Chandler 2005; Stucker and Cuthbert 2006). Gratto-Trevor et al. (2009) reported that 6 of 259 banded piping plovers observed more than once per winter moved across boundaries of the 7 U.S. regions. Of 216 birds observed in different years, only 8 changed regions between years, and several of these shifts were associated with late summer or early spring migration periods (Gratto-Trevor et al. 2009). Total number of individuals observed on the wintering grounds was 46 for Eastern Canada, 150 for the U.S. Great Lakes, 169 for the U.S. Great Plains, and 356 for Prairie Canada.

Local movements are more common. In South Carolina, Maddock et al. (2009) documented many cross-inlet movements by wintering banded piping plovers as well as occasional movements of up to 11.2 miles by approximately 10 percent of the banded population. Larger movements within South Carolina were seen during fall and spring migration. Similarly, eight banded piping plovers that were observed in two locations during 2006 and 2007 surveys in Louisiana and Texas were all in close proximity to their original location (Maddock 2008).

In 2001, 2,389 piping plovers were located during a winter census, accounting for only 40 percent of the known breeding birds recorded during a breeding census (Ferland and Haig 2002). About 89 percent of birds that are known to winter in the U.S. do so along the Gulf Coast (Texas to Florida), while 8 percent winter along the Atlantic Coast (North Carolina to Florida).

The status of piping plovers on winter and migration grounds is difficult to assess, but threats to piping plover habitat used during winter and migration identified by the Service during its designation of Critical Habitat continue to affect the species. Unregulated motorized and pedestrian recreational use, inlet and shoreline stabilization projects, beach maintenance and nourishment, and pollution affect most winter and migration areas. Conservation efforts at some locations have likely resulted in the enhancement of wintering habitat.

The 2004 and 2005 hurricane seasons affected a substantial amount of habitat along the Gulf Coast. Habitats such as those along Gulf Islands National Seashore have benefited from increased washover events which created optimal habitat conditions for piping plovers. Conversely, hard shoreline structures are put into place following storms throughout the species range to prevent such shoreline migration (see *Factors Affecting the Species Habitat within the Action Area*). Four hurricanes between 2002 and 2005 are often cited in reference to rapid erosion of the Chandeleur Islands, a chain of low-lying islands in Louisiana where the 1991 International Piping Plover Census tallied more than 350 piping plovers. Comparison of imagery taken 3 years before and several days after Hurricane Katrina found that the Chandeleur Islands lost 82 percent of their surface area (Sallenger et al. in review), and a review of aerial photography prior to the 2006 Census suggested little piping plover habitat remained (Elliott-Smith et al. 2009). However, Sallenger et al. (in review) noted that habitat changes in the Chandeleurs stem not only from the effects of these storms, but rather from the combined effects of the storms, long-term (greater than 1,000 years) diminishing sand supply, and sea-level rise relative to the land.

The Service is aware of the following site specific conditions that affect the status of several habitats piping plover use while wintering and migrating, including Critical Habitat Units. In Texas, one Critical Habitat Unit was afforded greater protection due to the acquisition of adjacent upland properties by the local Audubon chapter. In another unit in Texas, vehicles were removed from a portion of the beach decreasing the likelihood of automobile disturbance to plovers. Exotic plant removal is occurring in another Critical Habitat Unit in South Florida. The Service and other government agencies remain in a contractual agreement with the U.S. Department of Agriculture for predator control within limited coastal areas in the Florida panhandle, including portions of some Critical Habitat Units. Continued removal of potential terrestrial predators is likely to enhance survivorship of wintering and migrating piping plovers. In North Carolina, one Critical Habitat Unit was afforded greater protection when the local Audubon chapter agreed to manage the area specifically for piping plovers and other shorebirds following the relocation of a nearby inlet channel.

Biogeography and Habitat Preferences

Wintering piping plovers prefer coastal habitats that include sand spits, islets (small islands), tidal flats, shoals (usually flood tidal deltas), and sandbars that are often associated with inlets (Harrington 2008). Sandy mud flats, ephemeral pools, and overwash areas are also considered primary foraging habitats. These substrate types have a richer infauna than the foreshore of high energy beaches and often attract large numbers of shorebirds (Cohen et al. 2008). Wintering plovers are dependent on a mosaic of habitat patches and move among these patches depending on local weather and tidal conditions (Nicholls and Baldassarre 1990a).

Recent study results in North Carolina, South Carolina, and Florida, complement information from earlier investigations in Texas and Alabama (summarized in the 1996 Atlantic Coast and 2003 Great Lakes Recovery Plans) regarding habitat use patterns of piping plovers in their coastal migration and wintering range. As documented in Gulf Coast studies, nonbreeding piping plovers in North Carolina primarily used sound (bay or bayshore) beaches and sound islands for foraging and ocean beaches for roosting, preening, and being alert (Cohen et al. 2008). The probability of piping plovers being present on the sound islands increased with increasing exposure of the intertidal area (Cohen et al. 2008). Maddock et al. (2009) observed shifts to roosting habitats and behaviors during high-tide periods in South Carolina.

LeDee et al. (2008) conducted a remote analysis of piping plover wintering sites, measuring 11 ecological parameters to determine their correlation to piping plover presence. Piping plover abundance was negatively correlated with urban area and total road length, and positively correlated with inter-tidal area, presence on the mainland (as opposed to the peninsula/island feature), and total inter-tidal and beach area (LeDee et al. 2008).

Recent geographic analysis of piping plover distribution on the upper Texas coast noted major concentration areas at the mouths of rivers, washover passes (low, sparsely vegetated barrier island habitats created and maintained by temporary, storm-driven water channels), and major bay systems (Arvin 2008). Earlier studies in Texas have drawn attention to washover passes,

which are commonly used by piping plovers during periods of high bayshore tides and during the spring migration period (Zonick 1997; Zonick 2000). Elliott-Smith et al. (2009) reported piping plover concentrations on exposed seagrass beds and oyster reefs during seasonal low water periods in 2006.

Of all the states and provinces in North America, Florida is most intimately linked with the sea. Florida's 1,200-mile coastline (exclusive of the Keys) is easily the longest in the continental U.S. Of the 1,200 miles, 745 miles are sandy and mostly in the form of barrier islands. The coastline is dynamic and constantly changing as a result of waves, wind, tides, currents, sea-level change, and storms. The entire state lies within the coastal plain, with a maximum elevation of about 400 feet, and no part is more than 60 miles from the Atlantic Ocean or the Gulf of Mexico.

The east coast of Florida consists of a dynamic shoreline, with a relatively sloped berm, coarse-grained sand, and moderate to high surf (Witherington 1986). West-central Florida beaches are considered to be low energy beaches with a gradual offshore slope and fine-grained, quartz sand beaches. The dynamics of the Florida shoreline are shaped by the occurrence of storm surges and seas from tropical storms that occur mainly during August through early October. The East coast may also experience erosion from late September through March due to nor'easters. Gulf beaches are largely protected from severe nor'easters. The impacts of these two types of storms may vary from event to event and year to year.

Coasts with greater tidal ranges are more buffered against storm surges than are those with low tidal ranges, except when the storm strikes during high tide. Mean tidal ranges decrease southward along the Atlantic coast from a mean of 7 feet at the Florida-Georgia line to less than 2 feet in Palm Beach County. The mean tidal range along the Gulf Coast is less than 3 feet (microtidal) except in the extreme south where it ranges from 3 to 4 feet. Because of its lower elevation and lower wave energy regime, the West Coast of the peninsula is subject to greater changes during storm events than is the east coast.

Foraging/Food Habits

Behavioral observations of piping plovers on the wintering grounds suggest that they spend the majority of their time foraging (Nicholls and Baldassarre 1990a; Drake 1999a, 1999b). Plovers forage on moist substrate features such as intertidal portions of ocean beaches, washover areas, mudflats, sand flats, algal flats, shoals, wrack lines, sparse vegetation, and shorelines of coastal ponds, lagoons, and ephemeral pools, and adjacent salt marshes (Gibbs 1986; Zivojnovich and Baldassarre 1987; Nicholls 1989; Coutu et al. 1990; Nicholls and Baldassarre 1990a; Nicholls and Baldassarre 1990b; Hoopes 1993; Loegering 1992; Goldin 1993; Elias-Gerken 1994; Wilkinson and Spinks 1994; Zonick 1997; Service 2001a). Studies have shown that the relative importance of various feeding habitat types may vary by site (Gibbs 1986; Coutu et al. 1990; McConnaughey et al. 1990; Loegering 1992; Goldin 1993; Hoopes 1993). Feeding activities may occur during all hours of the day and night (Staine and Burger 1994; Zonick 1997), and at all stages in the tidal cycle (Goldin 1993; Hoopes 1993). Wintering plovers primarily feed on invertebrates such as polychaete marine worms, various crustaceans, fly larvae, beetles, and

occasionally bivalve mollusks found on top of the soil or just beneath the surface (Bent 1929; Cairns 1977; Nicholls 1989; Zonick and Ryan 1996).

As observed in Texas studies, Lott et al. (2009) identified bay beaches (bay shorelines as opposed to ocean-facing beaches) as the most common landform used by foraging piping plovers in southwest Florida. However in northwest Florida, Smith (2007) reported landform use by foraging piping plovers about equally divided between Gulf of Mexico (ocean-facing) and bay beaches. Exposed intertidal areas were the dominant foraging substrate in South Carolina (accounting for 94 percent of observed foraging piping plovers; Maddock et al. 2009) and in northwest Florida (96 percent of foraging observations; Smith 2007). In southwest Florida, Lott et al. (2009) found approximately 75 percent of foraging piping plovers on intertidal substrates.

Home Range

Plovers seem to exhibit strong site fidelity to nonbreeding areas. Plovers vary their habitat use, and it is suggested heterogeneous habitats may be more important than specific habitat features for plovers (Drake et al. 2001; Nicholls and Baldassarre 1990b). Mean home range size (95 percent of locations) for 49 radio-tagged piping plovers in southern Texas in 1997 through 1998 was 3,113 acres, mean core area (50 percent of locations) was 717 acres, and the mean linear distance moved between successive locations (1.97 ± 0.04 days apart) averaged across seasons, was 2.1 miles (Drake 1999a; Drake et al. 2001). Seven radio-tagged piping plovers used a 4,967-acre area (100 percent minimum convex polygon) at Oregon Inlet in 2005 and 2006, and piping plover activity was concentrated in 12 areas totaling 544 acres (Cohen et al. 2008). Noel and Chandler (2008) observed high fidelity of banded piping plovers along a 0.62 and 2.8 mile section of beach on Little St. Simons Island, Georgia.

Life Cycle

Piping plovers spend up to 10 months of their life cycle on their migration and at wintering grounds, generally July 15 through as late as May 15. Piping plover migration routes and habitats overlap breeding and wintering habitats, and, unless banded, migrants passing through a site usually are indistinguishable from breeding or wintering piping plovers. Migration stopovers by banded piping plovers from the Great Lakes have been documented in New Jersey, Maryland, Virginia, and North Carolina (Stucker and Cuthbert 2006). Migrating breeders from eastern Canada have been observed in Massachusetts, New Jersey, New York, and North Carolina (Amirault et al. 2005). As many as 85 staging piping plovers have been tallied at various sites in the Atlantic breeding range (Perkins 2008), but the composition (*e.g.*, adults that nested nearby and their fledged young of the year versus migrants moving to or from sites farther north), stopover duration, and local movements are unknown. In general, distance between stopover locations and duration of stopovers throughout the coastal migration range remains poorly understood.

Predators and Competitors

Plovers face predation by avian and mammalian predators that are present year-round on the wintering grounds. There are minimal studies on the impacts of predation on migrating or wintering piping plovers, and investigations into effects of predation on nonbreeding piping plovers falls under the Great Lakes recovery plan. Predator control on their wintering and migration grounds is considered to be a low priority at this time, except for the threat of disturbance to roosting and feeding piping plovers posed by dogs off leash (Service 2009). Plovers must compete with other shorebirds for suitable foraging and roosting habitat.

Disease Factors

Neither the final listing rule nor the recovery plans state that disease is an issue for the species, and no plan assigns recovery actions to this threat factor. The Piping Plover 5-Year Review: Summary and Evaluation provides additional information on the limited concern of avian influenza and West Nile virus on the species (Service 2009).

Roosting

Several studies identified wrack (organic material including seaweed, seashells, driftwood, and other materials deposited on beaches by tidal action) as an important component of roosting habitat for nonbreeding piping plovers. Lott et al. (2009) found greater than 90 percent of roosting piping plovers in southwest Florida in old wrack with the remainder roosting on dry sand. In South Carolina, 18 and 45 percent of roosting piping plovers were in fresh and old wrack, respectively. The remainder of roosting birds used intertidal habitat (22 percent), backshore (defined as the zone of dry sand, shell, cobble and beach debris from the mean high water line up to the toe of the dune; 8 percent), washover (2 percent), and ephemeral pools (1 percent) (Maddock et al. 2009). Thirty percent of roosting piping plovers in northwest Florida were observed in wrack substrates with 49 percent on dry sand and 20 percent using intertidal habitat (Smith 2007). In Texas, seagrass debris (bayshore wrack) was an important feature of piping plover roosting sites (Drake 1999a). Mean abundance of two other plover species in California, including the listed western snowy plover, was positively correlated with an abundance of wrack during the nonbreeding season (Dugan et al. 2003).

Seven years of surveys, two to three times per month, along 8 miles of Gulf of Mexico (ocean-facing) beach in Gulf County, Florida, cumulatively documented nearly the entire area used at various times by roosting or foraging piping plovers. Birds were reported using the midbeach to the intertidal zone. Numbers ranged from 0 to 39 birds on any given survey day (Eells unpublished data).

Atlantic Coast and Florida studies highlighted the importance of inlets for nonbreeding piping plovers. Almost 90 percent of roosting piping plovers at ten coastal sites in southwest Florida were on inlet shorelines (Lott et al. 2009). Piping plovers were among seven shorebird species found more often than expected ($p = 0.0004$; Wilcoxon Test Scores) at inlet locations versus

noninlet locations in an evaluation of 361 International Shorebird Survey sites from North Carolina to Florida (Harrington 2008).

Population dynamics

Population Size

The International Piping Plover Breeding Census is conducted throughout the breeding grounds every 5 years by the Great Lakes/Northern Great Plains Recovery Team of the U.S. Geological Survey (USGS). The census is the largest known, complete avian species census, and is coordinated by Elise Elliott Smith and various state and provincial coordinators. It is designed to determine species abundance and distribution throughout its annual cycle. The last survey in 2006 documented 3,497 breeding pairs, with a total of 8,065 birds throughout Canada and the U.S. A more recent 2010 Atlantic Coast breeding piping plover population estimate was 1,782 pairs, which was more than double the 1986 estimate of 790 pairs. This was determined to be a net increase of 86 percent between 1989 and 2010 (Service 2011). An associated winter census documented a total of 454 piping plovers in Florida (Elliott-Smith et al. 2009). For the Gulf Coast of Florida, the surveys documented 321 piping plovers at 117 sites covering approximately 522 miles of suitable habitat (Elliott-Smith et al 2009). A total of 133 plovers were observed along the Atlantic Coast during the 2009 survey, and Northwest Florida numbers for the 2006 International Piping Plover Census were 111, with an increased survey effort from previous years. This represents an increase from the 53 piping plovers sighted in the 2001 effort. More information on the results of past International Piping Plover Censuses and an analysis of the data is found in the 2009 Service's Piping Plover 5-Year Review: Summary and Evaluation (Service 2009) and in the report published by the USGS (Elliott-Smith et al. 2009). In addition, bird populations throughout Florida are monitored by volunteers and The Conservancy of Southwest Florida. Launched in 2002 by the Cornell Lab of Ornithology and National Audubon Society, eBird provides data concerning bird abundance and distribution at a variety of spatial and temporal scales. eBird is sponsored in part by several Service programs, research groups, non-government offices, and the University of the Virgin Islands. From January through November 2012, 703 reports of piping plovers were documented in the Action Area by eBird members. Although multiple observations of the same bird may have been documented, these reports included observations totaling 3,466 individuals; 240 reports with observations of 752 individuals located in the NFESO AOR, and 337 reports with observations of 2,032 individuals located in the SFESO AOR.

Population Variability

The pattern of population growth among the recovery units along the Atlantic Coast was uneven, and was accompanied by periodic declines in both overall and regional populations (Service 2011). Although there is some indication of recovery in the Atlantic Coast population, any optimism should be tempered by observed geographic and temporal variability in population growth.

Population Stability

The most consistent finding in the various population viability analyses conducted for piping plovers (Ryan et al. 1993; Melvin and Gibbs 1996; Plissner and Haig 2000; Wemmer et al. 2001; Larson et al. 2002; Amirault et al. 2005; Calvert et al. 2006; Brault 2007) indicates even small declines in adult and juvenile survival rates will cause increases in extinction risk. A banding study conducted between 1998 and 2004 in Atlantic Canada concluded lower return rates of juvenile (first year) birds to the breeding grounds than was documented for Massachusetts (Melvin and Gibbs 1996), Maryland (Loeering 1992), and Virginia (Cross 1996) breeding populations in the mid-1980s and very early 1990s. This is consistent with failure of the Atlantic Canada population to increase in abundance despite high productivity (relative to other breeding populations) and extremely low rates of dispersal to the U.S. over the last 15 plus years (Amirault et al. 2005). This suggests maximizing productivity does not ensure population increases. However, other studies suggest that survivability is good at wintering sites (Drake et al. 2001). Please see the Piping Plover 5-Year Review: Summary and Evaluation for additional information on survival rates at wintering habitats (Service 2009).

Status and distribution

Reasons for Listing

The 1985 final rule stated the number of piping plovers on the Gulf of Mexico coastal wintering grounds might be declining as indicated by preliminary analysis of the Christmas Bird Count data. Independent counts of piping plovers on the Alabama coast indicated a decline in numbers between the 1950s and early 1980s. At the time of listing, the Texas Parks and Wildlife Department stated 30 percent of wintering habitat in Texas had been lost over the previous 20 years. The final rule also stated, in addition to extensive breeding area problems, the loss and modification of wintering habitat was a significant threat to the piping plover.

Threats to Piping Plovers

The Piping Plover 5-Year Review: Summary and Evaluation (Service 2009) provides an analysis of threats to piping plovers in their migration and wintering range. The threats identified in this document that were of primary concern included the loss and modification of wintering habitat (including shoreline development, beach maintenance and nourishment, inlet dredging, and the construction of jetties and groins).

The Piping Plover 5-Year Review: Summary and Evaluation noted that overutilization for commercial, recreational, scientific, or educational purposes was not a current threat to piping plovers on their wintering and migration grounds. Disease was identified as being only a minor threat. The impacts of predation on nonbreeding populations are largely undocumented, but they remain a potential threat. However, the Service considers predator control on piping plover wintering and migration grounds to be a low priority at this time (Service 2009).

Neither the final listing rule nor the recovery plans state disease is an issue for piping plover, and no plan assigns recovery actions to this threat factor. Based on information available to date, West Nile virus and avian influenza are a minor threat to piping plovers (Service 2009).

Habitat loss and degradation on winter and migration grounds from shoreline and inlet stabilization efforts, both within and outside of designated Critical Habitat, remains a serious threat to all piping plover populations. In some areas, beaches that abut private property are needed by wintering and migrating piping plovers. However, residential and commercial developments that typically occur along private beaches may pose significant challenges for efforts to maintain natural coastal processes. The threat of habitat loss and degradation, combined with the threat of sea-level rise associated with climate change, raise serious concerns regarding the ability of private beaches to support piping plovers over the long term.

Future actions taken on private beaches will determine whether piping plovers continue to use these beaches or whether the recovery of piping plovers will principally depend on public property. As Lott et al. (2009) concludes, “The combination of development and shoreline protection seems to limit distribution of non-breeding piping plovers in Florida. If mitigation or habitat restoration efforts on barrier islands fronting private property are not sufficient to allow plover use of some of these areas, the burden for plover conservation will fall almost entirely on public land managers.”

While public lands may not be at risk of habitat loss from private development, significant threats to piping plover habitat remain on many municipal, State, and federally owned properties. These public lands may be managed with competing missions that include conservation of imperiled species, but this goal frequently ranks below providing recreational enjoyment to the public, readiness training for the military, or energy development projects.

Public lands remain the primary places where natural coastal dynamics are allowed. Of recent concern are requests to undertake beach nourishment actions to protect coastal roads or military infrastructure on public lands. If project design does not minimize impediments to shoreline overwash which are necessary to help replenish bayside tidal flat sediments and elevations, significant bayside habitat may become vegetated or inundated, thereby exacerbating the loss of preferred piping plover habitat. Conversely, if beach fill on public lands is applied in a way that allows for “normal” system overwash processes, and sediment is added back to the system, projects may be less injurious to barrier island species that depend on natural coastal dynamics.

Maintaining wrack for food and cover in areas used by piping plovers may help offset effects that result from habitat degradation due to sand placement associated with berm and beach nourishment projects and ensuing human disturbance. Leaving wrack on private beaches may improve use by piping plovers, especially during migration when habitat fragmentation may have a greater effect on the species. In addition, using recreation management techniques, Great Lakes recovery action 2.14 may minimize the effects of habitat loss. Addressing off-road vehicles and pet disturbance may increase the suitability of existing piping plover habitat.

The dredging and mining of sediment from inlet complexes threatens the piping plover on its wintering grounds through habitat loss and degradation. The maintenance of deep draft navigation channels by dredging can alter the natural coastal processes on inlet shorelines of nearby barrier islands (Service 2012). Forty-four percent of the tidal inlets within the U.S. wintering range of the piping plover have been or continue to be dredged, primarily for navigational purposes. The dredging of navigation channels or relocation of inlet channels for erosion-control purposes contributes to the cumulative effects of inlet habitat modification by removing or redistributing the local and regional sediment supply. Dredging can occur on an annual basis or every 2 to 3 years, resulting in continual perturbations and modifications to inlets and their adjacent shoreline habitats (Service 2012).

As sand sources for beach nourishment projects have become more limited, ebb tidal shoals are being utilized as borrow areas more frequently. Exposed ebb and flood tidal shoals and sandbars are prime roosting and foraging habitats for piping plovers. In general, these shoals are only accessible by boat and tend to receive less human recreational use than nearby mainland beaches. This mining of material from inlet shoals for use as beach fill is not equivalent to the natural sediment bypassing due to the virtually instantaneous movement of sand. In a natural system, the sand would gradually and continuously move through the inlet system, providing a greater opportunity for emergent shoals to form (Service 2012).

The Deepwater Horizon oil spill, which started April 20, 2010, discharged into the Gulf of Mexico through July 15, 2010. According to government estimates, the leak released between 100 and 200 million gallons of oil into the Gulf. The U.S. Coast Guard estimates that more than 50 million gallons of oil have been removed from the Gulf, or roughly a quarter of the spill amount. Additional effects to natural resources may be attributed to the 1.84 million gallons of dispersant applied to the spill. As of July 2010, approximately 625 miles of Gulf Coast shoreline was oiled (approximately 360 miles in Louisiana, 105 miles in Mississippi, 66 miles in Alabama and 94 miles in Florida) (Joint Information Center 2010). These numbers reflect a daily snapshot of shoreline that experienced effects from oil; however, they do not include cumulative effects to date, or shoreline that has already been cleaned.

Piping plovers have continued to winter within the Gulf of Mexico shorelines. Researchers have and continue to document oiled piping plovers stemming from this spill. Oiling of designated piping plover Critical Habitat has been documented. Affects to the species and its habitat are expected, but their extent remains difficult to predict. The U.S. Coast Guard, the states, and responsible parties from the Unified Command, with advice from Federal and State natural resource agencies, initiated protective and cleanup efforts per prepared contingency plans to deal with petroleum and other hazardous chemical spills for each state's coastline. The contingency plans identify sensitive habitats, including all federally listed species' habitats, which receive a higher priority for response actions. Those plans allow for immediate habitat protective measures for cleanup activities in response to large contaminant spills. While such plans usually ameliorate the threat to piping plovers, it is yet unknown how much improvement will result in this case given the breadth of the effects associated with the Deepwater Horizon incident.

Based on all available data prior to the Deepwater Horizon oil spill, the risk of effects from contamination to piping plovers and their habitat was recognized, but the safety contingency plans were considered adequate to alleviate most of these concerns. The Deepwater Horizon incident has brought heightened awareness of the intensity and extent of impacts to fish and wildlife habitat from large-scale releases. In addition to potential direct habitat degradation from oiling of intertidal habitats and retraction of stranded boom, effects to piping plovers may occur from the increased human presence associated with boom deployment and retraction, cleanup activities, wildlife response, and damage assessment crews working along shorelines. Research studies are documenting the potential expanse of effects to the piping plover.

Analysis of the species/Critical Habitat likely to be affected

The proposed action has the potential to adversely affect wintering and migrating piping plovers and their habitat from all three breeding populations that may use the Action Area. The Atlantic Coast and Great Plains breeding populations of piping plover are listed as threatened, while the Great Lakes breeding population is listed as endangered. Therefore, this P³BO considers the potential effects of this project on this species and its designated Critical Habitat.

The July 10, 2001, FR notice designated approximately 27,328 acres (corresponding to approximately 47 miles of beach) as Critical Habitat for wintering piping plovers in peninsular Florida. There are no Corps civil works shore protection projects located in designated Critical Habitat. There are five Corps civil works navigation projects that typically place dredged material in Critical Habitat Units: King's Bay (Unit FL-36), Ponce Inlet (Unit FL-34), St. Lucie Inlet (Unit FL-33), Matanzas Pass (Unit FL-25), and Tampa Harbor (Unit FL-21). Maintenance dredging at these navigational channels typically occurs on 1 to 5 year intervals. These five units account for 1,749 acres (10 miles) of the 23,709 acres of total designated Critical Habitat in the Action Area (or 7.4 percent). These and other Critical Habitat Units may also be affected by non-Civil Works projects under Corps regulatory authority.

This P³BO does not rely on the regulatory definition of "destruction or adverse modification" of Critical Habitat at 50 C.F.R. 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to Critical Habitat.

ENVIRONMENTAL BASELINE

Status of the species/Critical Habitat within the Action Area

As mentioned in Section II(C)1, the 2006 International Piping Plover Census surveys documented 321 wintering piping plovers at 117 sites covering approximately 522 miles of suitable habitat along the Gulf Coast of Florida, and an additional 133 plovers along the Atlantic Coast (Elliott-Smith et al 2009). In addition, bird populations throughout Florida are monitored by volunteers and The Conservancy of Southwest Florida. Launched in 2002, by the Cornell Lab of Ornithology and National Audubon Society, eBird provides data concerning bird abundance and distribution at a variety of spatial and temporal scales. eBird is sponsored in part by several

Service programs, research groups, non-government offices, and the University of the Virgin Islands. From January through November 2012, 703 reports of piping plovers were documented in the Action Area by eBird members. These reports included observations totaling 3,466 individuals; 240 reports with observations of 752 individuals located in the NFESO AOR, and 337 reports with observations of 2,032 individuals located in the SFESO AOR. It is important to note many of these observations may be multiple observations of the same specimen; therefore, these numbers do not represent a population estimate.

The Action Area encompasses 11 Critical Habitat Units in the NFESO's AOR (Figure 1), and an additional 11 Critical Habitat Units in the SFESO's AOR (Figure 2). The descriptions of the Critical Habitat Units associated with the proposed action vary, but generally include land from mean lower low water to where densely vegetated habitat or developed structures, not used by piping plovers, begin and where the PCEs no longer occur. The PCEs consist of intertidal flats including sand or mud flats with no or very sparse emergent vegetation. In addition, adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are important.

Factors affecting the species environment within the Action Area

Coastal development

Shoreline development throughout the wintering range poses a threat to all populations of piping plovers. Beach maintenance and nourishment, inlet dredging, and artificial structures, such as jetties and groins, can eliminate wintering areas and alter sedimentation patterns leading to the loss of nearby habitat. Structural development along the shoreline or manipulation of natural inlets upsets the dynamic processes and results in habitat loss or degradation (Melvin et al. 1991). Increased coastal development brings other recreational disturbances that are known to prevent bird usage of an area, including human disturbance, predation or disturbance by domestic animals, beach raking and cleaning, and habitat degradation by off-road vehicles (Service 2009).

Recreational management techniques, such as vehicle restrictions, pet restrictions, and symbolic fencing (usually sign posts and string) of roosting and feeding habitats, can help to address anthropogenic disturbances to wintering plovers. Educational materials, such as informational signs or brochures, can also provide valuable information to assist the public in understanding the need for conservation measures. Although these measures can be effective, they are not implemented consistently throughout the State.

Accelerated sea-level rise

Potential effects of sea-level rise on coastal beaches vary regionally due to subsidence or uplift as well as the geological character of the coast and nearshore (Service 2009). Low elevations and proximity to the coast make all nonbreeding coastal piping plover foraging and roosting habitats vulnerable to the effects of rising sea-level. Furthermore, areas with small astronomical tidal ranges (*e.g.*, portions of the Gulf Coast where intertidal range is less than 3.3 feet) are the most vulnerable to loss of intertidal wetlands and flats induced by sea-level rise (EPA 2009).

Inundation of piping plover habitat by rising seas could lead to permanent loss of habitat that lies immediately seaward of numerous structures or roads, especially if those shorelines are also armored with hardened structures. Without development or armoring, low undeveloped islands can migrate toward the mainland, pushed by the overwashing of sand eroding from the seaward side and being re-deposited in the bay (Scavia et al. 2002). Overwash and sand migration are impeded on developed portions of islands. Instead, as sea-level increases, the ocean-facing beach erodes and the resulting sand is deposited offshore. The buildings and the sand dunes then prevent sand from washing back toward the lagoons, and the lagoon side becomes increasingly submerged during extreme high tides (Scavia et al. 2002), diminishing both barrier beach shorebird habitat and protection for mainland developments.

A number of groups have met to discuss climate change and its potential impacts to Florida. In 2007, Governor Charlie Crist hosted “Serve to Preserve: A Florida Summit on Global Climate Change.” To combat climate change, this summit focused on methods for reducing emissions to avoid contributing to climate change. It did not address efforts to limit coastal development or to encourage more natural coastal processes. Based on the present level of available information concerning the effects of global climate change on the status of the piping plover and its designated Critical Habitat, the Service acknowledges the potential for changes to occur in the Action Area.

Sand placement activities

Sand placement projects have the potential to alter piping plover habitat, including the PCEs of Critical Habitat. Beach nourishment can create a beach seaward of existing hard stabilization or heavy development, where the beach has been lost due to erosion and/or sea-level rise, restoring associated ecosystem functions. Although dredge and fill projects that place sand on beaches or dunes may restore lost or degraded habitat, these projects may degrade habitat by altering the natural sediment composition and depressing the invertebrate base in some areas. This hinders habitat migration with sea-level rise, and replaces the natural dune beach nearshore system with artificial geomorphology (Service 2012). Lott et al. (2009) found a strong negative correlation between sand placement projects and the presence of plovers on the Gulf Coast of Florida; however, he noted that additional research was needed to clarify whether the cause was the sand placement project or the tendency for these projects to be located on highly developed shorelines. Harrington (2008) noted the need for a better understanding of the potential effects of inlet-related projects, such as jetties, on bird habitats.

In areas where the shoreline is highly eroded, sand placement activities can improve piping plover foraging and roosting habitat (National Research Council 1995). Sand placement activities add sand to the sediment budget, increasing the beach width and providing a sand source for emergent nearshore features to form. Although there is some research related to the management of beach nourishment projects to better maintain the habitat for piping plovers, much of this research is focused on beaches in the northern U.S. where breeding occurs (Melvin et al. 1991; Houghton 2005; Maslo et al. 2010). In their wintering grounds, increasing beach

width is an important aspect of beach nourishment projects in highly developed, eroding areas. The timing of the project is also important in preventing impacts to piping plovers as a result of sand placement activities.

EFFECTS OF THE ACTION

This section is an analysis of the beneficial, direct, and indirect effects of the proposed actions on wintering piping plovers within the Action Area. The analysis includes effects of interrelated and interdependent activities. An interrelated activity is an activity that is part of a proposed action and depends on the proposed activity. An interdependent activity is an activity that has no independent utility apart from the action.

Factors to be considered

The proposed projects will occur within habitat that is used by wintering piping plovers. Since piping plovers can be present on these beaches for up to 10 months per year, construction is likely to occur while the species is utilizing these beaches and associated habitats. Short-term and temporary impacts to piping plover activities could result from project work occurring on the beach that flushes birds from roosting or foraging habitat. Long-term impacts could include a hindrance in the ability of wintering plovers to recuperate from their migratory flight from their breeding grounds, survive on their wintering areas, or to build fat reserves in preparation for migration back to their breeding grounds. Long-term impacts may also result from changes in the physical characteristics of the beach from the placement of the sand.

Proximity of the action

Maintenance dredging of navigational inlets occurs throughout the state in both Federal and non-Federal channels. Sand placement activities (resulting from both shore protection projects and placement of dredged materials as a result of maintenance dredging activities) would occur within and adjacent to wintering piping plover foraging and roosting habitats. Groin and jetty repair or replacement would occur adjacent to inlets, or along beach habitats where they may be used to stabilize the beach and limit erosion.

Distribution

Sand placement activities that may impact piping plover roosting and foraging would occur along both the Gulf of Mexico and the Atlantic Ocean coasts. The Service expects the proposed construction activities could directly and indirectly affect the availability of habitat for migrating and wintering piping plovers to roost and forage. The proposed construction activities are also expected to cause piping plovers usage of Critical Habitat Units located within the Action Area to temporarily decrease.

Timing

The timing of maintenance dredging, sand placement, and groin/jetty repairs or replacement activities may occur during or outside of the migration and wintering period for piping plovers (July 15 to May 15). For projects occurring outside of the migration and wintering period, the Service expects indirect effects to occur later in time.

Nature of the effect

Although the Service expects direct short-term effects from disturbance during project construction, it is anticipated the action will also result in direct, and indirect, long term effects to piping plovers and Critical Habitat. The Service expects there may be morphological changes to piping plover habitat, including roosting and foraging habitat, and to Critical Habitat within the Action Area. Activities that affect or alter the use of optimal habitat, Critical Habitat, or increase disturbance to the species may decrease the survival and recovery potential of the piping plover. Effects to piping plovers and their habitat as a result of groin and jetty repair or replacement will primarily be due to construction ingress and egress when construction is required to be conducted from land. In addition, construction materials and equipment may need to be stockpiled on the beach. These effects would be more likely to be experienced with repair or replacement of groin structures that are located in shallower water, as the majority of work done to jetties is conducted from the water or from the crest of the structure (Martin 2013).

Duration

Time to complete the project construction varies depending on the project size, weather, and other factors (equipment mobilization and break downs, availability of fuel, lawsuits, etc.). According to Corps estimations, project work could take as little as 1 month and as long as 2 years. Piping plover habitats would remain disturbed until the project is completed and the habitats are restored. Beach restoration projects would typically be complete in 6 to 12 months. The direct effects would be expected to be short-term in duration, until the benthic community reestablishes within the new beach profile. Indirect effects from the activity, including those related to altered sand transport systems, may continue to occur as long as sand remains on the beach.

The effects of the proposed action are of a temporary quantitative and qualitative nature. The habitat will be temporarily unavailable to wintering plovers during the construction period, and the quality of the habitat will be reduced for several months following project activities. Dredging in inlets where emergent shoals have formed would result in a loss of optimal piping plover habitat, which may or may not reform in the same quality or quantity in the future. Dredging inlets, repairing and replacing groins or jetties, or sand placement during months when piping plovers are present causes disturbance that disrupts the birds' foraging efficiency and hinders their ability to build fat reserves over the winter and in preparation for migration, as well as their recuperation from migratory flights (Service 2009). The mean linear distance moved by wintering plovers from their core area is estimated to be approximately 2.1 miles (Drake et al.

2001), suggesting they could be negatively impacted by temporary disturbances anywhere in their core habitat area. The PCEs associated with designated Critical Habitat would be temporarily adversely affected during and following sand placement, but may also experience some positive benefits from the increase in available beach and its associated new wrack.

Disturbance frequency

The frequency of maintenance dredging activities varies greatly, and can be as often as annually or semiannually at some inlets that experience high rates of shoaling, or as infrequently as once every 7 years at inlets that do not experience high rates of shoaling. Sand placement activities as a result of shore protection activities typically occur once every 5 to 7 years. Dredging and sand placement can occur at any time during the year based on availability of funding, other applicable species' windows, and the availability of dredges to conduct the work.

The disturbance frequency related to groin and jetty repair and replacement varies greatly based on the original construction methodology, the construction materials, and the conditions under which the structure is placed. Most structures in Florida are constructed with Florida limerock or granite (preferred). Granite structures can last 50 years or more without requiring maintenance, while limerock structures may require maintenance on a slightly more frequent basis due to their lower densities. On average, hard structures are designed to require only minor repairs (such as replacing dislocated rock) that would only be expected approximately every 20 years (Martin 2013).

Disturbance severity

The Action Area encompasses a large percentage of the wintering range of the piping plover; however, the overall intensity of the disturbance is expected to be minimal. The intensity of the effect on piping plover habitat may vary depending on the frequency of the sand placement activities, the existence of staging areas, and the location of the beach access points. The severity is also likely to be slight, as plovers located within the Action Area are expected to move outside of the construction zone due to disturbance; therefore, no plovers are expected to be directly taken as a result of this action.

Analyses for effects of the action

The Action Area encompasses peninsular Florida within the AORs of the NFESO and the SFESO on both the Atlantic and Gulf coasts of Florida. It consists mostly of designated piping plover Critical Habitat Units and publicly owned land that exhibits the following features: located within 1 mile of an inlet; emergent nearshore sand bars; washover fans; emergent bayside and Ocean/Gulf-side shoals and sand bars; bayside mudflats, sand flats, and algal flats; or bayside shorelines of bays and lagoons.

Direct effects

Sand placement projects that utilize beach compatible material from either an appropriate borrow site or from the authorized Federal channel, have the potential to elevate the beach berm and widen the beach, providing storm protection and increasing recreational space. The construction window (*i.e.*, sand placement, dredging, groin and jetty repair/replacement) for each event is likely to extend through a portion of at least one piping plover migration and winter season. If material is placed on the beach, heavy machinery and equipment (*e.g.*, trucks and bulldozers operating on Action Area beaches, the placement of the dredge pipeline, and sand placement) may adversely affect migrating and wintering piping plovers in the Action Area by disturbing and disrupting normal activities such as roosting and feeding, and possibly forcing birds to expend valuable energy reserves to seek available habitat in adjacent areas along the shoreline. Sand placement may occur in and adjacent to habitat that appears suitable for roosting and foraging piping plovers, or that will become more optimal with time. Short-term and temporary construction effects to piping plovers will occur if the birds are roosting and feeding in the area during a migration stopover. The deposition of sand may temporarily deplete the intertidal food base along the shoreline and temporarily disturb roosting birds during project construction.

For some highly eroded beaches, sand placement will have a beneficial effect on the habitat's ability to support wintering piping plovers. Narrow beaches that do not support a productive wrack line may see an improvement in foraging habitat available to piping plovers following sand placement. The addition of sand to the sediment budget may also increase a sand-starved beach's likelihood of developing habitat features valued by piping plovers, including washover fans and emergent nearshore sand bars.

Maintenance dredging of shallow-draft inlets can occasionally require the removal of emergent shoals that may have formed at the location of the Federally-authorized channel from the migration of the channel over time. In these cases, the dredging activities would result in a complete take of that habitat. However, this take could be either temporary or more permanent in nature depending upon the location of future shoaling within the inlet.

Groins and jetties are shore-perpendicular structures that are designed to trap sand that would otherwise be transported by longshore currents. Jetties are defined as structures placed to keep sand from flowing into channels (Kaufman and Pilkey 1979; Komar 1983). In preventing normal sand transport, these structures accrete updrift beaches while causing accelerated beach erosion downdrift of the structures (Komar 1983; Pilkey et al. 1984). As sand fills the area updrift from the groin or jetty, some littoral drift and sand deposition on adjacent downdrift beaches may occur due to spillover. However, these groins and jetties often force the stream of sand into deeper offshore water, where it is lost from the system (Kaufman and Pilkey 1979). The greatest changes in beach profile near groins and jetties are observed close to the structures, but effects eventually may extend many miles along the coast (Komar 1983). The proposed activities associated with this P³BO only include the repair and replacement of existing groins and jetties. Since the primary effects associated with groins and jetties are associated with their alteration of sand movement, the effects would not change with the proposed action. Temporary

adverse effects to the piping plover from disruption in the immediate vicinity of the project would occur during construction.

Indirect effects

Indirect effects are a result of a proposed action that occur later in time and are reasonably certain to occur. During sand placement, suffocation of invertebrate species will occur and degrade the suitability of the habitat for foraging. The effects to the benthic communities and the indirect effects to the piping plover will occur even if sand placement activities occur outside the piping plover migration and wintering seasons. Timeframes projected for benthic recruitment and re-establishment following sand placement are between 6 months and 2 years. Tilling to loosen compacted sand, sometimes required following beach nourishment to minimize effects to nesting sea turtles, may affect wrack that has accumulated on the beach. However, tilling is usually conducted above the wrack line. This may affect feeding and roosting habitat for piping plovers since they often use wrack for cover and foraging.

Natural, undeveloped barrier islands need storms and overwash to maintain the physical and biological environments they support (Young et al. 2006). Sand placement may limit washover fans from developing, which could accelerate the successional state of sand flats such that they will likely become vegetated within a few years (Leatherman 1988). This may reduce an area's value to foraging and roosting piping plovers. The piping plover's rapid response to habitats formed by washovers from the hurricanes in 2004 and 2005 in the Florida panhandle at Gulf Islands National Seashore and Eglin Air Force Base's Santa Rosa Island, and similar observations of their preferences for overwash habitats at Phipps Preserve and Lanark Reef in Franklin County, Florida, and elsewhere in their range, demonstrate the importance of these habitats for wintering and migrating piping plovers.

Restoration of beaches through sand placement may increase recreational pressures within the project area. Recreational activities, including increased pedestrian use, have the potential to adversely affect piping plovers through disturbance and through increased presence of predators, including both domestic animals and feral animals attracted by the presence of people and their trash. Long-term effects could include a decrease in piping plover use of habitat due to increased disturbance levels.

Pilkey and Dixon (1996) stated beach replenishment frequently leads to more development in greater density within shorefront communities that are then left with a future of further replenishment or more drastic stabilization measures. Dean (1999) also noted the very existence of a beach nourishment project can encourage more development in coastal areas. Following completion of a beach nourishment project in Miami during 1982, investment in new and updated facilities substantially increased tourism there (National Research Council 1995). Increased building density immediately adjacent to the beach often resulted as much larger buildings that accommodated more beach users replaced older buildings. Overall, shoreline management creates an upward spiral of initial protective measures resulting in more expensive development, which leads to the need for more and larger protective measures. Greater

development may also support larger populations of mammalian predators, such as foxes and raccoons, than undeveloped areas. Optimal habitat for the piping plover often occurs on publicly owned lands where human development may be limited; however, development of roads, bridges, and recreational facilities may be subject to scenarios similar to those described above.

Species' response to the proposed action

The Service bases this P³BO on anticipated direct and indirect effects to piping plovers (wintering and migrating) and their Critical Habitat as a result of dredging, sand placement on beaches, and groin and jetty repair/replacement, which may prevent the maintenance or formation of habitat that piping plovers consider optimal for foraging and roosting. Heavy machinery and equipment (*e.g.*, trucks and bulldozers operating on project area beaches, the placement of the dredge pipeline along the beach, and sand disposal) may adversely affect migrating and wintering piping plovers in the project area by disturbance and disruption of normal activities such as roosting and foraging, and possibly forcing piping plovers to expend valuable energy reserves to seek available habitat elsewhere. In addition, foraging in suboptimal habitat by migrating and wintering piping plovers may reduce the fitness of individuals. Furthermore, increased and continual disturbance within optimal habitat, including Critical Habitat Units, could have effects on all three breeding populations of piping plovers.

Cumulative effects

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the Action Area considered in this Biological Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

It is reasonably certain coastal development, human occupancy, and recreational use along the Atlantic and Gulf coasts of Florida will increase in the future. However, areas identified as optimal piping plover habitat are not as likely to be affected by coastal development and human occupancy, since they are primarily protected areas that are relatively undeveloped compared to other beaches in Florida. Optimal Piping Plover Areas may still experience heavy recreational use. It is unknown how much influence beach nourishment will contribute to the development and recreational use of the shoreline. Most activities affecting designated piping plover Critical Habitat would require Federal permits or funding. The Service is unable to identify any specific activities that would be considered cumulative effects.

CONCLUSION

There are 2,340 miles of sandy shoreline available (although not necessarily suitable) throughout the piping plover wintering range within the conterminous U.S. The primary effects of the proposed activities are to piping plover foraging and roosting habitat, and these effects are typically limited to the first year following project construction. Beach wrack and the benthic community are often reestablished between 6 months and 1 year following project construction.

In the long-term, sand placement activities will add sediment to the system that could otherwise be removed as part of inlet maintenance, and increase the availability of suitable habitat for the species.

After reviewing the current status of the northern Great Plains, Great Lakes, and Atlantic Coast wintering piping plover populations, the environmental baseline for Action Area, the effects of the proposed activities, the Conservation Measures proposed by the Corps, and the cumulative effects, it is the Service's biological opinion that implementation of these actions, as proposed, is not likely to jeopardize the continued existence of the piping plover.

In addition, after reviewing the current status of the affected species, the environmental baseline for the Action Area, the effects of the proposed activities, and the cumulative effects, it is the Service's biological opinion the action, as proposed, will not adversely modify designated critical habitat for the reason given below.

Although some Critical Habitat Units may be impacted by project activities, these would most frequently be units or portions of units that are highly eroded and where habitat for piping plovers has become degraded. In these instances, the adverse effects of project activities would be offset over time by beneficial effects associated with the restoration of beaches. In all cases, neither the negative nor the positive effects of beach nourishment are likely to be permanent due to the dynamic nature of shoreline processes. Project activities would not affect a Critical Habitat Unit to the extent that, over time, the unit would be unable to serve its intended purposes. Therefore, any loss of habitat would not have a significant effect on the species' persistence or on the function of these Critical Habitat Units as a whole.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered or threatened species without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary, and must be implemented by the Corps so they become binding conditions of any permit issued, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the Terms and

Conditions or, (2) fails to adhere to the Terms and Conditions of the incidental take statement through enforceable terms that are added to the permit, the protective coverage of section 7(o)(2) may lapse. In order to monitor the effects of incidental take, the Corps must report the progress of the action and its effects on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

It is difficult for the Service to estimate the exact number of piping plovers that could be migrating through or wintering within the Action Area at any one point in time and place during project construction. Disturbance to suitable habitat resulting from both dredging and sand placement activities within the Action Area would affect the ability of an undetermined number of piping plovers to find suitable foraging and roosting habitat during the migrating and wintering periods of any given year. Because the number of piping plovers that would be affected by projects cannot be determined, the Service will use the annual disturbance in shoreline miles as a surrogate for take.

The FDEP's Critically Eroded Beaches in Florida report identified 204.2 miles of critically eroded beaches on the Atlantic Coast of Florida, and an additional 102.3 miles of critically eroded beaches on the Gulf Coast of Florida in the Action Area (FDEP 2012). FDEP's definition of "critically eroded" requires upland development, recreation, wildlife habitat, or important cultural resources to be threatened. Due to the threat to upland interests, it is anticipated that beaches identified by FDEP to be critically eroding would be the most likely to be affected by the proposed action. Of the 204.2 miles of critically eroded beaches on the Atlantic Coast, approximately 49.4 miles are located on public lands primarily managed for conservation purposes; on the Gulf Coast, approximately 14.7 miles of the 102.3 miles of critically eroded beaches are located on public lands, for a total of 64.1 miles in the Action Area that are most likely to be affected. We acknowledge some additional public lands that are not defined as critically eroded and not included in the estimate above may also be affected. However, not all public lands have habitat elements that support migrating or wintering piping plover on a regular basis; therefore, some public lands included in the estimate above are not optimal piping plover habitat.

The July 10, 2001, FR notice designated approximately 27,328 acres, corresponding to approximately 47 miles of beach, as Critical Habitat for wintering piping plovers in peninsular Florida. Most designated Critical Habitat is publicly owned (see Appendix A) and the Critical Habitat most likely to be disturbed would fall under the critically eroded, publicly owned category, part of the estimated 64.1 miles of beach cited above.

An additional 15.0 miles of beach in six units are defined as optimal piping plover habitat, but not located on publically-owned lands or Critical Habitat Units. Over time, most or all of these areas may be subject to project-related disturbance. Therefore, the total shoreline (optimal piping plover habitat) estimated to be effected by the proposed action is 79.1 miles, rounded for our purposes to 80 miles. It is estimated approximately 10 percent or less of the total 80 miles of

potentially affected optimal habitat would be impacted in any given year (or approximately 8 miles). In years following emergency events, the impacted area is expected to increase to approximately 25 percent or less of the total mileage, or 20 miles of shoreline. Over the past 10 years, two Congressional Orders occurred due to emergency events (2004-2005 hurricane season, and the 2012 hurricane season). The increased sand placement activities due to emergency events are anticipated to occur once in a 7-year period. This estimate is considered to be conservative, as many of the lands identified as optimal piping plover habitat are undeveloped. Since upland development is generally not threatened in these areas, the cost of placing sand on these shorelines is not justified.

Sand placement resulting from maintenance dredging projects is the most likely activity to affect these areas due to the preference to keep sand within the littoral system. It is expected the exact mileage of shoreline affected by the proposed action will vary from year to year. Maintenance dredging and sand placement activities may result in an unspecified number of piping plovers occupying these areas to be taken in the form of harm (*e.g.*, death, injury) and harassment as a result of this action.

EFFECT OF THE TAKE

In this P³BO, the Service determined the proposed project is not likely to result in jeopardy to the piping plover.

REASONABLE AND PRUDENT MEASURES

The Service has determined the following Reasonable and Prudent Measures are necessary and appropriate to minimize take of the piping plover in the Action Area. If the Corps is unable to comply with the Reasonable and Prudent Measures and Terms and Conditions, the Corps as the construction agent or regulatory authority may:

1. Inform the Service why the Term and Condition is not reasonable and prudent for the specific project or activity and request exception under the P³BO; or
2. Initiate consultation with the Service for the specific project or activity.

The Service may respond by either of the following:

1. Allowing an exception to the Terms and Conditions under the P³BO; or
2. Recommending or accepting initiation of consultation (if initiated by the Corps) for the specific project or activity.

The post construction survey requirements are described in Reasonable and Prudent Measure #5 and Term and Condition #8. These requirements are subject to congressional authorization and

the allocation of funds. If the Corps or Applicant cannot fulfill these Reasonable and Prudent Measures, the Corps will notify the Service when initiating consultation for the project.

1. All sand placed on the beach or in the nearshore shall be compatible with the existing beach and will maintain the general character and functionality of the existing beach.
2. The Corps or the Applicant will notify the Service of the commencement of projects that utilize this P³BO for the purposes of tracking incidental take of the species.
3. The Corps shall protect habitat features considered preferred by plovers outside of the project footprint in accordance with Terms and Conditions 3, 4, 5, and 6.
4. The Corps will facilitate awareness of piping plover habitat by educating the public on ways to minimize disruption to the species.
5. The Corps, the Applicant, or the local sponsor shall provide the mechanisms necessary to monitor impacts to piping plovers within the Action Area.
6. The Corps shall facilitate an annual meeting with the Service to assess the effectiveness of the protection and minimization measures outlined in this P³BO.

TERMS AND CONDITIONS

1. Beach compatible fill shall be placed on the beach or in any associated dune system. Beach compatible fill must be sand that is similar to a native beach in the vicinity of the site that has not been affected by prior sand placement activity. The fill material must be similar in both coloration and grain size distribution to that native beach. Beach compatible fill is material that maintains the general character and functionality of the material occurring on the beach and in the adjacent dune and coastal system. Fill material shall comply with FDEP requirements pursuant to the Florida Administrative Code (FAC) subsection 62B-41.005(15). A Quality Control Plan shall be implemented pursuant to FAC Rule 62B-41.008(1)(k)4.b.
2. The Corps or the Permittee must provide the following information to the Service Field Supervisor of the appropriate Field Office at least 10 business days prior to the commencement of work:
 - a. Project location (include FDEP Range Monuments and latitude and longitude coordinates);
 - b. Project description (include linear feet of beach, actual fill template, access points, and borrow areas);
 - c. Date of commencement and anticipated duration of construction; and
 - d. Names and qualifications of personnel involved in piping plover surveys.

3. Prior to construction, the Corps shall delineate preferred piping plover habitat (intertidal portions of ocean beaches, ephemeral pools, washover areas, wrack lines) adjacent to or outside of the project footprint that might be impacted by construction activities. Obvious identifiers shall be used (for example, pink flagging on metal poles) to clearly mark the beginning and end points to prevent accidental impacts to use areas.
4. Piping plover habitat delineated adjacent to or outside of the project footprint shall be avoided to the maximum extent practicable when staging equipment, establishing travel corridors, and aligning pipeline.
5. Driving on the beach for construction shall be limited to the minimum necessary within the designated travel corridor, which will be established just above or just below the primary “wrack” line.
6. Predator-proof trash receptacles shall be installed and maintained during construction at all beach access points used for the project construction to minimize the potential for attracting predators of piping plovers. Workers shall be briefed on the importance of not littering and keeping the project area trash and debris free. See Appendix B for examples of suitable receptacles.
7. Educational signs shall be installed at public access points within the project area with emphasis on the importance of the beach habitat and wrack for piping plovers. When the project area has a pet or dog regulation, the provisions of the regulation shall be included on the educational signs.
8. For one full piping plover migration and winter season (beginning July 15 to May 15) prior to construction, and 2 years following each dredging and sand placement event, bi-monthly (twice-monthly) surveys for piping plovers shall be conducted in the beach fill and in any other intertidal or shoreline areas within or affected by the project. If a full season is not available, at least 5 consecutive months with three surveys per month spaced at least 9 days apart are required. During emergency projects, the surveys will begin as soon as possible prior to, and up to implementing the project. Piping plover identification, especially when in non-breeding plumage, can be difficult. If pre-construction monitoring is not practicable, it will be so indicated in the notification to the Service (see Term and Condition #2 above) and the Service will decide whether to require a separate individual consultation. See introductory paragraph to Reasonable and Prudent Measures earlier in this document.
9. The person(s) conducting the survey must demonstrate the qualifications and ability to identify shorebird species and be able to provide the information listed below. The following will be collected, mapped, and reported:

- a. Date, location, time of day, weather, and tide cycle when survey was conducted;
- b. Latitude and longitude of observed piping plover locations (decimal degrees preferred);
- c. Any color bands observed on piping plovers;
- d. Behavior of piping plovers (*e.g.*, foraging, roosting, preening, bathing, flying, aggression, walking);
- e. Landscape features(s) where piping plovers are located (*e.g.*, inlet spit, tidal creeks, shoals, lagoon shoreline);
- f. Habitat features(s) used by piping plovers when observed (*e.g.*, intertidal, fresh wrack, old wrack, dune, mid-beach, vegetation);
- g. Substrata used by piping plovers (*e.g.*, sand, mud/sand, mud, algal mat);
- h. The amount and type of recreational use (*e.g.*, people, dogs on or off leash, vehicles, kite-boarders); and
- i. All other shorebirds/waterbirds seen within the survey area.

All information shall be provided in an Excel spreadsheet. Monitoring results shall be submitted (datasheets, maps, database) on standard electronic media (*e.g.*, CD, DVD) to the appropriate Field Office by July 31 of each year in which monitoring is completed. If an appropriate web based reporting system becomes available, it would be used in lieu of hard copy/media.

[NOTE: As a condition to a permit from the FDEP, the bird monitor may also be required to report shorebird data to the Florida Fish and Wildlife Conservation Commission (FWC) <https://public.myfwc.com/crossdoi/shorebirds/SigninExploreData.aspx>.]

10. The Corps shall meet with the Service and the FWC (and BOEM as appropriate) annually to discuss the effectiveness of the avoidance measures and additional measures to include for future projects. The agencies will also review the projects utilizing this P³BO the previous year to ensure that the reporting requirements for calculating the extent of take are adequate. This meeting will also explore:

- a. The possibility of using dredged materials to enhance potential or existing piping plover habitat within and adjacent to the project area;
- b. Methods for funding beneficial use opportunities for dredged materials that are not least-cost disposal to benefit piping plovers and their habitat;
- c. The development of shore protection design guidelines that can be utilized during future project planning to protect and/or enhance piping plover habitat; and
- d. Incorporating artificial lagoons or ephemeral pools into project designs adjacent to inlets where sand placement is proposed.

CONSERVATION RECOMMENDATIONS

Section 7(a) (1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and

threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or Critical Habitat, to help implement recovery plans, or to develop information.

1. The Corps will facilitate a meeting between the Applicant or the local sponsor, the FWC, and the Service to discuss steps for the long-term protection of wrack within the project area; and
2. The Service encourages continued investigation into opportunities for increasing monitoring for Civil Works operations and maintenance projects.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

The amount or extent of incidental take for piping plovers will be considered exceeded if sand is placed on more than 8 miles of optimal piping plover shoreline during a nonemergency year, and a maximum of 20 miles of optimal piping plover shoreline during or following an emergency event (declared disaster or Congressional Order) as a result of this programmatic action. If the anticipated level of incidental take is exceeded during the course of this action, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Corps must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

This concludes formal consultation on the action outlined in the request. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or Critical Habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or Critical Habitat not considered in this opinion; or (4) a new species is listed or Critical Habitat designated that may be affected by the action. Reinitiation of formal consultation is also required 10 years after the issuance of this P³BO. In instances where the amount or extent of incidental take is exceeded, any operations causing such take shall cease pending reinitiation.

MIGRATORY BIRD TREATY ACT

Migratory Bird Treaty Act (MBTA) for all Projects:

Comply with the FWC's standard shorebird protection guidelines to protect against impacts to nesting shorebirds during implementation of these projects on the Gulf Coast during the periods from February 15-August 31 or on the Atlantic Coast from April 1- August 31. All sand placement events could impact nesting shorebirds protected under the MBTA.

***The MBTA implements various treaties and conventions between the U.S., Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Under the provisions of the MBTA it is unlawful by any means or manner to pursue, hunt, take, capture or kill any migratory bird except as permitted by regulations issued by the Service. The term "take" is not defined in the MBTA, but the Service has defined it by regulation to mean to pursue, hunt, shoot, wound, kill, trap, capture or collect any migratory bird, or any part, nest or egg or any migratory bird covered by the conventions or to attempt those activities.

LITERATURE CITED

- Amirault, D.L., F. Shaffer, K. Baker, A. Boyne, A. Calvert, J. McKnight, and P. Thomas. 2005. Preliminary results of a five year banding study in Eastern Canada – support for expanding conservation efforts to non-breeding sites? Unpublished Report. Canadian Wildlife Service; Ontario, Canada.
- Arvin, J. 2008. A survey of upper Texas coast critical habitats for migratory and wintering piping plover and associated resident “sand plovers”. Gulf Coast Bird Observatory’s interim report to Texas Parks and Wildlife Department; Austin, Texas.
- Below, T.H. 2010. Wintering and winter site-fidelity of Piping Plovers *Charadrius melodus* in SW Florida, USA. *Wader Study Group Bulletin*. 117(1):51–55.
- Bent, A.C. 1929. Life histories of North American Shorebirds. *U.S. Natural Museum Bulletin* 146:236-246.
- Brault, S. 2007. Population viability analysis for the New England population of the piping plover (*Charadrius melodus*). Report 5.3.2-4. Prepared for Cape Wind Associates, L.L.C.; Boston, Massachusetts.
- Cairns, W.E. 1977. Breeding biology and behaviour of the piping plover *Charadrius melodus* in southern Nova Scotia. M.S. thesis. Dalhousie University; Halifax, Nova Scotia.
- Calvert, A.M., D.L. Amirault, F. Shaffer, R. Elliot, A. Hanson, J. McKnight, and P.D. Taylor. 2006. Population assessment of an endangered shorebird: The piping plover (*Charadrius melodus melodus*) in eastern Canada. *Avian Conservation and Ecology* 1(3):4.
- Cohen, J.B., S.M. Karpanty, D.H. Catlin, J.D. Fraser, and R.A. Fischer. 2008. Winter ecology of piping plovers at Oregon Inlet, North Carolina. *Waterbirds* 31:472-479.
- Cohen, J. 2009. Feasibility and utility of survival modeling for detecting differences in piping plover survival across their breeding and wintering range. Report to U.S. Fish and Wildlife Service; Sudbury, Massachusetts. 10 pp.
- Coutu, S.D., J.D. Fraser, J.L. McConnaughy, and J.P. Loegering. 1990. Piping plover distribution and reproductive success on Cape Hatteras National Seashore. Unpublished report. Cape Hatteras National Seashore; Manteo, North Carolina.
- Cross, R.R. 1990. Monitoring, management and research of the piping plover at Chincoteague National Wildlife Refuge. Unpublished report. Virginia Department of Game and Inland Fisheries; Richmond, Virginia.

- Cross, R.R. 1996. Breeding ecology, success, and population management of the piping plover at Chincoteague National Wildlife Refuge, Virginia. M.S. thesis. College of William and Mary; Williamsburg, Virginia.
- Dean, R.G. 1999. Design considerations for coastal zones exposed to hurricane-induced wave action. *New Orleans Structures Congress*.
- Drake, K. L. 1999a. Time allocation and roosting habitat in sympatrically wintering piping and snowy plovers. M. S. thesis. Texas A&M University; Kingsville, Texas.
- Drake, K.R. 1999b. Movements, habitat use and survival of wintering piping plovers. M.S. thesis. Texas A&M University; Kingsville, Texas.
- Drake, K.R., J.E. Thompson, K.L. Drake, and C. Zonick. 2001. Movements, habitat use, and survival of non-breeding piping plovers. *Condor* 103:259–267.
- Dugan, J.E., D.M. Hubbard, M.D. McCrary, and M.O. Pierson. 2003. The response of macrofauna communities and shorebirds to macrophyte wrack subsidies on exposed sandy beaches of southern California. *Estuarine, Coastal and Shelf Science* 58:25-40.
- Eells, B. Unpublished data. Piping plover winter and migration survey data collected from Indian Pass to Cape San Blas, Gulf County, Florida from 2002-2009.
- Elias-Gerken, S.P. 1994. Piping plover habitat suitability on central Long Island, New York barrier islands. M.S. thesis. Virginia Polytechnic Institute and State University; Blacksburg, Virginia.
- Elliott-Smith, E. and S. M. Haig. 2004. Piping plover (*Charadrius melodus*), in *The birds of North America online* (A. Poole, ed). Ithaca: Cornell Lab of Ornithology. Available at <http://bna.birds.cornell.edu/bna/species/002/articles/introduction>, accessed April 2013.
- Elliott-Smith, E., S.M. Haig, and B.M. Powers. 2009. Data from the 2006 International Piping Plover Census: U.S. Geological Survey Data Series 426. 332 pp.
- Environmental Protection Agency (EPA). 2009. Coastal Zones and sea level rise. Accessed on 18 December 2012 at <http://www.epa.gov/climatechange/impacts-adaptation/coasts.html>.
- Ferland, C.L. and S.M. Haig. 2002. 2001 International piping plover census. U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center; Corvallis, Oregon.
- Florida Department of Environmental Protection (FDEP). 2012. Critically eroded beaches in Florida. Bureau of Beaches and Coastal Systems, Division of Water Resource Management. Updated, June 2012. Accessed online at <http://www.dep.state.fl.us/beaches/publications/pdf/critical-erosion-report-2012.pdf>.

- Gibbs, J.P. 1986. Feeding ecology of nesting piping plovers in Maine. Unpublished report. The Nature Conservancy; Topsham, Maine.
- Goldin, M.R., C. Griffin, and S. Melvin. 1990. Reproductive and foraging ecology, human disturbance, and management of piping plovers at Breezy Point, Gateway National Recreational Area, New York, 1989. Progress Report. U.S. Fish and Wildlife Service; Newton Corner, Massachusetts.
- Goldin, M.R. 1993. Piping plover (*Charadrius melodus*) management, reproductive ecology, and chick behavior at Goosewing and Briggs Beaches, Little Compton, Rhode Island, 1993. The Nature Conservancy; Providence, Rhode Island.
- Gratto-Trevor, C., D. Amirault-Langlais, D. Catlin, F. Cuthbert, J. Fraser, S. Maddock, E. Roche, and F. Shaffer. 2009. Winter distribution of four different piping plover breeding populations. Report to U.S. Fish and Wildlife Service. 11 pp.
- Haig, S.M. 1992. Piping plover. *In* The Birds of North America, No. 2 (A. Poole, P. Stettenheim, and F. Gill, eds). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union. 17 pp.
- Haig, S.M. and E. Elliott-Smith. 2004. Piping Plover. The Birds of North America Online [Internet]. Cornell Laboratory of Ornithology; Ithaca, New York [cited January 6, 2011]. Available from: http://bna.birds.cornell.edu/BNA/account/Piping_Plover/
- Hake, M. 1993. 1993 summary of piping plover management program at Gateway NRA Breezy Point district. Unpublished report. Gateway National Recreational Area; Long Island, New York.
- Harrington, B.R. 2008. Coastal inlets as strategic habitat for shorebirds in the Southeastern United States. Technical Notes Collection ERDC TN-DOER-E25. U.S. Army Corps of Engineers Research and Development Center; Vicksburg, Mississippi.
- Hoopes, E.A. 1993. Relationships between human recreation and piping plover foraging ecology and chick survival. M.S. Thesis. University of Massachusetts. 106 pp.
- Houghton, L.M. 2005. Piping plover population dynamics and effects of beach management practices on piping plovers at West Hampton Dunes and Westhampton Beach, New York (Doctoral dissertation). Virginia Polytechnic Institute and State University. Accessed online at <http://scholar.lib.vt.edu/theses/available/etd-08222005-172829/unrestricted/LarryHoughtonETD.pdf>.
- Joint Information Center. 2010. News release [Internet]. [cited July 28, 2010]. Available from: <http://app.restorethegulf.gov/go/doc/2931/832251/>

- Kaufman, W. and O.H. Pilkey. 1979. The beaches are moving: The drowning of America's shoreline. Duke University Press; Durham, North Carolina. 336 pp.
- Komar, P.D. 1983. Handbook of coastal processes and erosion. CRC Press; Boca Raton, Florida. 305 pp.
- Larson, M.A., M.R. Ryan, and R.K. Murphy. 2002. Population viability of piping plovers: Effects of predator exclusion. *Journal of Wildlife Management* 66:361-371.
- Leatherman, S.P. 1988. Barrier Island Handbook. Coastal Publications Series. University of Maryland; College Park, Maryland.
- LeDee, O.E., F.J. Cuthbert, and P.V. Bolstad. 2008. A remote sensing analysis of Coastal Habitat Composition for a Threatened Shorebird, the Piping Plover (*Charadrius melodus*). *Journal of Coastal Research*. 24(3):719-726.
- Loegering, J.P. 1992. Piping plover breeding biology, foraging ecology and behavior on Assateague Island National Seashore, Maryland. M.S. thesis. Virginia Polytechnic Institute and State University; Blacksburg, Virginia.
- Lott, C.A., C.S. Ewell Jr., and K.L. Volanky. 2009. Habitat associations of shoreline-dependent birds in barrier island ecosystems during fall migration in Lee County, Florida. Technical Report. Prepared for U.S. Army Corps of Engineers, Engineer Research and Development Center; Washington, D.C.
- MacIvor, L.H. 1990. Population dynamics, breeding ecology, and management of piping plovers on outer Cape Cod, Massachusetts. M.S. thesis. University of Massachusetts; Amherst, Massachusetts.
- Maddock, S.B. 2008. Wintering piping plover surveys 2006-2007, East Grand Terre, Louisiana to Boca Chica, Texas, December 20, 2006 - January 10, 2007, final report. Unpublished report prepared for the Canadian Wildlife Service, Environment Canada, Edmonton, Alberta.
- Maddock, S., M. Bimbi, and W. Golder. 2009. South Carolina shorebird project, draft 2006-2008 piping plover summary report. Audubon North Carolina and U.S. Fish and Wildlife Service; Charleston, South Carolina. 135 pp.
- Martin, T. 2013. Personal communication. Coastal engineer. Discussion related to groin and jetty construction, to their repair and replacement frequency, and to the nature of potential impacts to piping plover habitat during repair and replacement activities. March 18, 2013, Jacksonville, Florida.

- Maslo, B., S.N. Handel, and T. Pover. 2010. Restoring beaches for Atlantic Coast piping plovers (*Charadrius melodus*): A classification and regression tree analysis of nest-site selection. *Restoration Ecology*, 19(201):194-203.
- McConnaughey, J.L., J.D. Fraser, S.D. Coutu, and J.P. Loegering. 1990. Piping plover distribution and reproductive success on Cape Lookout National Seashore. Unpublished report to National Park Service.
- Melvin, S.M., C.R. Griffin, and L.H. MacIvor. 1991. Recovery strategies for piping plovers in managed coastal landscapes. *Coastal Management* 19:21-34.
- Melvin, S.M. and J.P. Gibbs. 1996. Viability analysis for the Atlantic Coast population of piping plovers. Pages 175-186 in Piping plover (*Charadrius melodus*), Atlantic Coast population, revised recovery plan. U.S. Fish and Wildlife Service; Hadley, Massachusetts.
- National Park Service. 2007. Cape Hatteras National Seashore 2007 annual piping plover (*Charadrius melodus*) report. Cape Hatteras National Seashore; Manteo, North Carolina.
- National Research Council. 1995. Beach nourishment and protection. Committee on Beach Nourishment and Protection, Marine Board, Commission on Engineering and Technical Systems. National Academy Press; Washington, DC.
- Nicholls, J.L. 1989. Distribution and other ecological aspects of piping plovers (*Charadrius melodus*) wintering along the Atlantic and Gulf Coasts. M.S. thesis. Auburn University; Auburn, Alabama.
- Nicholls, J.L. and G.A. Baldassarre. 1990a. Habitat selection and interspecific associations of piping plovers along the Atlantic and Gulf Coasts of the United States. M.S. thesis. Auburn University; Auburn, Alabama.
- Nicholls, J.L. and G.A. Baldassarre. 1990b. Habitat associations of piping plovers wintering in the United States. *Wilson Bulletin* 102(4):581-590.
- Noel, B.L. and C.R. Chandler. 2005. Report on migrating and wintering piping plover activity on Little St. Simons Island, Georgia in 2003-2004 and 2004-2005. Report to U.S. Fish and Wildlife Service; Panama City, Florida. 38 pp.
- Noel, B.L., C.R. Chandler, and B. Winn. 2007. Seasonal abundance of nonbreeding piping plovers on a Georgia barrier island. *Journal of Field Ornithology* 78:420-427.
- Noel, B.L., and C.R. Chandler. 2008. Spatial distribution and site fidelity of nonbreeding piping plovers on the Georgia coast. *Waterbirds* 31:241-251.

- Palmer, R.S. 1967. Piping plover. Pages 183-184 in G.D. Stout, ed. The shorebirds of North America. Viking Press; New York, New York.
- Perkins, S. 2008. Personal communication. Ornithologist. E-mail to the U.S. Fish and Wildlife Service dated 29 September 2008. Massachusetts Audubon Society; Chatham, Massachusetts.
- Pilkey, O.H., Jr., D.C. Sharma, H.R. Wanless, L.J. Doyle, O.H. Pilkey, Sr., W.J. Neal, and B.L. Gruver. 1984. Living with the East Florida shore. Duke University Press; Durham, North Carolina.
- Pilkey, O.H. and K.L. Dixon. 1996. The Corps and the Shore. Island Press; Washington, D.C., 272 pp.
- Pinkston, J. 2004. Observations of wintering piping plovers using Gulf of Mexico barrier beaches along the Central Texas coast. Year One research summary report to U.S. Fish and Wildlife Service Corpus Christi, Texas, Field Office. July 2004. One page + maps and tables.
- Plissner, J.H. and S.M. Haig. 2000. Viability of piping plover *Charadrius melodus* metapopulations. *Biological Conservation* 92:163-173.
- Pompei, V.D., and F.J. Cuthbert. 2004. Spring and fall distribution of piping plovers in North America: Implications for migration stopover conservation. Report to the U.S. Army Corps of Engineers. University of Minnesota; St. Paul, Minnesota.
- Ryan, M.R., B.G. Root, and P.M. Mayer. 1993. Status of piping plover in the Great Plains of North America: A demographic simulation model. *Conservation Biology*. 7:581-585.
- Sallenger, A.H. Jr., C.W. Wright, P. Howd, and K. Doran. In review. Barrier island failure modes triggered by Hurricane Katrina: implications for future sea-level-rise impacts. Submitted to *Geology*.
- Scavia, D., J.C. Field, D.F. Boesch, R.W. Buddemeier, V. Burkett, D.R. Cayan, M. Fogarty, M.A. Harwell, R.W. Howarth, C. Mason, D.J. Reed, T.C. Royer, A.H. Sallenger, and J.G. Titus. 2002. Climate change impacts on U.S. coastal and marine ecosystems. *Estuaries* 25:149-164.
- Smith, B.S. 2007. 2006-2007 nonbreeding shorebird survey, Franklin and Wakulla counties, Florida. Final report to the U.S. Fish and Wildlife Service in fulfillment of Grant # 40181-7-J008. Apalachicola Riverkeeper; Apalachicola, Florida. 32 pp.
- Staine, K.J. and J. Burger. 1994. Nocturnal foraging behavior of breeding piping plovers (*Charadrius melodus*) in New Jersey. *The Auk* 111(3):579-587.

- Stucker, J.H. and F.J Cuthbert. 2006. Distribution of nonbreeding Great Lakes piping plovers along Atlantic and Gulf coastlines: 10 years of band resightings. Report to the U.S. Fish and Wildlife Service, East Lansing, Michigan and Panama City, Florida Field Offices. 20 pp.
- U.S. Fish and Wildlife Service (Service). 1985. Endangered and Threatened Wildlife and Plants; Determination of Endangered and Threatened Status for the Piping Plover. Federal Register 50(238):50726-50734.
- U.S. Fish and Wildlife Service (Service). 1996. Piping Plover (*Charadrius melodus*), Atlantic Coast Population, Revised Recovery Plan. Prepared by the Atlantic Coast Piping Plover Recovery Team for the U.S. Fish and Wildlife Service, Region Five. Hadley, Massachusetts. Accessed online at <http://www.fws.gov/northeast/pipingplover/pdf/summary.pdf>.
- U.S. Fish and Wildlife Service (Service). 2001a. Endangered and Threatened Wildlife and Plants; Final Designation of Critical Habitat for Wintering Piping Plovers. Federal Register 66:36038-36143.
- U.S. Fish and Wildlife Service (Service). 2001b. Endangered and Threatened Wildlife and Plants; Final Determination of Critical Habitat for the Great Lakes Breeding Population of the Piping Plover. Federal Register 66:22938-22969.
- U.S. Fish and Wildlife Service (Service). 2002. Questions and Answers about the Northern Great Plains Population of Piping Plover. Webpage accessed at http://www.fws.gov/mountain-prairie/species/birds/pipingplover/Piping_Plover_Great_Plains_Q&A_Sept5.htm.
- U.S. Fish and Wildlife Service (Service). 2003. Recovery Plan for the Great Lakes Piping Plover (*Charadrius melodus*). Region 3, Fort Snelling, Minnesota. Accessed online at <http://www.fws.gov/northeast/nyfo/es/GLplover03.pdf>.
- U.S. Fish and Wildlife Service (Service). 2009. Piping Plover (*Charadrius melodus*) 5-Year Review: Summary and Evaluation. Northeast Region, Hadley, Massachusetts, and the Midwest Region's East Lansing Field Office, Michigan. Accessed online at http://www.fws.gov/northeast/endangered/PDF/Piping_Plover_five_year_review_and_summary.pdf.
- U.S. Fish and Wildlife Service (Service). 2011. Abundance and productivity estimates – 2010 update: Atlantic Coast piping plover population. Sudbury, Massachusetts. 4 pp.
- U.S. Fish and Wildlife Service (Service). 2012. Comprehensive Conservation Strategy for the Piping Plover (*Charadrius melodus*) in its Coastal Migration and Wintering Range in the Continental United States. East Lansing, Michigan.

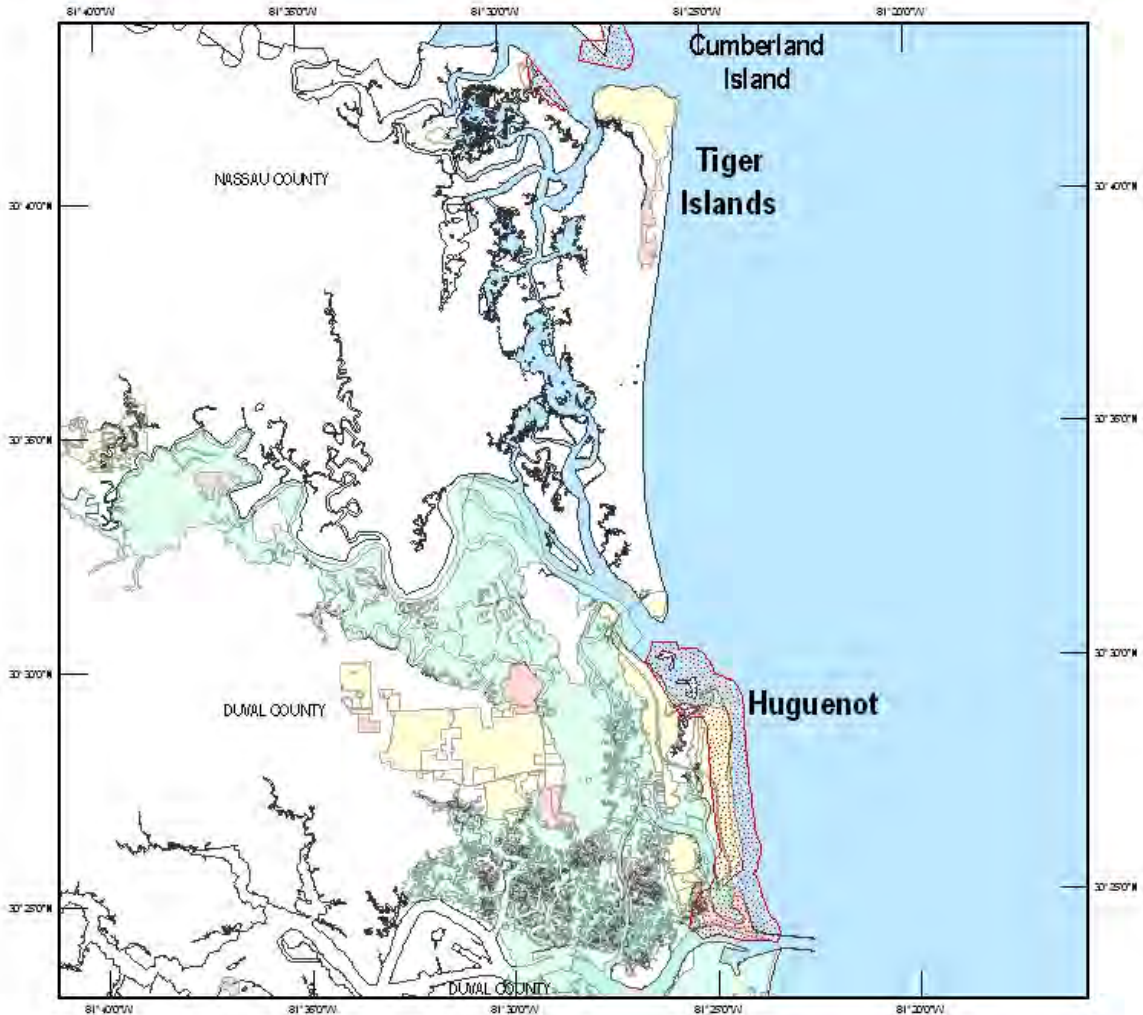
- Wemmer, L.C., U. Ozesmi, and F.J. Cuthbert. 2001. A habitat-based population model for the Great Lakes population of the piping plover (*Charadrius melodus*). *Conservation Biology* 99(2):169-181.
- Wilcox, L. 1959. A twenty year banding study of the piping plover. *Auk* 76:129-152.
- Wilkinson, P. M. and M. Spinks. 1994. Winter distribution and habitat utilization of piping plovers in South Carolina. *Chat* 58(2):33-37.
- Witherington, B.E. 1986. Human and natural causes of marine turtle clutch and hatchling mortality: and their relationship to hatchling production on an important Florida nesting beach. M.S. thesis. University of Central Florida; Orlando, Florida.
- Young, R.S., C. Alexander, J. Kelley, S. Riggs, D. Barber, W.J. Neal, S.K. Boss, C. Fletcher, A. Trembanis, O.H. Pilkey, D.M. Bush, A. Coburn, N.P. Psuty, J. Donoghue, D. Heron, C. Houser, and S.Culver. 2006. In letter submitted to M.A. Bomar, Director, National Park Service; Washington, D.C.
- Zivojnovich, M. J. and G.A. Baldassarre. 1987. Habitat selection, movements and numbers of piping plovers wintering in coastal Alabama. Alabama Department of Conservation and Natural Resources.
- Zonick, C. 1997. The use of Texas barrier island washover pass habitat by piping plovers and Other coastal waterbirds. National Audubon Society. A Report to the Texas Parks and Wildlife Department and the US Fish and Wildlife Service.
- Zonick, C.A. 2000. The winter ecology of piping plovers (*Charadrius melodus*) along the Texas Gulf Coast. Doctoral dissertation. University of Missouri-Columbia; Columbia, Missouri.
- Zonick, C. and Ryan, M. 1996. The ecology and conservation of piping plovers (*Charadrius melodus*) wintering along the Texas Gulf Coast. Department of Fisheries and Wildlife, University of Missouri, Columbia, Missouri. 1995 Annual report. 49 pp.

APPENDIX A: PIPING PLOVER CRITICAL HABITAT UNITS IN THE ACTION AREA



U.S. Fish & Wildlife Service

PIPING PLOVER CRITICAL HABITAT



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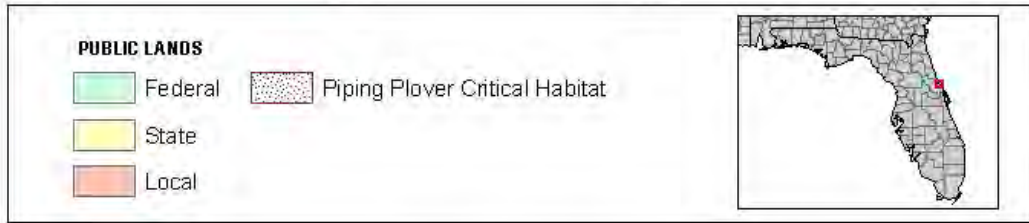
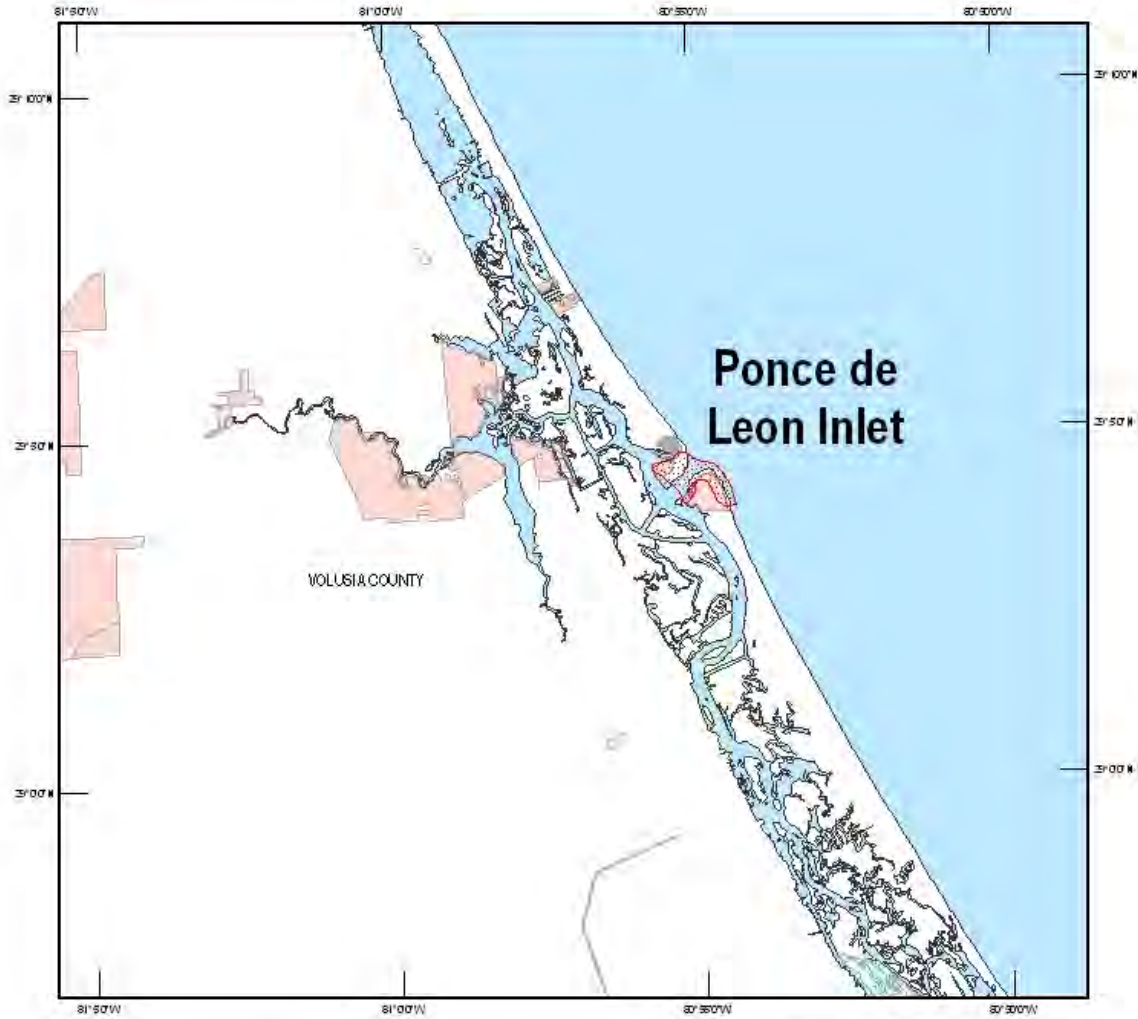


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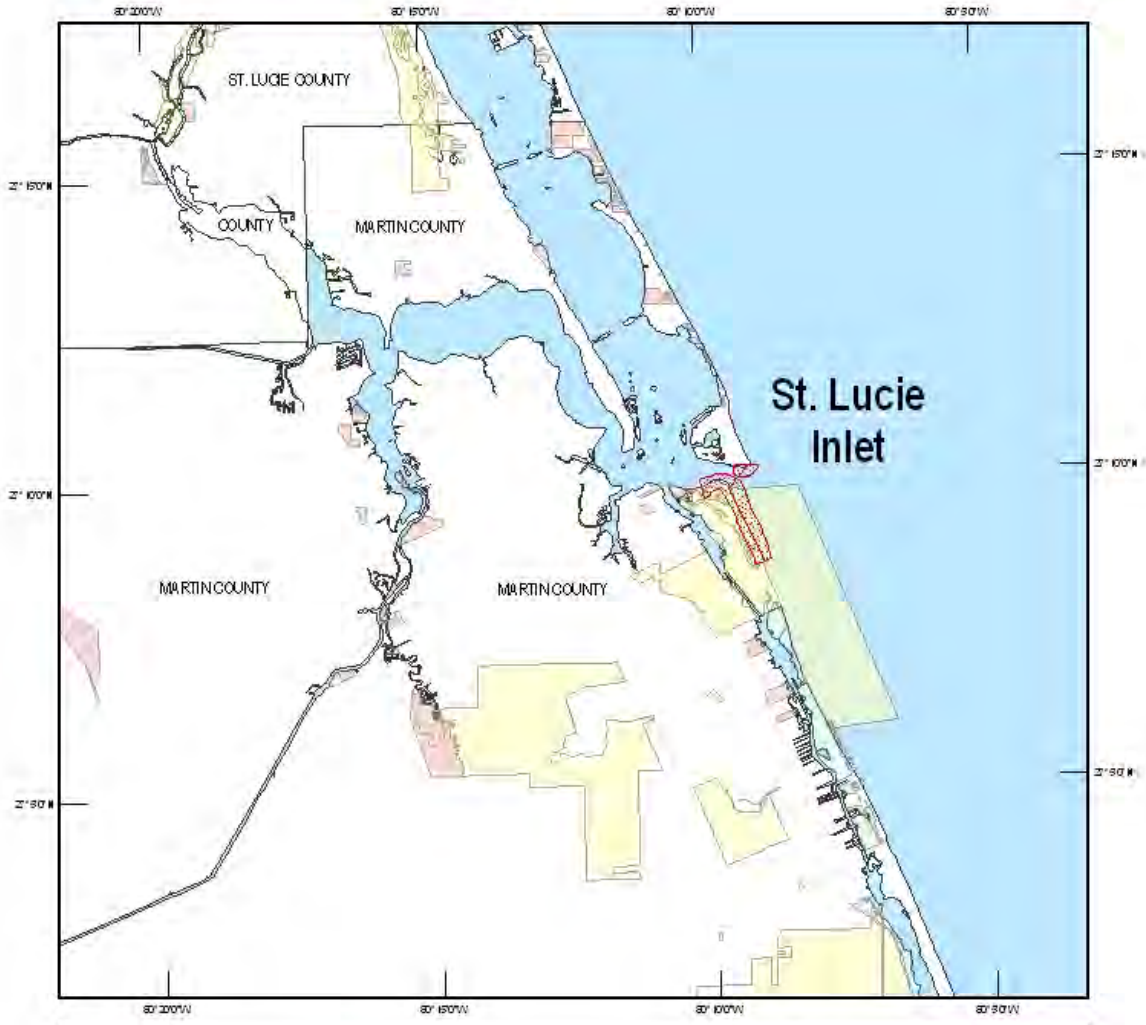
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






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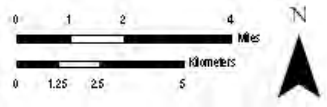
PIPING PLOVER CRITICAL HABITAT



PUBLIC LANDS	
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	Piping Plover Critical Habitat



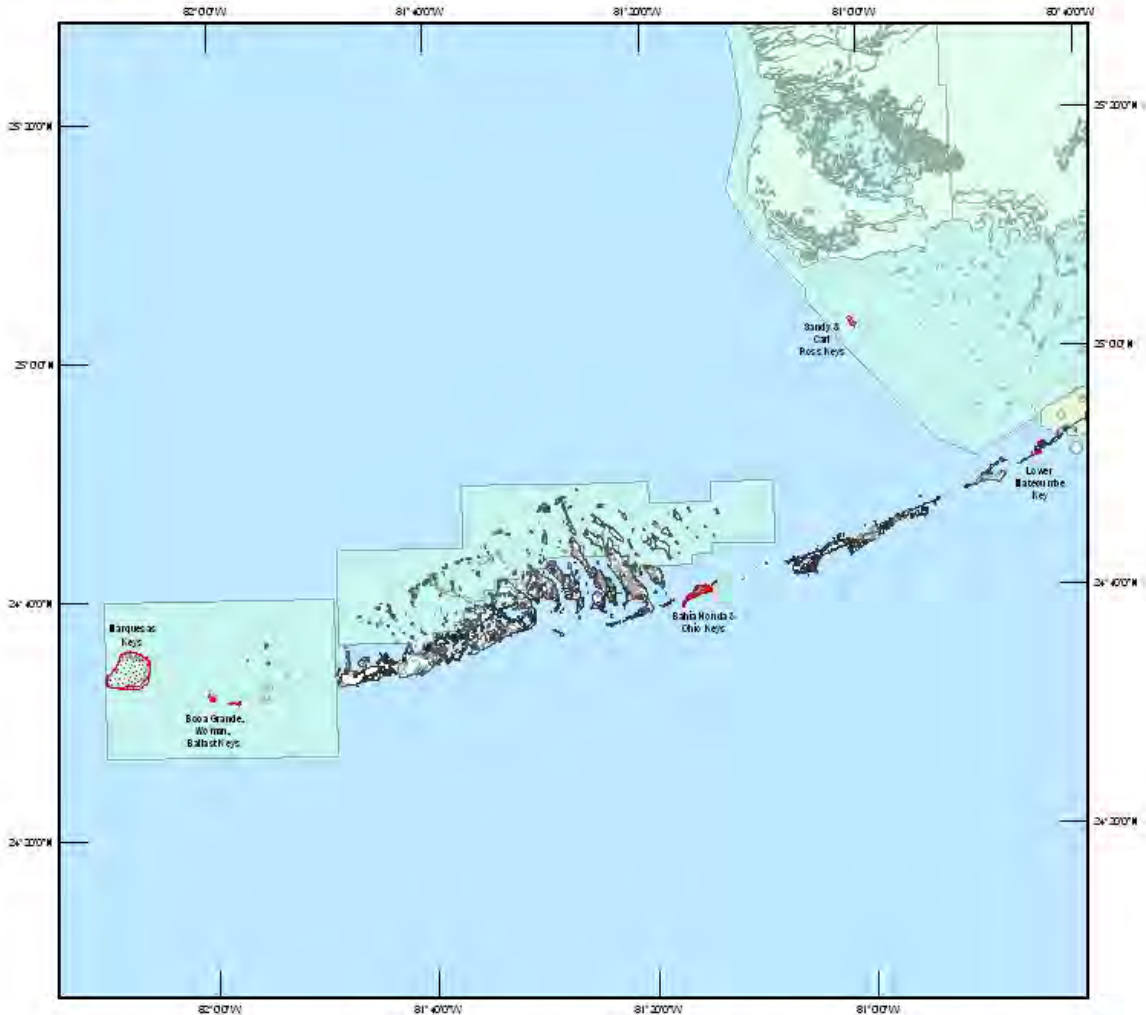
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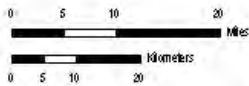
PIPING PLOVER CRITICAL HABITAT



PUBLIC LANDS	
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	Piping Plover Critical Habitat



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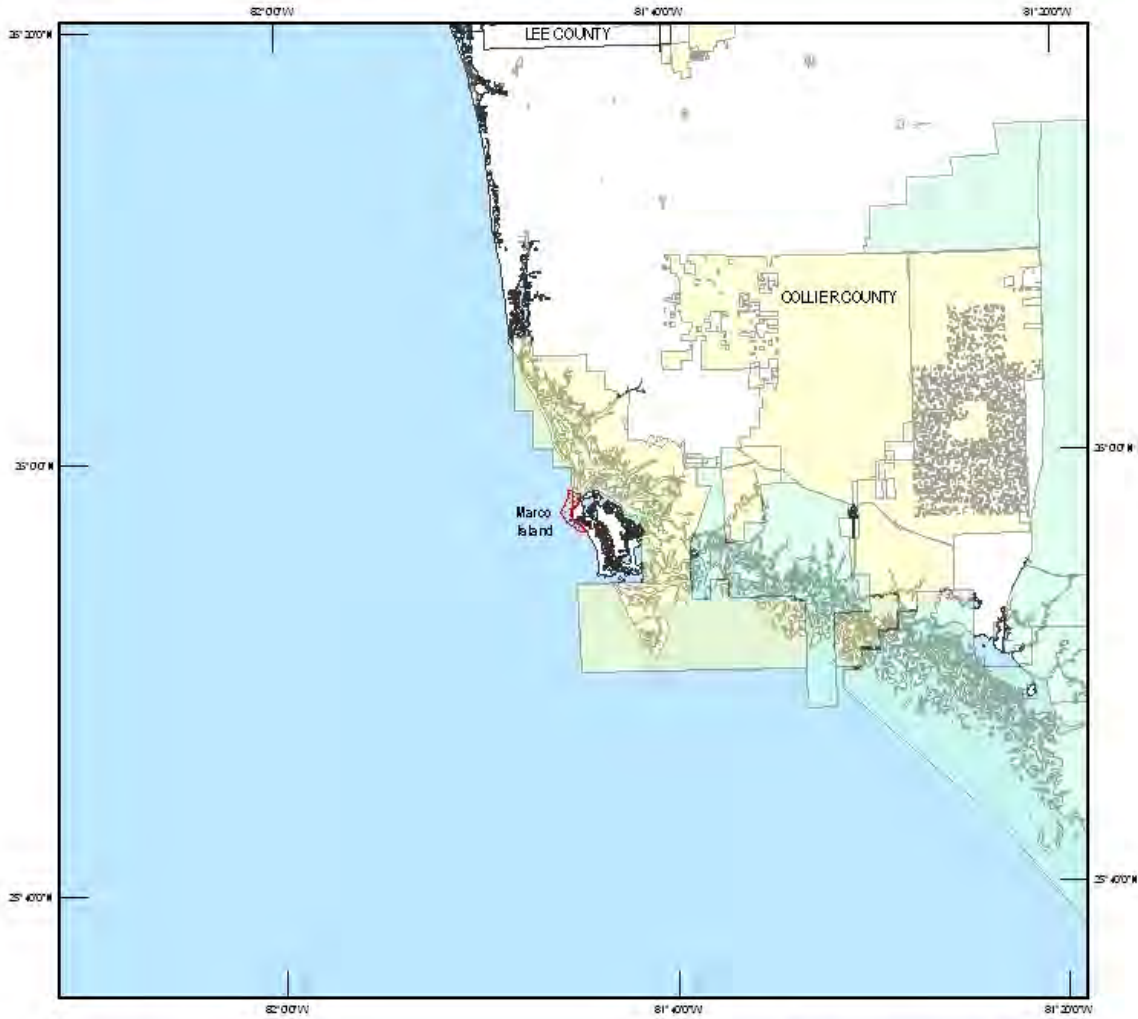






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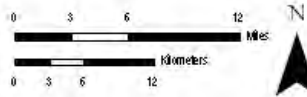
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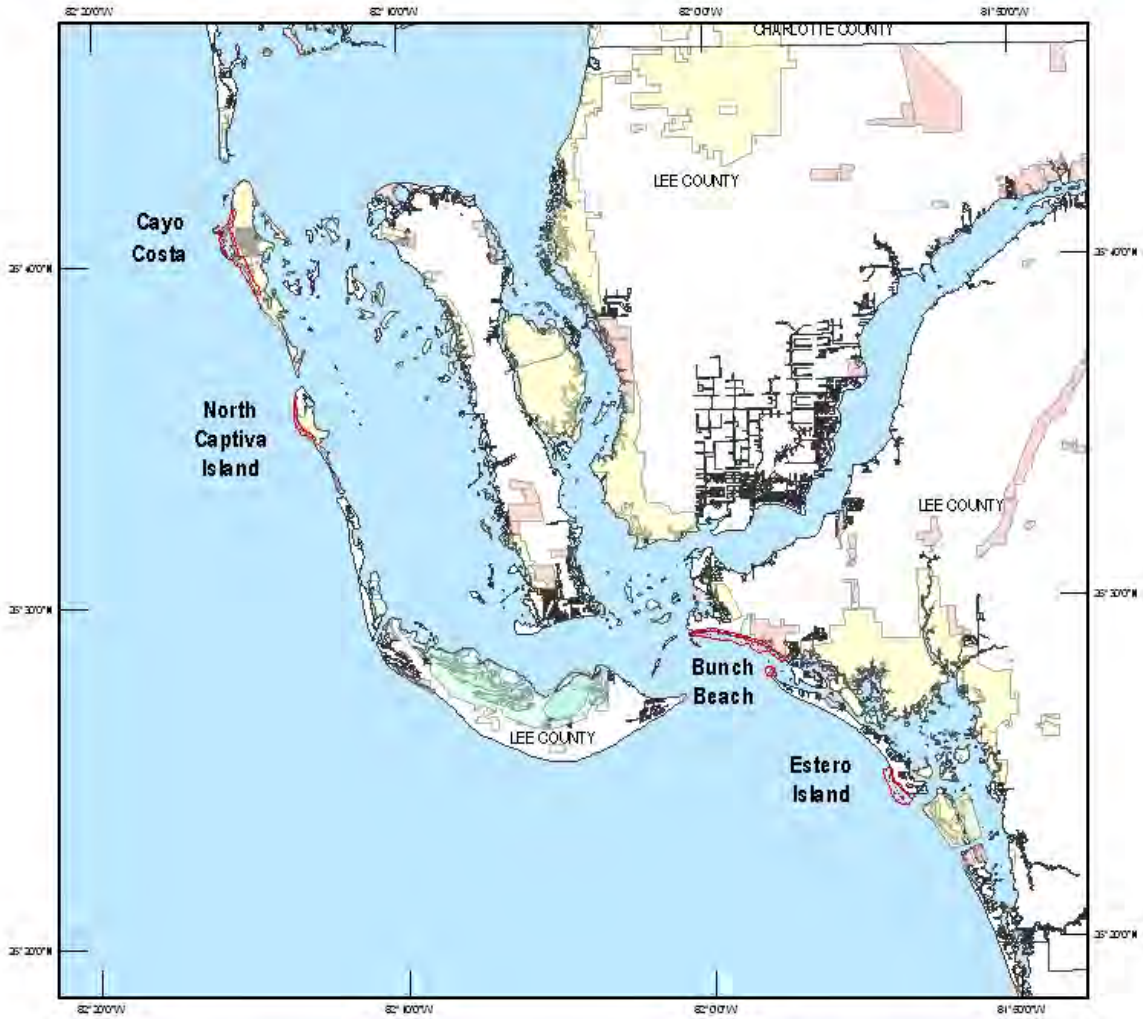


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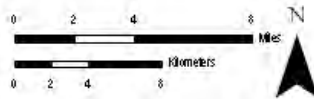
PIPING PLOVER CRITICAL HABITAT



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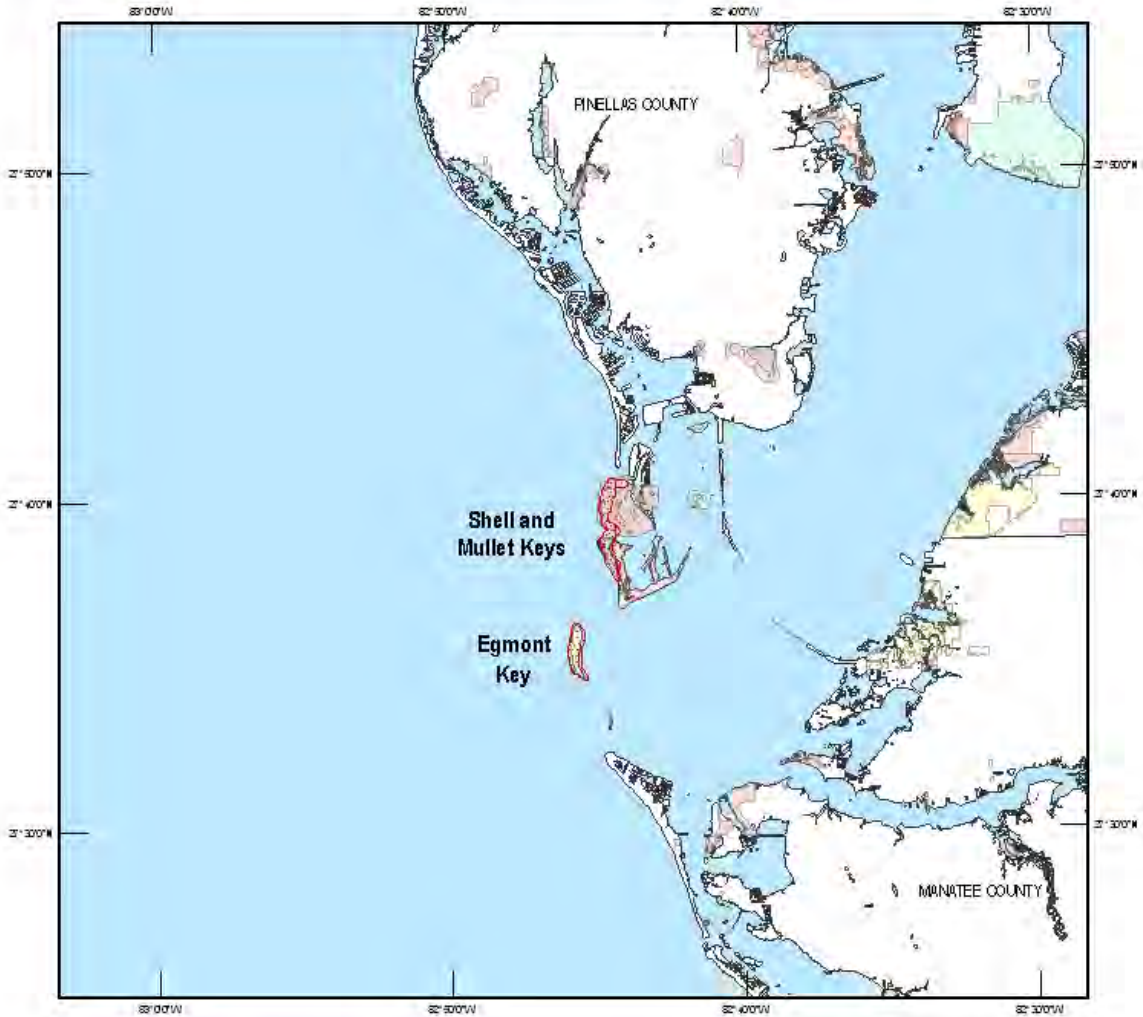
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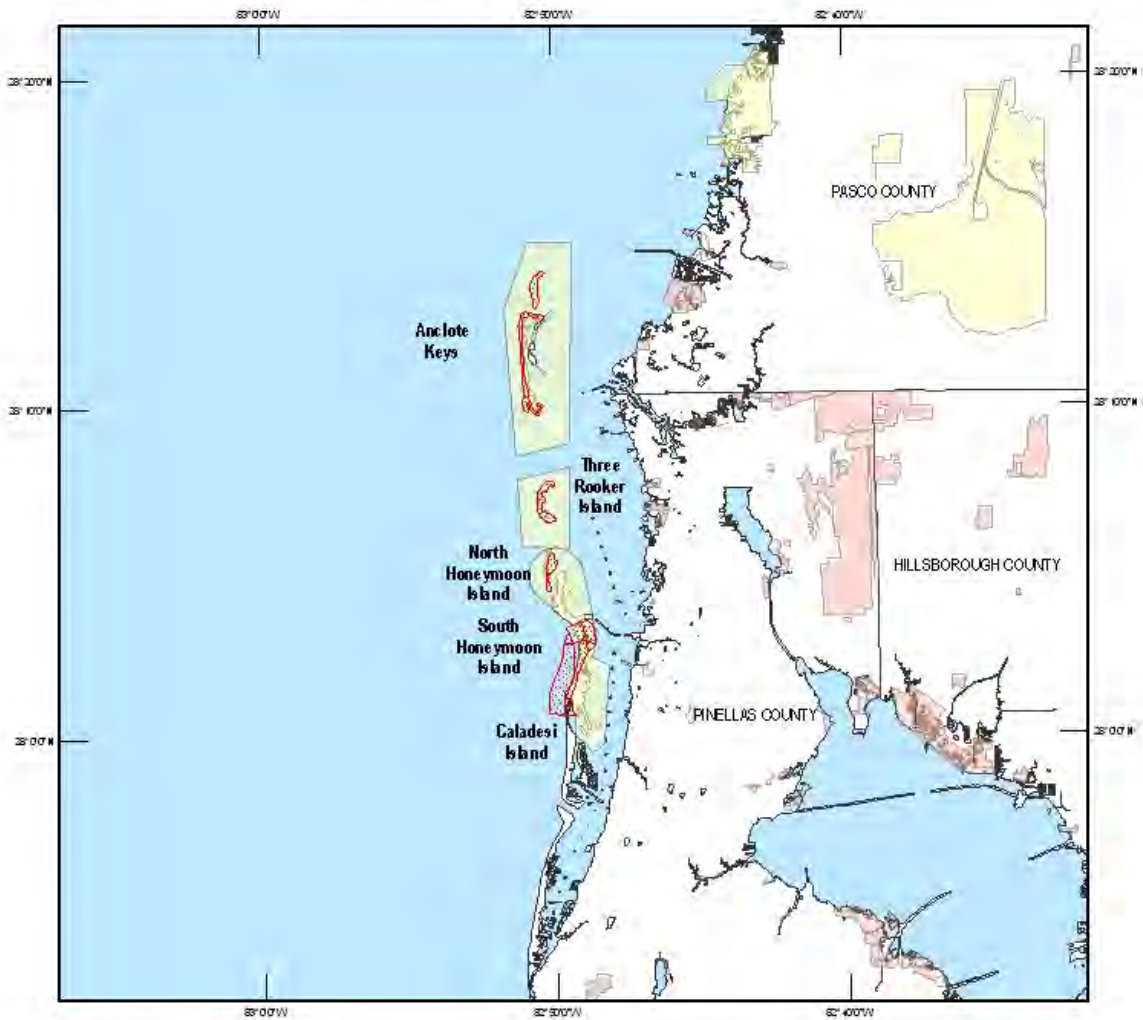


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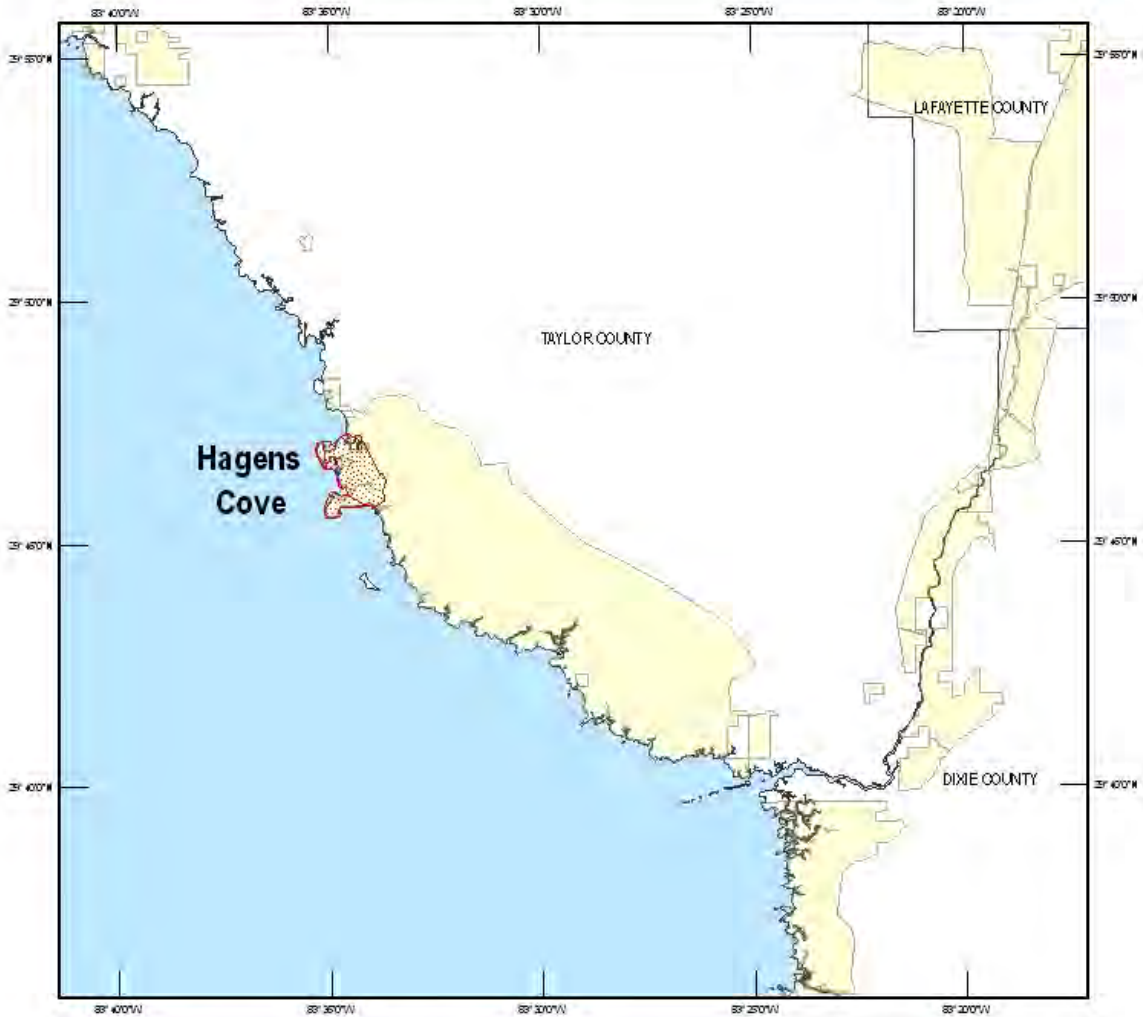


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APPENDIX B: EXAMPLE PREDATOR PROOF TRASH RECEPTACLES



Example of predator proof trash receptacle at Gulf Islands National Seashore. Lid must be tight fitting and made of material heavy enough to stop animals such as raccoons.



Example of trash receptacle anchored into the ground so it is not easily turned over.



Example of predator proof trash receptacle at Perdido Key State Park. Metal trash can is stored inside. Cover must be tight fitting and made of material heavy enough to stop animals such as raccoons.



Example of trash receptacle that is secured and heavy enough not to easily be turned over.