Appendix C
USFWS Biological Opinion and Conference

United States Department of the Interior

FISH AND WILDLIFE SERVICE
176 Croghan Spur Road, Suite 200
Charleston, South Carolina 29407

April 12, 2023

LTC Andrew Johannes, District Engineer
Department of the Army – Charleston District, Corps of Engineers
69A Hagood Avenue
Charleston, South Carolina 29403

Attn: Mr. Alan Shirey

Re: Murrells Inlet Federal Navigation Project
Georgetown County, South Carolina
FWS ECOSphere # 2022-0077876

Dear Colonel Johannes:

This letter transmits the enclosed biological opinion (BO) and conference opinion (CO) of the U.S. Fish and Wildlife Service (Service) for the Murrells Inlet Federal Navigation Project (the Action). The Corps is proposing to dredge up to of 1,090,000 cubic yards (cy) of material from the navigational channel and place the material along 9,920 linear feet of shoreline on the Huntington Beach State Park side of Murrells Inlet and the oceanfront of Garden City Beach. The Service received your revised letter on November 22, 2022, requesting to initiate formal consultation for the Action described in the Biological Assessment. You determined that the Action *is likely to adversely affect (LAA)* the piping plover (*Charadrius melodus*) and its designated critical habitat (Unit SC-10), rufa red knot (*Calidris canutus rufa*) and its proposed critical habitat (Unit SC-16), loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), and seabeach amaranth (*Amaranthus pumilus*).

You also determined that the Action *is not likely to adversely affect* (*NLAA*) the American wood stork (*Mycteria americana*), Eastern black rail (*Laterallus jamaicensis jamaicensis*), and West Indian manatee (*Trichechus manatus*). The initially determined that the Action *is likely to adversely affect* for the Kemp's ridley (*Lepidochelys kempii*) and leatherback (*Dermochelys coriacea*) sea turtles, but the Service disagreed because neither species has been documented within the action area and take is not anticipated. We recommended a *NLAA* determination for the Kemp's ridley and leatherback sea turtles. The Service previously concurred with these determinations by letter dated November 22, 2022. After reviewing the most recent information on the status of seabeach amaranth in the Action Area and the current habitat conditions, it is the Service's opinion that formal consultation is not necessary since the species is has not been documented in the Action Area since 2001. Based on this information, a *NLAA* determination is appropriate, and this letter serves as our concurrence and concludes consultation on the seabeach amaranth.

The enclosed BO and CO answers your request for formal consultation, concludes that the Action is not likely to jeopardize the continued existence of the species listed above, and is not likely to destroy or adversely modify the designated critical habitats listed above. This finding fulfills the requirements applicable to the Action for completing consultation under §7(a)(2) of the Endangered Species Act of 1973, as amended (ESA). The BO includes an ITS, which requires the U.S. Army Corps of Engineers (Corps) to implement monitoring and reporting requirements that the Service considers necessary or appropriate to monitor the impacts of incidental take on listed species. The incidental take of listed species that is compliance with the terms and conditions of this statement is exempted from the prohibitions against taking under the ESA.

Reinitiating consultation is required if the Corps retains discretionary involvement or control over the Action (or is authorized by law) when:

a. The amount or extent of incidental take is exceeded;

b. New information reveals that the Action may affect listed species or designated critical habitat in a manner or to an extent not considered in this BO;

c. The Action is modified in a manner that causes effects to listed species or designated critical habitat not considered in this BO; or

d. A new species is listed, or critical habitat designated that the Action may affect.

A complete administrative record of this consultation is on file in our office at the letterhead address. If you have any questions about the BO, please contact Ms. Melissa Chaplin at (843) 300-0427 or by email: melissa_chaplin@fws.gov. In future correspondence concerning the project, please reference FWS ECOSphere # 2022-0077876.

Sincerely,

Thomas D. McCoy

Thomas D. McCoy
Field Supervisor

TDM/MKC

Enclosure

Biological and Conference Opinion

Murrells Inlet Federal Navigation Project

FWS ECOSphere # 2022-0077876

Prepared by:

U.S. Fish and Wildlife Service
South Carolina Ecological Services Field Office
176 Croghan Spur Road, Suite 200
Charleston, South Carolina 29407

Thomas D. McCoy — April 12, 2023

Thomas D. McCoy, Field Supervisor — Date

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CONSULTATION HISTORY

This section lists key events and correspondence during the course of this consultation. A complete administrative record of this consultation is on file in the U.S. Fish and Wildlife Service's (Service) South Carolina Ecological Service's Field Office (SCESFO).

2022-10-26 – The Service received the U.S. Army Corps of Engineers' (Corps) letter requesting to initiate consultation on the next round of operation and maintenance dredging for the Murrells Inlet Navigation Project and biological assessment (BA).

2022-11-22 – The Service provided comments to the Corps regarding the proposed project. The Service concurred with the Corps' determination of *may affect, is not likely to adversely affect* for the American wood stork, Eastern black rail, and West Indian manatee. The Service did not concur with the Corps' determination of *may affect, is not likely to adversely affect* for the piping plover and its designated critical habitat and the red knot. The Service recommended that the Corps request to initiate formal consultation on the piping plover, its critical habitat (Unit SC-3), the red knot, and its proposed critical habitat (Unit SC-1 and SC-2). The Service concurred with the Corps' determination of *may affect, is likely to adversely affect* for the green and loggerhead sea turtles and seabeach amaranth. The Service did not concur with the Corps' determination of *may affect, is likely to adversely affect* for the Kemp's ridley and leatherback sea turtles.

2022-11-28 – The Service received a letter from the Corps' requesting to initiate formal consultation on the green sea turtle, loggerhead sea turtle, piping plover and its designated critical habitat, red knot, and its proposed critical habitat, and seabeach amaranth.

2022-12-13 – The Service sent a letter to the Corps acknowledging receipt of all information necessary to initiate the consultation and provided an expected date of April 12, 2023, for completion of our biological opinion.

BIOLOGICAL OPINION

1. INTRODUCTION

A biological opinion (BO) is the document that states the opinion of the Service under the Endangered Species Act of 1973, as amended (ESA), as to whether a Federal action is likely to:

- Jeopardize the continued existence of species listed as endangered or threatened; or
- Result in the destruction or adverse modification of designated critical habitat.

The Federal action addressed in this BO is the next round of operation and maintenance dredging for the Murrells Inlet Federal Navigation Project (the Action). This BO considers the effects of the Action on the piping plover (*Charadrius melodus*) and its critical habitat, the red knot (*Calidris canutus rufa*) and its proposed critical habitat, the loggerhead sea turtle (*Caretta caretta*), and the green sea turtle (*Chelonia mydas*).

The Service previously concurred with the Corps determination that the Action *may affect but is not likely to adversely affect* the American wood stork, Eastern black rail, and West Indian manatee, Kemp's ridley sea turtle, and leatherback sea turtle by letter dated November 22, 2022. After reviewing the most recent information on the status of seabeach amaranth in the Action Area and the current habitat conditions, it is the Service's opinion that formal consultation is not necessary since the species is has not been documented in the Action Area since 2001. These species are not further addressed in this BO.

A BO evaluates the effects of a Federal action along with those resulting from interrelated and interdependent actions, and from non-Federal actions unrelated to the proposed Action (cumulative effects), relative to the status of listed species and the status of designated critical habitat. A Service opinion that concludes a proposed Federal action is *not* likely to jeopardize species and is *not* likely to destroy or adversely modify critical habitat fulfills the Federal agency's responsibilities under §7(a)(2) of the ESA.

"*Jeopardize the continued existence*" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR §402.02). "*Destruction or adverse modification*" means a direct or indirect alteration that appreciably diminishes the value of designated critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features (50 CFR §402.02).

This BO uses hierarchical numeric section headings. Primary (level-1) sections are labeled sequentially with a single digit (e.g., 2. PROPOSED ACTION). Secondary (level-2) sections within each primary section are labeled with two digits (e.g., 2.1. Action Area), and so on for level-3 sections. The basis of our opinion for each listed species and each designated critical habitat identified in the first paragraph of this introduction is wholly contained in a separate level-1 section that addresses its status, environmental baseline, effects of the Action, cumulative effects, and conclusion.

2. PROPOSED ACTION

The proposed action is operation and maintenance dredging for the Murrells Inlet Federal Navigation Project. The volume of material dredged is anticipated to be between 355,000 cubic yards (cy) and 1,090,000 cy. The dredged material will be placed over ~40 acres (ac) on the front beach of Garden City Beach along 9,150 linear feet (lf) of shoreline and over ~10 ac on the terminal west end of the south jetty on Huntington Beach State Park along 770 lf of shoreline (**Figure 2-1**). Material will no longer be placed on the front beach of Huntington Beach State Park. Project construction is expected to take 4-6 months to complete.

Figure 2-1. Murrells Inlet Federal Navigation Project dredging and material placement footprint (Corps 2022).

2.1. Action Area

For purposes of consultation under ESA §7, the Action Area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR §402.02). The "Action Area" for this consultation includes the inlet and ocean shoreline of Huntington Beach State Park, Garden City Beach, and Surfside Beach (**Figure 2-2**). Sea turtles and shorebirds may move to other areas along the shorelines of Huntington Beach State Park, Garden City Beach, and Surfside Beach during project construction.

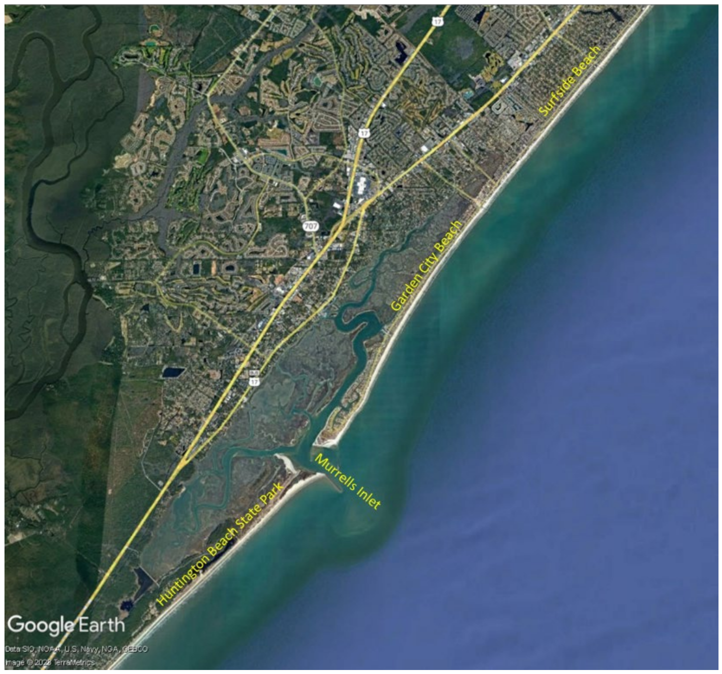


Figure 2-2. The Action Area includes the shorelines of inlet and ocean shoreline of Huntington Beach State Park, Garden City Beach, and Surfside Beach.

2.2. Interrelated and Interdependent Actions

A BO evaluates the effects of a proposed Federal action. For purposes of consultation under ESA §7, the effects of a Federal action on listed species or critical habitat include the direct and indirect effects of the action, and the effects of interrelated or interdependent actions. "Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration" (50 CFR §402.02).

In its request for consultation, the Corps did not describe, and the Service is not aware of, any interrelated or interdependent actions to the Action. Therefore, this BO does not further address the topic of interrelated or interdependent actions.

3. PIPING PLOVER

3.1. Status of the species

On January 10, 1986, the piping plover (*Charadrius melodus*) was listed under the Endangered Species Act (ESA) 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 (USFWS 1985). The preamble of this rule acknowledged the continuing recognition of two subspecies, *Charadrius melodus melodus* (Atlantic Coast of North America) and *Charadrius* *melodus circumcinctus* (Northern Great Plains of North America) in the American Ornithologist Union's most recent treatment of subspecies (AOU 1957). Subsequent ESA actions have consistently recognized three separate breeding populations of piping plovers on the Atlantic Coast (threatened), Great Lakes (endangered) and Northern Great Plains (NGP) (threatened). Piping plovers that breed on the Atlantic Coast of the U.S. and Canada belong to the subspecies *C. m. melodus*. The second subspecies, *C. m. circumcinctus,* is comprised of two Distinct Population Segments (DPS). One DPS breeds on the Northern Great Plains of the U.S. and Canada, while the other breeds on the Great Lakes. Each of these three entities is demographically independent. Piping plovers from all three breeding populations winter 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 (Elliott-Smith and Haig 2004) (**Figure 3-1**).

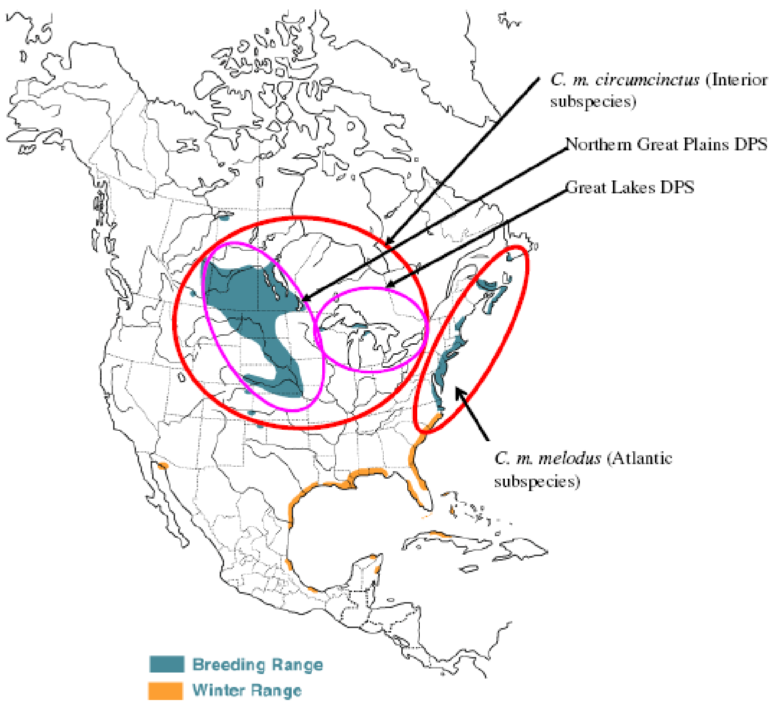


Figure 3-1. **Distribution and range of piping plovers (base map from Elliott-Smith and Haig 2004). Conceptual presentation of subspecies and DPS ranges are not intended to convey precise boundaries.**

The best available scientific information continues to support recognition of two separate subspecies of piping plover, and three separate entities consistent with the ESA definition of "species." Genetic analyses have shown that piping plovers that breed on the Atlantic Coast of the U.S. and Canada belong to the subspecies *C. m. melodus* and plovers that breed on the Northern Great Plains of the U.S. and Canada, as well as on the Great Lakes, belong to a second subspecies, *C. m. circumcinctus* (Miller *et al.* 2010).

3.1.1. Species Description

The piping plover, named for its melodic call, is a small North American shorebird approximately 17 centimeters (cm) (7 inches (in)) long with a wingspan of about 38 cm (15 in) and weighing 40-65 grams (1.4-2.3 ounces) (Palmer 1967, Elliot-Smith and Haig 2004). Adult piping plovers exhibit breeding and nonbreeding plumage. Plovers can arrive on wintering grounds with partial breeding plumage remaining (a single black breastband, which is often incomplete, and a black bar across the forehead). During the late summer or early autumn, the birds lose the black bands, the legs fade from orange to pale yellow, and the bill turns from orange and black to mostly black. Most adults begin their molt into breeding plumage before northward migration and complete the molt before arrival on their breeding sites. Piping plover subspecies are considered phenotypically indistinguishable, although slight clinal breeding plumage variations between populations have been noted (Elliot-Smith and Haig 2004).

3.1.2. Life History

Piping plovers migrate annually between the three populations' breeding ranges in the U.S. and Canada and their shared wintering range along the Atlantic and Gulf coasts of the Southeastern U.S. and Mexico, and parts of the Caribbean. Plovers live an average of five years, although studies have documented birds as old as 11 (Wilcox 1959) and 15 years. 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). Plovers are known to begin breeding as early as one year of age (MacIvor 1990, Haig 1992); however, the percentage of birds that breed in their first adult year is unknown. Piping plovers generally fledge only a single brood per season but may re-nest several times if previous nests are lost.

Habitat Use

NGP plovers primarily breed on open, sparsely vegetated sand and gravel areas associated with four habitat types: alkali lakes and wetlands; large inland lakes; reservoirs; and rivers (USFWS 2020a). Great Lakes plovers breed on open, sparsely vegetated sandy or cobble Great Lake shorelines. Atlantic Coast plovers breed on sparsely-vegetated beaches and washover areas adjacent to moist foraging substrates (USFWS 1996, 2009, 2020a). Wintering piping plovers utilize a mosaic of habitat patches and move among these patches in response to local weather and tidal conditions (Nicholls and Baldassarre 1990a, Nicholls and Baldassarre 1990b, Drake *et al.* 2001, Cohen *et al.* 2008). Preferred coastal habitats include sand spits, small islands, tidal flats, shoals (usually flood tidal deltas), and sandbars that are often associated with inlets (Nicholls and Baldassarre 1990b, Harrington 2008, Addison 2012, Tweel et al. 2023).

Phenology

Piping plovers spend up to 10 months of their life cycle on their migration and winter grounds, generally July through May (Elliott-Smith and Haig 2004, Noel *et al.* 2007, Stucker *et al.* 2010). 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. Migration routes and habitats overlap breeding and wintering habitats, and, unless banded, migrants passing through a site usually are indistinguishable from other breeding or wintering piping plovers. Piping plovers depart their wintering grounds for their breeding grounds as early as March, but northbound migration can extend into May. Plovers depart their breeding grounds for their wintering grounds as early as July (Cohen *et al.* 2018, Weithman *et al.* 2018, Loring and Paton 2019), but southbound migration can extend into November. Cohen *et al.* (2018) documented an entry probability of ~50% by the end of July for the fall migrant and wintering populations. The entry probability increased to 95% for both populations by October indicating that the majority of plovers wintering in South Carolina arrive by October (Cohen *et al.* 2018). These results are the basis for the Service nonbreeding piping plover protocol that calls for using survey counts only from the core winter months of December and January to estimate local winter population numbers (Chaplin pers. comm. 2019).

Site Fidelity

Piping plovers exhibit a high degree of intra- and inter-annual fidelity to nesting and wintering areas, which often encompass several relatively nearby sites (Wilcox 1959, MacIvor *et al.* 1987, Loegering 1992, Drake *et al.* 2001, Cohen *et al.* 2006, Noel and Chandler 2008, Stucker *et al.* 2010, Cohen and Gratto-Trevor 2011, Gratto-Trevor *et al.* 2012, 2016, Catlin *et al.* 2015, Friedrich *et al.* 2015, Anteau 2018, Gibson *et al.* 2017, 2018). Winter site fidelity does not appear to be influenced by disturbance and is overall similar to breeding site fidelity. Individuals are more likely to remain at a site, regardless of site quality or disturbance, than emigrate to a new site thereby resulting in lower survival (Gibson *et al.* 2018). For example, during the Deepwater Horizon oil spill, marked piping plovers rarely moved between sites, and researchers observed high detection rates, even in oil-impacted sites that were heavily disturbed due to clean up efforts (Gibson *et al.* 2017).

3.1.3. Numbers, Reproduction, and Distribution

The data from the International Piping Plover Breeding Censuses represent a minimum estimate of the number of adult piping plovers and breeding pairs in all three breeding populations (**Table 3-1**). Although the effort is as comprehensive as possible, some populations and some areas are able to be more intensively monitored than others outside of Census years. However, some portions of populations are only monitored during Census years (NGP Prairie Canada), so this data is currently the best way to get a rough estimate of the status of all three breeding populations. The data from the 2016 Census has not been complied and the 2021 Census was postponed due to COVID-19. The 2011 Piping Plover Breeding Census documented 2,391 breeding pairs with a total of 5,723 birds throughout Canada and U.S (Elliott-Smith *et al.* 2015) (**Table 3-1**).

Table 3-1. Number of Adults Documented During the 1991, 1996, 2001, 2006, and 2011 International Piping Plover Breeding Census (Haig *et al.* 2005, Elliott-Smith *et al.* 2009, Elliott-Smith *et al.* 2015).

Population	**Number of piping plovers**				
	1991	**1996**	**2001**	**2006**	**2011**
NGP	3469	3286	2953	4662	3486
Canada	*1437*	*1687*	*972*	*1703*	*2249*
U.S.	*2032*	*1599*	*1981*	*2959*	*1237*
Great Lakes	40	48	72	110	112
Canada	*0*	*1*	*1*	*1*	*14*
U.S.	*40*	*47*	*71*	*109*	*98*
Atlantic Coast	1641	2591	2911	3312	3362
Canada	*509*	*422*	*481*	*457*	406
U.S.	*1462*	*2169*	*2430*	*2855*	2952
Total	**5480**	**5925**	**5936**	**8084**	**5723**

Northern Great Plains Population

The NGP plover breeds from Alberta to Manitoba, Canada and south to Nebraska in the U.S. (**Figure 3-2**). Within the U.S., the key breeding habitat occurs in Montana, North and South Dakota, and Nebraska. Despite the significant level of effort invested in breeding surveys for many years, there is currently no reliable means to estimate the current NGP range-wide abundance nor population trends over time. Local population estimates within the three U.S. GMRs (U.S. Alkali Lakes (ALMR), Northern Rivers (NRMR), and Southern Rivers (SRMR)) are a more manageable way to assess the status of portions of the NGP population, but the survey effort varies between the GMRs (USFWS 2020a). The recovery goal for the NGP in Prairie Canada is 2,500 breeding pairs and 1,300 breeding pairs in the U.S. distributed across Montana, North Dakota, South Dakota, Nebraska, and Minnesota (USFWS 2020a). Annual breeding censuses record the number of adults, not breeding pairs, which makes data interpretation more difficult. Although the NGP in the U.S. may have come close to meeting the recovery goal in 2005, the numbers sharply declined from 2009 through 2011 (**Figure 3-3**) (USFWS 2020a). While the population increase seen since 2011 demonstrates the possibility that the population can rebound from low population numbers, ongoing efforts are needed to maintain and ensure growth within the population (USFWS 2020a). In the 2020 status review, the Service concluded that the NGP population remains vulnerable due to management of river systems throughout the breeding range (USFWS 2020a).

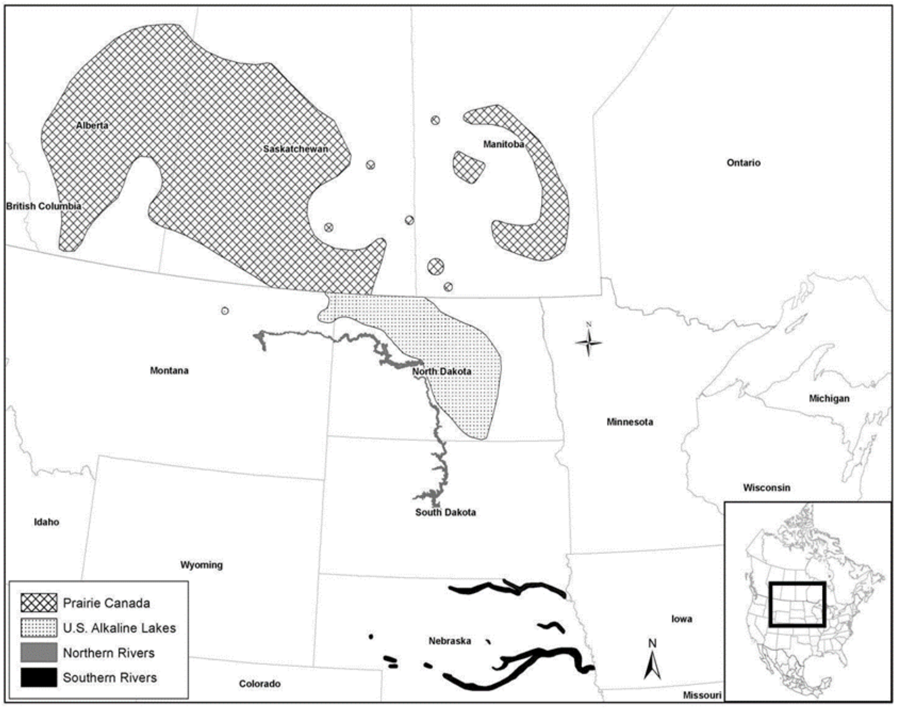


Figure 3-2. The four Geographical Management Regions (GMRs) for breeding piping plovers within the NGP.

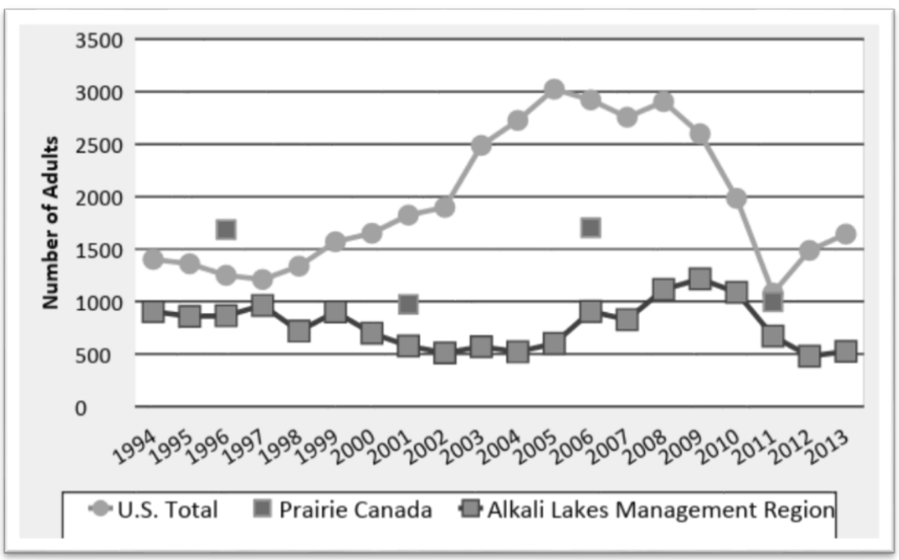


Figure 3-3. The estimated abundance of piping plover adults counted during the annual June breeding census within ALMR compared to prairie Canada and compared to the total estimated abundance summed from all the management regions in the U. S. from 1994–2013.

Great Lakes Population

The Great Lakes plovers historically nested on Great Lakes beaches in Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario, but they currently nest on Great Lakes beaches in Wisconsin, Michigan, Ontario, and New York (**Figure 3-4**). This population is the smallest of the three breeding populations, which makes it the most vulnerable; however, the population has shown significant growth, from 16 pairs at the time of listing in 1986 to 76 pairs, the highest number of breeding pairs recorded to date, in 2017. The number of breeding pairs from 2018, 2019, 2020, 2021, and 2022 were 67, 71, 64, 74, and 72 respectively **(Figure 3-5)**. The recovery goal for the Great Lakes population is 150 breeding pairs, and thirty years of intensive recovery efforts have brought the population to the halfway mark of the recovery goal in some of the recent years (USFWS 2020a). Intensive management has also contributed to the population meeting the productivity goals specified in the 2003 recovery plan over the past five years. During this period, the average annual fledging rate has been 1.7, well above the 1.5 fledglings per breeding pair recovery goal (USFWS 2020a). In the 2020 status review, the Service concluded that the population remains susceptible to extinction (i.e., 12% quasi-extinction [defined as ≤ 15 breeding pairs] probability within the next 10 years; Saunders *et al.* 2018) due to its small size, limited distribution, and vulnerability to stochastic events, such as disease outbreak.

Figure 3-4. Piping plover nesting distribution in the Great Lakes.

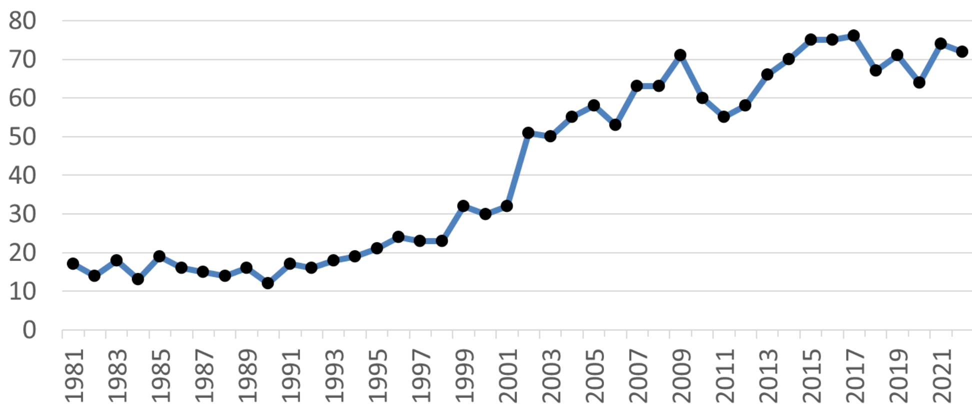


Figure 3-5. Number of pairs of Great Lakes piping plovers from 1981-2022.

Atlantic Coast Population

The Atlantic Coast piping plover breeds on coastal beaches from Newfoundland and southeastern Quebec to North Carolina. Intensive recovery efforts have contributed to substantial population growth, from approximately 790 pairs in 1986 to 2,289 pairs in 2021 (**Figure 3-6**). The preliminary estimate for 2022 is not available. In the 2020 status review, the Service concluded that the increased abundance of Atlantic Coast piping plovers has reduced near-term vulnerability to extinction, but the population remains vulnerable to low numbers in three of its four recovery units (USFWS 2020a). The New England recovery unit has been able to reach and sustain its abundance target, but the other three recovery units remain below target and two have declined since the 2009 status review (USFWS 2020a).

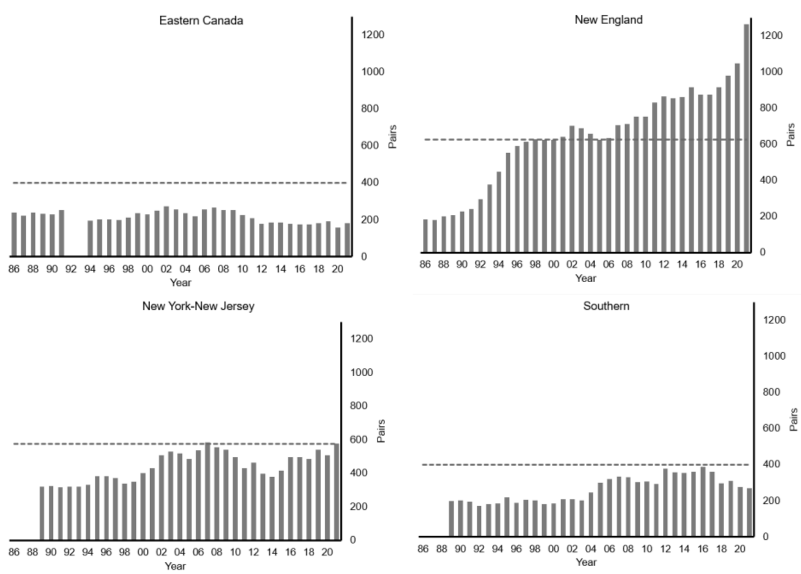


Figure 3-6. Abundance of Atlantic Coast piping plover breeding pairs by recovery unit, 1986–2021. Bars denote the annual pair estimate. Dashed lines indicate abundance objectives established in the 1996 revised recovery plan.

Nonbreeding (Winter and Migration) Range

Piping plovers from all three breeding populations overlap in the nonbreeding range and spend up to 10 months of their annual cycle on their migration and winter grounds, typically from July through May (Elliott-Smith and Haig 2004, Noel *et al.* 2007, Stucker *et al.* 2010). Gratto-Trevor *et al.* (2012) found distinct patterns (but no exclusive partitioning) in winter distribution of banded piping plovers from four breeding areas (**Figure 3-7**). Resightings of more than 700 uniquely marked birds from 2001 to 2008 were used to analyze winter distributions along the Atlantic and Gulf Coasts. Plovers from eastern Canada and most Great Lakes birds wintered from North Carolina to Southwest Florida. However, eastern Canada birds were more heavily concentrated in North Carolina, while a larger proportion of Great Lakes piping plovers were found in South Carolina, Georgia, and Florida. This pattern is consistent with analysis of band sightings of Great Lakes plovers from 1995-2005 by Stucker *et al.* (2010). Gratto-Trevor *et al.* (2012) also found that Northern Great Plains populations were primarily seen farther west and south, especially on the Texas Gulf Coast. Most birds from Prairie Canada portion of the NGP were observed in Texas (particularly southern Texas), while individuals from the U.S. portion of the NGP were more widely distributed on the Gulf Coast from Texas to Florida. Based on band resights, Grato-Trevor *et al.* (2016) were able to conclude that the Bahamas are home to at least 32% of the Atlantic Coast breeding population in the winter, and as much as 19% of the global piping plover population for up to 9 months of the year. Therefore, specific breeding populations will be disproportionately affected by habitat and threats occurring where they are most concentrated in the winter.

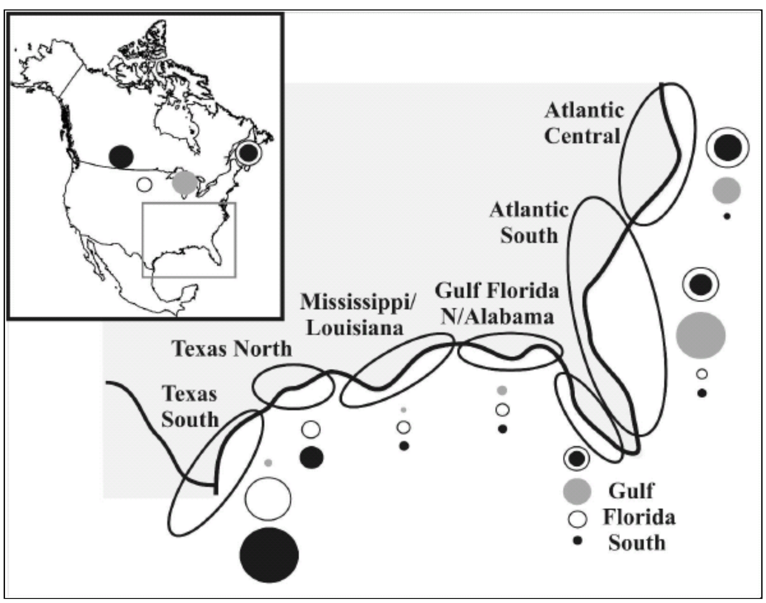


Figure 3-7. The winter distribution in the continental U.S. of piping plovers from four breeding locations (inset), including eastern Canada (white circle with central black dot), Great Lakes (gray circle), U.S. Northern Great Plains (white circle), and Prairie Canada (black circle). The wintering range is expanded to the right, divided into different wintering regions. The size of the adjacent circles relative to the others represents the percentage of individuals from a specific breeding area reported in that wintering region (from Gratto-Trevor *et al.* 2012; reproduced by permission).

Plover abundance and distribution continues to be better documented throughout the coastal migration and wintering range within and outside of the U.S. International Piping Plover Censuses (Census), which began in 1991, have been conducted during mid-winter over a 2-week period at five-year intervals across the species' range (**Table 3-2**). It should be noted that sites may only be surveyed once during the Census so poor weather conditions and the tidal cycle can negatively influence survey results, which may underestimate site use and importance. Therefore, the Census is considered a minimum estimate of abundance and may not reflect local site use. For some parts of the wintering range; however, the Census is the only time that plovers are surveyed and these efforts are particularly important outside of the U.S. The 2011 Census helped confirm the importance of the Bahamas to piping plovers (Gratto-Trevor *et al.* 2016). Individuals from the Great Lakes and Atlantic Coast populations use the Bahamas as a winter site, but the vast majority are from the Atlantic Coast population (Gratto-Trevor *et al.* 2016, 2019). Twenty-seven percent of the total number of piping plovers counted during the 2011 Census were seen in the Bahamas. The 2016 Census was the largest effort in the Caribbean to date to document piping plovers, which resulted in over 1,500 plovers counted (Elliott-Smith 2016). The 2016 Census data for the entire winter range has not been complied and the 2021 Census was cancelled due to COVID-19.

Table 3-2. Results of the 1991, 1996, 2001, 2006, and 2011 international piping plover winter censuses (Haig *et al.* 2005, Elliott-Smith *et al.* 2009, Elliott-Smith *et al.* 2015).

Location	**Number of piping plovers**				
	1991	**1996**	**2001**	**2006**	**2011**
Virginia	ns[a]	Ns	ns	1	1
North Carolina	20	50	87	84	43
South Carolina	51	78	78	100	86
Georgia	37	124	111	212	63
Florida	551	375	416	454	306
-Atlantic	*70*	*31*	*111*	*133*	*83*
-Gulf	*481*	*344*	*305*	*321*	*223*
Alabama	12	31	30	29	38
Mississippi	59	27	18	78	88
Louisiana	750	398	511	226	86
Texas	1,904	1,333	1,042	2,090	2,145
Puerto Rico	0	0	6	ns	2
U.S. Total	**3,384**	**2,416**	**2,299**	**3,355**	**2,858**
Mexico	27	16	ns	76	30
Bahamas	29	17	35	417	1066
Cuba	11	66	55	89	19
Other Caribbean Islands	0	0	0	28	0
GRAND TOTAL	**3,451**	**2,515**	**2,389**	**3,884**	**3,973**

[a] ns = not surveyed

Survival

Demographic analyses have revealed wintering range effects on individual piping plover annual survival. Analysis of data collected in the Carolinas and Georgia in 2010-2017 found that plovers using recreationally disturbed habitats with significant modifications to their habitat have lower survival rates (10% less) and lower body condition (7% lower mass) than birds that use less disturbed habitat without modifications (Gibson *et al.* 2018). Further, birds that emigrated from disturbed sites had higher survival (0.80) than birds that stayed (0.67); but because of their strong site fidelity, birds were more likely to die than leave because of disturbance (Gibson *et al.* 2018). The model used in Gibson *et al.* (2018) found little support that an individual's breeding population influenced annual survival. This study further supports findings in Roche *et al.* (2010) that annual survival is influenced by where individuals overwinter rather than association with a breeding population. Roche *et al.* (2010) found that after-hatch-year apparent survival declined in four of their seven study populations. They found evidence of correlated year-to-year fluctuations in annual survival among populations wintering primarily along the southeastern U.S. Atlantic Coast, as well as indications that shared overwintering or stopover sites may influence annual variation in survival among geographically disparate breeding populations.

3.1.4. Conservation Needs and Threats

Conservation Needs

Piping plovers depend on a mosaic of ephemeral habitats within their breeding and wintering home ranges. Habitat availability and quality may shift seasonally, annually, or episodically due to local environmental conditions (storm events, lunar and/or wind-driven tides, and extreme temperatures), degree of development (need for shoreline stabilization to protect developed shorelines, structures preventing or limiting natural coastal processes), and site use (degree of disturbance from people and dogs). Since piping plovers exhibit such high site fidelity regardless of habitat conditions, low disturbance levels are critical, especially at lower quality sites (periods of limited food resources, nest sites or roosting areas far from foraging areas, and frequent disturbances that limit nest or brood attendance and foraging time), to allow plovers to maintain daily energetic requirements.

Threats

Piping plovers face many threats throughout their entire range, but some are more prevalent in certain parts of the range. Therefore, the most prevalent threats within each of the three breeding ranges and the nonbreeding range are summarized below. For a complete list of threats within each breeding range and the nonbreeding range, refer to the recovery plans and status reviews available at Species Profile for Piping Plover(Charadrius melodus) (fws.gov).

NGP Breeding Range

Destruction, Modification, and Loss of Habitat

Destruction, modification, and loss of habitat remains the largest threat within the NGP breeding range. Nesting habitat within the NGP breeding range has been negatively impacted by the construction of reservoirs, channelization of rivers, modification of river flows, commercial sand and gravel mining, oil and gas development and production, agricultural practices, wind energy production, and invasive vegetation growth. Modification of river flows in the U.S. is a major threat to plovers nesting within the NRMR and SRMR, which can account for up to 45% of the nests within the NGP (USFWS 2020a).

Human Recreational Disturbance

Recreational disturbance is not a range-wide threat, but it is a particular concern in river or reservoir reaches near cities. An estimated 20-80% of the NGP plovers in the U.S. nest in riverine sandbar habitat (Haig and Plissner 1992, Plissner and Haig 1997, Ferland and Haig 2002, USACE 2006, 2012, Elliott-Smith *et al.* 2009, Nelson 2011, Brown *et al.* 2012, Peyton and Wilson 2013). Sandbar habitat also often attracts human recreation, including sandbars on the Missouri River, and reservoirs in Nebraska and Colorado (USFWS 2003a, Nelson 2012).

Great Lakes Breeding Range

Destruction, Modification, and Loss of Habitat

The 2003 recovery plan cites shoreline development as the leading cause of habitat destruction in the Great Lakes, and it remains a major threat (USFWS 2003b). As of 2017, 13% of the U.S. Great Lakes population's nests occur on private lands that are particularly vulnerable to development (Cuthbert and Saunders 2017). Vegetation encroachment and rising water levels are additional factors effecting habitat availability.

Human Recreational Disturbance

Human activities such as illegal off-road vehicle use, unleashed dogs, bike riding, bonfires, horseback riding, camping, and beach going continue to disturb nesting piping plovers (USFWS 2020a). Human disruption, and therefore pet disruption, of piping plovers is likely to increase, as the shoreline of the Great Lakes is becoming an increasingly popular vacation destination. Sleeping Bear Dunes National Seashore, which supports half of the Great Lakes breeding population, had a 42% increase in park visitation between 2009 and 2018, concurrent with a 67% increase in the number of pairs nesting at Sleeping Bear Dunes (USFWS 2020a).

Predation

Predation remains one of the most significant threats to the Great Lakes population in their breeding range (USFWS 2020a). Merlins are suspected to have killed 40 adult plovers since 2005 (Cuthbert and Saunders 2017, Saunders *et al.* 2018). Roche *et al.* (2010) found annual mortality of adults associated with disappearances averaged 5.7% from 2002 to 2007, and that the disappearances were most frequently attributed to merlin predation. The authors mentioned the frequency of these events has increased dramatically since 2002, and currently accounts for approximately one fifth of annual adult mortality (Roche *et al.* 2010).

Atlantic Coast Breeding Range

Destruction, Modification, and Loss of Habitat

Sandy beach development and modification are continuing threats within the Atlantic Coast breeding range. Rice (2017) found that 45 percent of the sandy beaches in the U.S. breeding range of the Atlantic Coast piping plover were developed as of 2015. A comparison of the levels of development modifying sandy beaches from Maine to Virginia in the 1970s (reported by the Heritage Conservation and Research Service) and 2015, found substantial increases in every state except Maine, Rhode Island, and New York (Rice 2017). Forty-two percent of overwash that occurred between Connecticut and Maryland during Hurricane Sandy occurred on developed shoreline where it could not create habitat; this includes 48 and 71 percent of the overwash that occurred on the south shore of Long Island and New Jersey, respectively (Rice 2015). As of 2015, only 31 percent of sandy beach habitat in the piping plover's U.S. Atlantic Coast breeding range remained unmodified (Rice, pers. comm. 2018).

Human Recreational Disturbance

Recreational disturbance remains a serious threat to Atlantic Coast plovers. The 2020 status review summarized new information that provides additional insight into the mechanisms by which disturbance affects piping plover breeding success (USFWS 2020a). Two recent studies demonstrate recreational disturbance impacts to chick survival (DeRose-Wilson *et al.* 2018) and habitat suitability (Maslo *et al.* 2018). DeRose-Wilson *et al.* (2018) document significantly lower rates of survival to fledging for piping plover chicks hatched in areas with high recreational use compared with chicks hatched in areas with low recreational use. Chicks hatched in high use areas fledged at a later age, and chicks exposed to all levels of disturbance had lower daily survival rates on weekends (when recreational activity was high) than on weekdays. On weekends, chicks spent less time in habitats with higher prey abundance, less time foraging, and made fewer foraging attempts per minute than they did on weekdays. Thus, current management in some locations with medium and high human use may not assure sufficient foraging opportunities for plover chicks. Maslo *et al.* (2018) demonstrate the importance of managing human disturbance to prevent degradation of habitat suitability for piping plovers and least terns in New Jersey. Absent the current conservation network, less than three percent of nesting habitat would remain suitable for breeding piping plovers in New Jersey.

Predation

Predation remains a pervasive, persistent, and serious threat to breeding Atlantic Coast piping plovers (USFWS 2009, 2020). Without predator management, piping plover productivity would be substantially less (USFWS 2009). The 2020 status review highlighted a recent study at Cape Hatteras National Seashore, North Carolina by Kwon *et al.* (2018) on ghost crab predation that found daily survival rates of piping plover nests with evidence of ghost crab presence were significantly lower than nests without ghost crabs. This suggests that an earlier study by Wolcott and Wolcott (1999) may have underestimated ghost crab predation on piping plover nests.

Accelerating Sea Level Rise

Effects of accelerating sea level rise on future availability of Atlantic Coast piping plover breeding habitats will largely depend on the response of barrier islands and barrier beaches. With accelerating sea level rise, barrier islands that have historically retreated landward may simply retreat faster; under more drastic sea level rise projections, they may also become reduced in size (FitzGerald *et al.* 2008, Gutierrez *et al.* 2009). The dynamic nature of beach response to sea level rise will be heavily influenced by a variety of site specific factors (e.g. sediment supply, level of development, current elevation) (FitzGerald *et al.* 2008, Lentz *et al.* 2016), wherein worst case or even most likely relative sea level rise projections (Sweet *et al.* 2017) have the potential to outpace the rate at which barrier and mainland beaches are able to migrate laterally to maintain width and elevation (FitzGerald *et al.* 2008; Gutierrez *et al.* 2009).

Nonbreeding Range

Destruction, Modification, and Loss of Habitat

Developed shorelines within the piping plover coastal migration and wintering range have caused and continue to cause the majority of habitat loss, modification, and degradation due to the perpetual maintenance of infrastructure as well as permanent structures previously placed on or adjacent to shifting shorelines (USFWS 2009, 2012, 2020a). Shoreline stabilization projects aimed at protecting existing development and infrastructure can cause temporary or lasting effects depending on the type of project, location, timing, and quality of sand source. Sand placement projects can have beneficial effects by creating unvegetated, open areas, which make optimal roosting habitat, and create more space for birds on the beach, but these effects are short-lived, often lasting only a few years before vegetation encroaches again (Chaplin, pers. comm. 2019). Sand placement projects and inlet relocation projects have more of an impact on foraging habitat by directly impacting benthic invertebrates or altering substrates, which indirectly influences the distribution and abundance of the benthic community (USFWS 2012, SCDNR 2015a, b, Wooldridge *et al.* 2016, SCDNR 2017). Wooldridge *et al.* (2016) found that replenished sections of beach had half as many invertebrates as control sections after 15 months. Polychaete density was also reduced to one third of control levels after 15 months. Although no overall effect of total invertebrate abundance was detected, Wooldridge *et al.* (2016) indicated that replenishment affects taxon within the community differently, such as polychaete worms, which are the preferred prey item of piping plovers.

Human Recreational Disturbance

The Service's *Comprehensive Conservation Strategy for the Piping Plover in its Coastal Migration and Wintering Range in the Continental United States* (CCS) identified human recreational disturbance as a major threat to piping plovers in their coastal migration and wintering range (USFWS 2012). The Atlantic Flyway Shorebird Initiative (AFSI) has also identified human recreational disturbance at stopover sites as a major threat to migrating shorebirds (Mengak *et al.* 2019, Hunt *et al.* 2019). Additional studies have documented the effects of disturbance since the CCS was completed in 2012 (Burger and Niles 2013, Lafferty *et al.* 2013, McLeod *et al.* 2013, Schlacher *et al.* 2013, Burger and Niles 2014, Koch and Paton 2014, Weston *et al.* 2014, Cestari 2015, Glover *et al.* 2015, Martin *et al.* 2015, Vas *et al.* 2015, Allport 2016, Drever *et al.* 2016, McEvoy *et al.* 2016, Murchison *et al.* 2016, Stigner *et al.* 2016, Ramli and Norazlimi 2017, Watts 2017, Gibson *et al.* 2018, DeRose-Wilson *et al.* 2018, Hunt *et al.* 2019). A 2017-2018 literature review documented 632 citations published between 1974 and 2018 on disturbances to shorebirds, their habitats, and their prey base in addition to management recommendations for reducing disturbance (Comber *et al.* 2019). This literature review highlights that this threat is well documented, but not well managed.

Human disturbance is often associated with developed shorelines (Bimbi 2016) and 40% of the shoreline within the coastal migration and wintering range is developed (Rice 2012). Human disturbance can be functionally equivalent to habitat loss if the disturbance prevents birds from using the area or extends the time and energy needed to feed and rest (Goss-Custard *et al.* 2006). The presence of people has been documented to displace shorebirds and influence habitat use (Pfister *et al.* 1992, Fitzpatrick and Bouchez 1998, McCrary and Pierson 2000, Cornelius *et al.* 2001, Mizrahi 2002, Hvenegaard and Barbieri 2010, Forys 2011, Burger and Niles 2013, Lafferty *et al.* 2013, Burger and Niles 2014, Cestari 2015, Martín *et al.* 2015, Drever *et al.* 2016, Watts 2017, Hunt *et al.* 2019, Mengak *et al.* 2019). Gibson *et al.* (2018) found piping plovers using disturbed sites across North Carolina, South Carolina, and Georgia had lower true annual survival rates than those using undisturbed sites. The study also found that plovers using more disturbed sites weighed an average of seven percent less than those using less disturbed sites (Gibson *et al.* 2018). Due to their strong site fidelity, plovers that have previously used disturbed habitat are likely to return to that same location instead of finding more suitable habitat elsewhere (Gibson *et al.* 2018). Plovers foraging in disturbed areas spend less time foraging, and more time alert, than those in undisturbed areas. This leads to lower body condition, due to the plover's increased stress levels and reduced time feeding (Rutter 2016).

Interactions between dogs, particularly dogs running off leash, and shorebirds elicit the strongest response from shorebirds. Shorebirds are more likely to flush from the presence of dogs than people, and breeding and nonbreeding shorebirds react to dogs from distances farther than the distance to people (USFWS 2012, Murchison *et al.* 2016, Stigner *et al.* 2016, Ramli and Norazlimi 2017, Mengak *et al.* 2019). Unleashed dogs often chase birds and can elevate a piping plover's stress enough to impact individual survival (Rutter 2016).

Predation

In 2012, the CCS concluded that the extent of predation on nonbreeding piping plovers is unknown, but it could be a potential threat (USFWS 2012). Predation is often difficult to document, but between December 2012 and September 2017, five mortalities likely due to avian predation were reported along the Texas Coast. In the Florida panhandle, higher counts of raptors coincided with the piping plover nonbreeding season as well as with sites with high piping plover use (Tuma pers. comm. 2018).

Accelerating Sea Level Rise

The CCS concluded that accelerating sea level rise (SLR) poses a threat to piping plovers within their coastal migration and wintering range. The CCS also noted that the magnitude of threats from SLR is closely linked to threats from developed coastlines because sites that are able to adapt to SLR are likely to become more important to plovers as habitat at developed or stabilized sites degrades. Von Holle *et al.* (2019) investigated the effect of local and eustatic SLR on important sea turtle, seabird, and shorebird habitat across the South Atlantic Bight (SAB) and found a substantial increase in the coastal erosion vulnerability under a modest increase in SLR by 2030. Fifty percent of the winter piping plover habitat within the SAB will have an increased vulnerability by 2030 as compared to year 2000 vulnerability levels (Von Holle *et al.* 2019). Habitat within the SAB with high piping plover wintering densities is projected to have an even higher (66%) increased vulnerability due to accelerating SLR as compared to the 2000 levels (Von Holle *et al.* 2019). This is significant since 40% of the coastal migration and wintering range beaches is already developed (Rice 2012) and developed beaches are predicted to be more vulnerable to SLR due to their limited ability to adapt. The remaining 60% of undeveloped beaches within the coastal migration and wintering range is also vulnerable to SLR. Von Holle *et al.* (2019) suggests that available piping plover habitat could become much more vulnerable to SLR impacts in the next ten years.

Storms and Storm Response

Storms are a component of the natural processes that form coastal habitats and can benefit or adversely affect piping plovers at all life stages (Saunders *et al.* 2014, Bourque *et al.* 2015). Storms can eliminate local roost sites, lead to decreases in food supply within foraging habitat, and even directly kill birds (Saunders *et al.* 2014). Saunders *et al.* (2014) found that adult piping plover survival was negatively correlated with hurricane frequency. Some birds may have resiliency to storms and move to unaffected areas without harm, while other reports suggest birds may perish from storm events. In 2014, Hurricane Arthur was responsible for the loss of 15 chicks (63%) along Cape Lookout National Seashore in North Carolina (NPS 2014). Between 2011 and 2016, 25% of all nest losses were due to flooding or high winds (NPS 2011, 2012, 2013, 2014, 2015, 2016). In 2017, following Hurricane Mathew, all known banded piping plovers observed before the storm at regularly surveyed sites in South Carolina were observed during surveys following the storm (Chaplin pers. comm. 2019).

Other storm-induced adverse effects include post-storm acceleration of human activities such as beach nourishment, sand scraping, and berm and seawall construction. Storms can accelerate these activities because coastal habitat is especially vulnerable to degradation from natural erosion, sea level rise, recreation, and coastal development (USGS 2018). The Atlantic Coast breeding range has had close to 80 km of sediment placement projects permitted to modify beach habitat following Hurricane Sandy. This was a 15% increase in the amount of modified shoreline prior to Hurricane Sandy (Rice 2017).

Severe Cold Weather

Several sources suggest the potential for adverse effects of severe winter cold on survival of piping plovers. Cold weather can directly lead to reductions in survival, as seen in a population of piping plovers in Georgia that declined by 52% concurrent with a 4-week period of cold weather (Gibson *et al.* 2017). Unusually cold temperatures can also affect survival indirectly by reducing the amount of food available. Reduced food availability causes piping plovers to expend valuable energy foraging and results in lower body conditions that reduce chances of survival (Saunders *et al.* 2014).

Summary of Threats

The 2020 status review concludes that losses and degradation of habitat continues and that levels of recreational disturbance are increasing (USFWS 2020a). As a result, cumulative losses of habitat and habitat function throughout the coastal migration and wintering range continues to be the primary threat. Oil spills, predation, storms, and severe cold weather are of concern, but they remain lower threats when considered independently. Cumulatively, oil spills, due to the associated clean-up response, and storms, due to the shoreline stabilization efforts that tend to follow, have the potential to exacerbate ongoing threats from habitat loss and disturbance locally and regionally. This is particularly significant for the Great Lakes population because the population is already more vulnerable due to low numbers; therefore, affected areas where Great Lakes birds occur could have population level effects. Accelerating SLR is a growing concern because the magnitude of threats from SLR is closely linked to threats from developed coastlines since those shorelines have less adaptability. Shoreline stabilization efforts in response to SLR and the increase in storm frequency are likely to compound ongoing habitat losses throughout the coastal migration and wintering range. Cumulatively, all of these threats will likely limit the recovery potential of all three breeding populations, particularly the Great Lakes population, unless habitat within the coastal migration and winter range is effectively managed to minimize recreational disturbance and habitat loss and degradation.

3.1.5. Summary of the Status of the Piping Plover

The 2020 status review recommended retaining the Atlantic Coast and NGP populations of the piping plover as threatened throughout their ranges and recommended revising the current listing of the Great Lakes population to endangered throughout its current breeding, migration, and wintering range (USFWS 2020a). Even though intensive management of the Great Lakes, Atlantic Coast, and portions of the NGP populations has resulted in population increases, none of the breeding populations have fully attained each population’s recovery goals. Therefore, both the Atlantic Coast and NGP populations remain likely to become endangered within the foreseeable future within their entire range. The Great Lakes population remains in danger of extinction due to its low abundance, limited distribution, and persistent threats from habitat degradation, human disturbance, and predation. In addition to the considerations pertinent to each breeding population, all piping plovers remain at risk due to continuing habitat loss and increasing human disturbance during the two-thirds of their annual cycle spent in the migration and wintering range. Research continues to demonstrate the importance of migration and wintering range habitat conditions on the adult survival rates of all three breeding populations, particularly the Great Lakes population due to its low numbers (Gibson *et al.* 2018).

For a more detailed account of the species description, life history, population dynamics, conservation needs, and threats, refer to Species Profile for Piping Plover(Charadrius melodus) (fws.gov).

3.2. Environmental Baseline

This section is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the piping plover, its habitat, and ecosystem within the Action Area. The environmental baseline is a "snapshot" of the species' health in the Action Area at the time of the consultation and does not include the effects of the Action under review.

South Carolina barrier beaches are part of a complex and dynamic coastal system that continually respond to inlets, tides, waves, erosion and deposition, longshore sediment transport, and depletion, fluctuations in sea level, and weather events. The location and shape of the coastline perpetually adjusts to these physical forces. Winds move sediment across the dry beach forming dunes and the island interior landscape. The natural communities contain plants and animals that are subject to shoreline erosion and deposition, salt spray, wind, drought conditions, and sandy soils. Vegetative communities include foredunes, primary, and secondary dunes, interdunal swales, sand pine scrub, and maritime forests. However, the protection or persistence of these important natural landforms, processes, and wildlife resources is often in conflict with long-term beach stabilization projects and their indirect effects, i.e., increases in residential development, infrastructure, and public recreational uses.

South Carolina has approximately 182 miles of coastline and approximately 51% (93/182 miles) of the coastline is developed (SCDHEC 2010). Approximately 37% (67.6/182 miles) of the state's coastline has received sand placement via beach nourishment or dredge disposal placement (Rice 2012a). South Carolina currently has 47 tidal inlets open and 36% (17/47 inlets) have been stabilized with some type of hard structure(s) along at least one shoreline (Rice 2012b).

Huntington Beach State Park is owned and managed by South Carolina Parks Recreation and Tourism. Garden City Beach and the Town of Surfside Beach are public beaches in the Grand Strand area. These areas are subject to dynamic coastal processes that influence and shape the shoreline.

3.2.1. Action Area Numbers and Distribution

Shorebirds, including piping plovers, are known to use a mosaic of habitats associated with inlet complexes. Piping plovers have been observed on both sides Murrells Inlet and documented in the Action Area since the early 1990s. The migrant population is typically much larger than the winter population. Piping plovers that overwinter, meaning they spend most of their nonbreeding season at one location, can arrive at their winter site in South Carolina as early as August and depart as late as April (Maddock *et al.* 2013), but the best local winter population estimate cannot be determined until the core winter season (November 15 – February 15). Results of a band re-sighting analysis for birds documented at sites in South Carolina showed zero immigration or emigration during the months of December and January (Cohen *et al.* 2018); therefore, the Service determines the local winter population by using the single highest count of birds during surveys conducted between December 1 and January 31. Available data suggests the Murrells Inlet Complex supports 0 – 11 wintering piping plovers. Resights of uniquely marked piping plovers indicate that birds from all three breeding populations use these sites, but most birds are from the Atlantic Coast and Great Lakes populations (Gratto-Trevor *et al.* 2012, USFWS 2020a). Two individuals banded on Fire Island in New York wintered at Huntington Beach State Park during the 2022/2023 nonbreeding season (Walker 2022, pers. com.).

3.2.2. Action Area Conservation Needs and Threats

Habitat loss, recreational disturbance, predation, accelerated sea level rise, storms, and severe cold, which are the six most prevalent threats to piping plovers within their nonbreeding range, are present or possible on the beaches of Huntington Beach State Park and Garden City, but less likely on Surfside Beach. Chronic recreational disturbance, which is the most widespread and serious threat in South Carolina, exacerbates physiological effects on body condition that are difficult to offset particularly in lower quality habitats. When birds must eat more, which requires more time and effort, and move more to find food and/or respond to a disturbance, weight is harder to gain and maintain. Gibson *et al*. (2018) found that birds wintering at more disturbed sites were seven percent lighter than birds wintering at less disturbed sites.

3.3. Effects of the Action

This section analyzes the direct and indirect effects of the Action on the piping plover, which includes the direct and indirect effects of interrelated and interdependent actions. Direct effects are caused by the Action and occur at the same time and place. Indirect effects are caused by the Action but are later in time and reasonably certain to occur.

3.3.1. Effects of sand placement

Beneficial Effects

Sand placement projects can have beneficial effects by creating unvegetated, open areas, which make optimal roosting habitat, and create more space for birds on the beach, but these effects are short-lived, often lasting only a few years before vegetation encroaches again (Chaplin 2019).

Adverse Effects

Wintering piping plovers depend on the availability and abundance of benthic invertebrates such as polychaete worms and amphipods as their primary food source (Tweel *et al*. 2023). Polychaete worms comprise most of the shorebird diet (Kalejta 1992, Mercier and McNeil 1994, Tsipoura and Burger 1999, Verkuil *et al.* 2006); and are preferred by piping plovers (Hoopes 1993, Nicholls 1989, Zonick and Ryan 1996, Tweel *et al*. 2023). Burial of benthic invertebrates, delayed recovery of benthic invertebrates, or changes in their communities due to physical habitat changes may affect the quality of piping plover foraging habitat. Disturbance from project construction and lower quality foraging habitats can adversely affect piping plovers by lowering their survival (Gibson *et al*. 2018).

Direct effects: Direct effects are those direct or immediate effects of a project on the species or its habitat.

Removal, burial, and mortality of benthic invertebrates will likely occur during project construction. Timeframes projected for benthic recruitment and re-establishment following beach nourishment range between 6 months to 2 years (Thrush *et al.* 1996, Peterson *et al.* 2000, Zajac and Whitlatch 2003, Bishop *et al.* 2006, Peterson *et al.* 2006) depending on sediment composition and timing of construction.

Indirect effects*:* Indirect effects are effects caused by or result from the proposed action, are later in time, and are reasonably certain to occur.

Piping plovers wintering in the Action Area may experience lower survival by being displaced to lower quality foraging areas. Ocean-facing beach flats without runnels are considered a lower quality foraging habitat for piping plovers compared to inlet-facing flats (Tweel *et al*. 2023). Plovers may be pushed to lower quality foraging habitats during project construction on the Murrells Inlet side of Huntington Beach State Park.

3.4. Cumulative Effects

For purposes of consultation under ESA §7, cumulative effects are those caused by future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. Future Federal actions that are unrelated to the proposed action are not considered, because they require separate consultation under §7 of the ESA. The Service is not aware of any cumulative effects in the Action Area at this time; therefore, cumulative effects are not relevant to formulating our opinion for the Action.

3.5. Conclusion

In this section, the Service summarizes and interprets the findings of the previous sections for the piping plover (status, baseline, effects, and cumulative effects) relative to the purpose of a BO under §7(a)(2) of the ESA, which is to determine whether a Federal action is likely to:

a) Jeopardize the continued existence of species listed as endangered or threatened; or
b) Result in the destruction or adverse modification of designated critical habitat.

"Jeopardize the continued existence" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR §402.02).

Status

The 2020 status review recommended retaining the Atlantic Coast and NGP populations of the piping plover as threatened throughout their ranges and recommended revising the current listing of the Great Lakes population to endangered throughout its current breeding, migration, and wintering range (USFWS 2020a). Even though intensive management of the Great Lakes, Atlantic Coast, and portions of the NGP populations has resulted in population increases, none of the breeding populations have fully attained each population's recovery goals. Therefore, both the Atlantic Coast and NGP populations remain likely to become endangered within the foreseeable future within their entire range. The Great Lakes population remains in danger of extinction due to its low abundance, limited distribution, and persistent threats from habitat degradation, human disturbance, and predation. In addition to the considerations pertinent to each breeding population, all piping plovers remain at risk due to continuing habitat loss and increasing human disturbance during the two-thirds of their annual cycle spent in the migration and wintering range. Research continues to demonstrate the importance of migration and wintering range habitat conditions on the adult survival rates of all three breeding populations, particularly the Great Lakes population due to its low numbers (Gibson *et al.* 2018).

Baseline

Available data suggests the Murrells Inlet Complex supports 0 – 11 wintering piping plovers. Resights of uniquely marked piping plovers indicate that birds from all three breeding populations use these sites, but most birds are from the Atlantic Coast and Great Lakes populations (Gratto-Trevor *et al.* 2012, USFWS 2020a). Habitat loss, recreational disturbance, predation, accelerated sea level rise, storms, and severe cold, which are the six most prevalent threats to piping plovers within their nonbreeding range, are present or possible in the Action Area. Recreational disturbance, which is the most widespread and serious threat in South Carolina, is present even when minimized at all three sites within the Action Area.

Effects

The proposed action is expected to temporarily disturb piping plovers present during project construction and temporarily reduce benthic invertebrates in the sand placement area. Typically, ocean-facing beach flats without runnels are considered a lower quality foraging habitat for piping plovers (Tweel *et al*. 2023) and plovers may be pushed to these areas during project construction.

After reviewing the current status of the Northern Great Plains, Great Lakes, and Atlantic Coast piping plover breeding populations range wide, the environmental baseline for the action area, and the cumulative effects, it is the Service's biological opinion that the action is not likely to jeopardize the continued existence of the piping plover.

4. CRITICAL HABITAT FOR THE PIPING PLOVER

4.1. Status of Critical Habitat

The Service has designated critical habitat for the piping plover on three occasions. Two of these designations protected different breeding populations. Critical habitat for the Great Lakes breeding population was designated May 7, 2001, (66 [FR] (Federal Register) 22938, USFWS 2001a), and critical habitat for the northern Great Plains breeding population was designated September 11, 2002, (67 FR 57637, USFWS 2002). No critical habitat has been proposed or designated for the Atlantic Coast breeding population, but the needs of all three breeding populations were considered in the 2001 critical habitat designation for wintering piping plovers (66 FR 36038, USFWS 2001b) and subsequent redesignations (USFWS 2008d, 2009d). 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.

4.1.1. Description

Critical habitat for wintering piping plovers currently comprises 141 units totaling 256,513 acres along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas. The original designation included 142 areas (the rule erroneously states 137 units) encompassing approximately 1,798 miles of mapped shoreline and 165,211 acres of mapped areas (USFWS 2001b). A revised designation for four North Carolina units was published in 2008 (USFWS 2008d). Eighteen revised Texas critical habitat units were designated in 2009, replacing 19 units that were vacated and remanded by a 2006 court order (USFWS 2009c). Designated areas include habitats that support roosting, foraging, and sheltering activities of piping plovers.

Critical habitat designation for nonbreeding piping plovers used the term "primary constituent elements" (PCEs) to identify the key components of critical habitat that are essential to its conservation and may require special management considerations or protection. Revisions to the critical habitat regulations in 2016 (81 FR 7214, 50 CFR §4.24) discontinue use of the term PCEs and rely exclusively on the term “physical and biological features” (PBFs) to refer to these key components, because the latter term is the one used in the statute. This shift in terminology does not change how the Service conducts a “destruction or adverse modification” analysis. In this BO, we use the term PBFs to label the key components of critical habitat that provide for the conservation of the nonbreeding piping plover that were identified in its critical habitat designation rule as PCEs.

The PBFs of nonbreeding piping plover critical habitat are sand or mud flats or both with no or sparse emergent vegetation for foraging piping plovers and adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide for roosting piping plovers (66 FR 36038). 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.

4.1.2. Conservation Value

Designation of critical habitat can help focus conservation activities for a listed species by identifying areas that contain PBFs that are essential for the conservation of that species. Recovery of piping plovers is dependent upon available habitat throughout the range of the species.

4.1.3. Conservation Needs

All critical habitat units were occupied at the time of designation. Due to the dynamic nature of these ephemeral habitats, all units are needed for the recovery of the species. Natural coastal processes are also necessary to ensure the existence and functionality of these units in the future. When these processes are limited or altered, habitat quality diminishes.

4.2. Environmental Baseline

See **Section 3.2**.

4.2.1. Action Area Conservation Value

The Action Area overlaps designated critical habitat unit SC-3 (**Figure 4-1**), which currently contain all PBFs. Available data suggests the Murrells Inlet Complex supports 0 – 11 wintering piping plovers. Resights of uniquely marked piping plovers indicate that birds from all three breeding populations use these sites, but most birds are from the Atlantic Coast and Great Lakes populations (Gratto-Trevor *et al.* 2012, USFWS 2020a). Each unit within the nonbreeding piping plover designation is essential to the recovery of the species. The text description of the unit is as follows:

Unit SC-3: Murrells Inlet/Huntington Beach
135 ha (334 ac) in Georgetown County.

The majority of the unit is within Huntington Beach State Park. This unit extends from the southern tip of Garden City Beach, just south of the groins (a rigid structure or structures built out from a shore to protect the shore from erosion or to trap sand) north of Murrells Inlet from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begins and where the constituent elements no longer occur stopping perpendicular with the southern end of Inlet Point Drive. It includes from MLLW south of Murrells Inlet to the northern edge of North Litchfield Beach approximately 4.5 km (3.0 mi). The unit from the Atlantic Ocean up to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The lagoon at the north end of Huntington Beach State Park is also included.

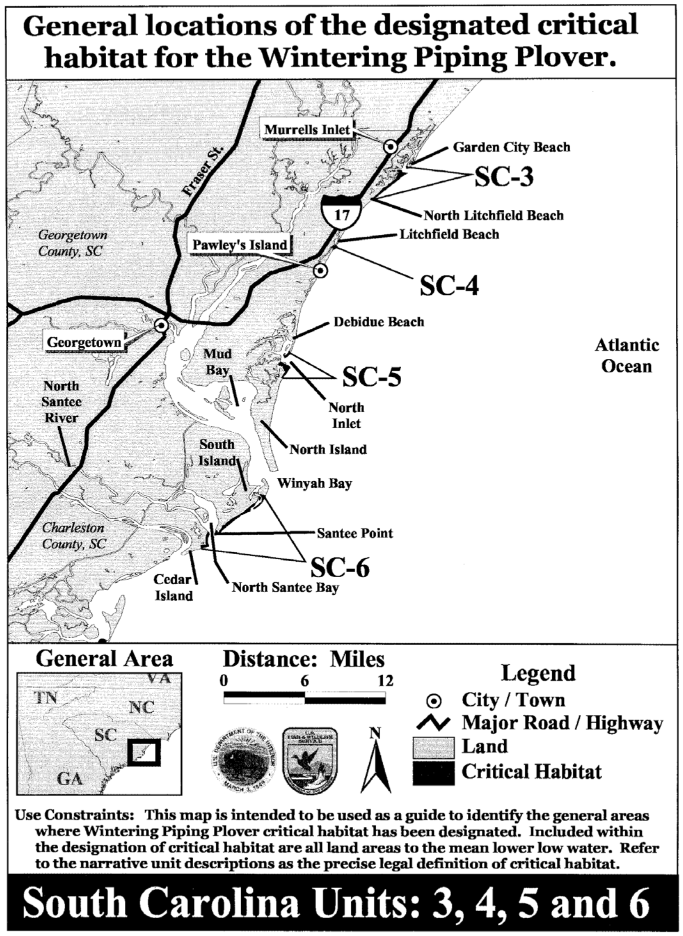


Figure 4-1. Map of piping plover designated critical habitat units SC-3, 4, 5, and 6.

4.2.2. Action Area Conservation Needs

Minimizing Recreational Disturbance

Intense human disturbance in winter habitat can be functionally equivalent to habitat loss. If the disturbance prevents birds from using an area (Goss-Custard *et al*. 1996), this can lead to roost abandonment and population declines (Burton *et al*. 1996). Disturbance from human and pet presence alters plover behavior and often negatively influences distribution.

4.3. Effects of the Action

This section analyzes the direct and indirect effects of the Action on critical habitat for the piping plover, which includes the direct and indirect effects of interrelated and interdependent actions. Direct effects are caused by the Action and occur at the same time and place. Indirect effects are caused by the Action but are later in time and reasonably certain to occur. Our analyses are organized according to the description of the Action in section 2 of this BO.

4.3.1. Effects of Sand Placement

The project will temporarily impact up to 10 acres of foraging habitat by reducing the quality of PBFs within the project footprint, but roosting habitat is expected to increase.

4.4. Cumulative Effects

See **Section 3.4.**

4.5. Conclusion

In this section, we summarize and interpret the findings of the previous sections for nonbreeding piping plover critical habitat (status, baseline, effects, and cumulative effects) relative to the purpose of a BO under §7(a)(2) of the ESA, which is to determine whether a Federal action is likely to:

a) jeopardize the continued existence of species listed as endangered or threatened; or
b) result in the destruction or adverse modification of designated critical habitat.

"*Destruction or adverse modification*" means a direct or indirect alteration that appreciably diminishes the value of designated critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features (50 CFR §402.02).

After reviewing the current status of the critical habitat, the environmental baseline for the Action Area, the effects of the Action, and the cumulative effects, it is the Service's biological opinion that the Action is not likely to destroy or adversely modify designated critical habitat for the piping plover because impacts to PBFs that support foraging habitat will be temporary and PBFs that support roosting habitat will be created.

5. RED KNOT

5.1. Status of the species

On December 11, 2014, the Service published the final rule to list the rufa red knot (*Calidris canutus rufa*) as a threatened subspecies under the ESA (79 FR 73706). Four genetically distinct groups of *Calidris canutus* have been identified. Three of the groups correspond to recognized subspecies: *C. canutus canutus*, *C.c. piersma*, *C.c. rogersi*. The fourth is a North American group containing the other three recognized subspecies (*C.c. rufa*, *C.c. roselaari* and *C.c. islandica*), which are not fully distinct at the genetic level based on analyses conducted to date (Buehler and Baker 2005). *Calidris canutus canutus*, *C.c. piersma*, and *C.c. rogersi* do not occur in North America. **Figure 5-1** shows the worldwide range and distribution of the six subspecies.

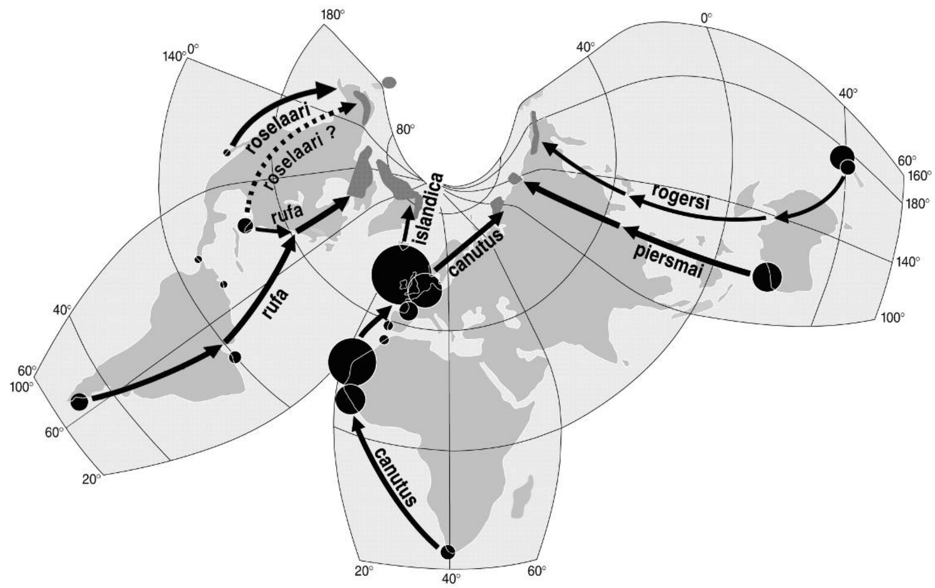


Figure 5-1. Range and distribution of the six subspecies of *Calidris canutus*. Map drawn by Dick Visser, provided by Jan van Gils, and reproduced by permission.

5.1.1. Species Description

The rufa red knot is a medium-sized shorebird about 9 to 11 inches (23 to 28 centimeters) in length. The red knot is easily recognized during the breeding season by its distinctive reddish feathers. The face, prominent stripe above the eye, breast, and upper belly are a deep red, sometimes with a few scattered light feathers mixed in. The feathers of the lower belly and under the tail are whitish with dark flecks. Upperparts are dark brown with white and reddish feather edges; outer primary feathers are dark brown to black. Females are similar in color to males, though the reddish colors are typically less intense, with more buff or light gray on the back parts. Nonbreeding plumage is dusky gray above and whitish below. Juveniles resemble nonbreeding adults, but the feathers of the scapulars (shoulders) and wing coverts (small feathers covering base of larger feathers) are edged with white and have narrow, dark bands, giving the upperparts a scalloped appearance (Davis 1983).

5.1.2. Life History

The rufa red knot migrates annually between its breeding grounds in the central Canadian Arctic and several wintering regions, including the Southeastern U.S./Caribbean, the Western Gulf of Mexico/Central America, Northern Coast of South America, and Tierra del Fuego at the southern tip of South America. Knots wintering in Tierra del Fuego make one of the longest distance migrations known in the animal kingdom, traveling up to 19,000 mi (30,000 km) annually. The rufa red knot's typical life span is at least 7 years (Niles *et al.* 2008), with the oldest known wild bird at least 21 years old as of 2014 (Bauers 2014, Jordan 2014). Age of first breeding is at least 2 years (Harrington 2001). Female rufa red knots lay only one clutch per season and as far as is known, do not lay a replacement clutch if the first is lost (Niles *et al.* 2008).

Habitat Use

Red knots generally nest in dry, slightly elevated tundra locations, often on windswept slopes with little vegetation in the central Canadian Arctic and stopover and winter in coastal marine and estuarine habitats with large areas of exposed intertidal sediments. Migration and wintering habitats include both high-energy ocean- or bay-front areas, as well as tidal flats in more sheltered bays and lagoons. Preferred roosting habitat in wintering and stopover areas includes areas with the following qualities: close to feeding areas; protected from predators; have sufficient space during the highest tides; and free from excessive human disturbance.

Phenology

Red knots spend about 60% of the calendar year along the U.S. Atlantic Coast on their way to and from breeding and wintering areas (USFWS 2020b). Red knots arrive on their breeding grounds in late May or early June and remain intact until shortly after the eggs hatch (Niles *et al.* 2008, Harrington 2001). Departure from the breeding grounds (fall migration) begins in mid-July and continues through August. Females are thought to leave first, followed by males and then juveniles. Adult *Calidris canutus* pass through stopover sites along the migratory route earlier in years with low reproductive success than in years with high reproductive success. Southbound red knots start arriving in July along the U.S. Atlantic coast. Numbers of adults peak in mid-August and most depart by late September, although geolocators and resighting have shown some birds (especially northern-wintering knots) stay through November. Depending on the wintering region location, the main red knot movement north from Tierra del Fuego occurs in February. Birds moving north from Argentina may make several stops along the coast, and typically arrive in northern Brazil in April. Departure from Brazil tends to occur in the first half of May. Many knots marked in Argentina and Chile are seen on the Atlantic coasts of Florida, Georgia, South Carolina, and North Carolina during, but not before, May (USFWS 2020b).

Site Fidelity

Red knots show very high fidelity to each of the four wintering regions (Southern, Northern Coast of South America, Western Gulf of Mexico/Central America, and the Southeastern U.S./Caribbean (USFWS 2014). Minimal intra- and inter-annual movement of birds among wintering regions has been reported, but intra- and inter-annual regional movements within wintering regions has been documented in the Texas Laguna Madre and the Southeast (Niles *et al.* 2008, Newstead *et al.* 2013).

5.1.3. Numbers, Reproduction, and Distribution

For the red knot, population size is best measured on the wintering grounds due to the difficulty of regularly accessing remote breeding areas in the Canadian Arctic. Counts on the wintering grounds are particularly useful in estimating red knot populations and trends because the birds generally remain within a given wintering area for a longer period of time compared to migration stopover areas. This minimizes errors associated with turnover or double counting that can occur during migration counts (USFWS 2014).

Wintering Regions within the Nonbreeding Range

The 2020 SSA concluded that the four red knot wintering regions (**Figure 5-2**) support separate populations. Evidence suggests that at least three of the wintering populations are genetically distinct (Baker *et al.* 2013, Baker *et al.* 2011), which would indicate some degree of behavioral and/or geographic breeding segregation. Stable isotope, tracking, and genetic analyses suggest that red knots from different wintering regions partially segregate (in time and/or space) in migration areas (Kazyak *et al.* 2018, USFWS 2014). Birds from different wintering populations show marked differences in migration strategy (e.g., timing, routes, long "jumps" versus shorter "hops," timing of feather molt, degree of reliance on particular staging areas) and also show, on average, morphological differences (USFWS 2014).

The sharp decline of the Southern wintering population that occurred in the 2000s (likely due to horseshoe crab overharvest in Delaware Bay) and its stabilization since 2011 are corroborated by declining counts at certain stopover areas and by analyses of other data sets. The decline of the Southern population drove a decline of the subspecies as a whole (USFWS 2014). Although less reliant on Delaware Bay, the Western Gulf of Mexico/Central American wintering population is also thought to have declined in recent decades, while the Northern Coast of South America and the Southeastern U.S./Caribbean wintering populations are considered stable (**Table 5-1**) (USFWS 2020b).

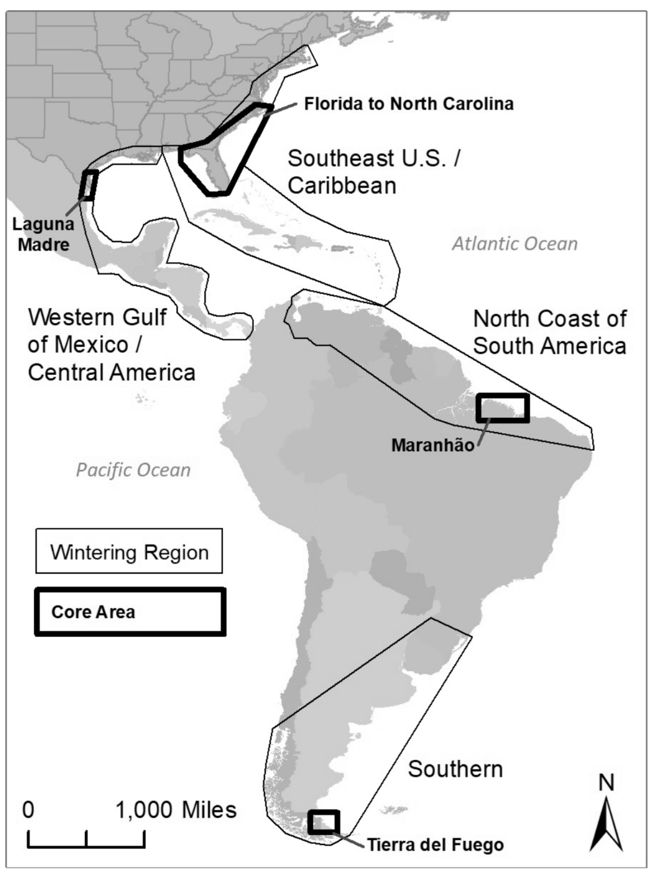


Figure 5-2. Rufa Red Knot Wintering Regions.

Table 5-1. Current Estimates of Rufa Red Knot Abundance by Wintering Region.

Wintering Population	Current Abundance Estimate	Certainty	Source
Southern	11,600	High	WHSRN 2020, 2019, 2018a
Northern Brazil	31,000	Moderate	Mizrahi 2020, p. 6
Southeast U.S./Caribbean	15,500	Moderate	Lyons *et al.* 2017, p. 11
Western Gulf of Mexico/Central America	5,500	Low	Newstead pers. comm. 2019, 2020
Total	**63,600**		

Migration Staging and Stopover Areas

Warnock (2010) defines stopover habitat as places where migrant birds stop to rest, drink, and eat, while staging areas (a subset of stopover habitats) are defined as those stopover sites with abundant, predictable food resources where birds prepare for an energetic challenge (usually a long flight over a barrier such as an ocean or a desert) requiring substantial fuel stores and physiological changes without which significant fitness costs are incurred. Warnock (2010) gives three conditions that staging areas must meet for birds to overcome these energetic challenges: (1) the site must provide predictable, abundant, accessible fuel, especially in the face of time constraints during spring migration or during molting when mobility is limited; (2) the site must provide other critical resources (such as water and resting places) to accommodate birds (often many thousands of birds) for longer periods of time (often weeks); and (3) the site must have low levels of disturbance (predators or human-induced disturbance). Distinctions between staging areas and other stopover habitats are given in **Table 5-3.**

Table 5-3. Comparison of staging areas and other stopover habitats (Warnock 2010).

Comparison of staging and stopover sites: key ecological characteristics of birds using these sites and of the sites themselves.

	Staging	Stopover
Bird characteristics:		
Destination distance to next site	1000s km, usually over barrier such as ocean/desert	Generally 100s of km
Fueling rate	Typically high, especially when migrating to breeding grounds	Not necessarily high
Fuel store prior to migrating	Require large fuel store, typically >40% (fat mass relative to mean body mass)	Not necessary, typically <30%
Changes in digestive system prior to next flight	Growth in capacity during staging period usually followed by decrease in size prior to next flight	Some change while stopping but not followed by significant decrease in size prior to next flight
Length of stay at site	Long (weeks)	Hours-days
Proportion of population using site at once	High	Low
Prey choice	Frequently selective, often one type of prey item	Not necessarily selective
Effect of loss or degradation of site on migrants	Population level effect	Individual level effect
Site characteristics:		
Site/area has high prey quantity/quality	Yes	Not necessary
Site/area has predictable prey	Yes	Not necessary
Size	Typically large	Variable

Spring (Northbound) Migration

Well-known spring stopover areas along the Atlantic coast of the Americas include Río Gallegos, Península Valdés, San Antonio Oeste, Bahía Blanca, Punta Rasa, and Bahía Samborombón (Patagonia, Argentina); Lagoa do Peixe (eastern Brazil, State of Rio Grande do Sul); Maranhão (northern Brazil); the Southeast United States (i.e., the Carolinas to Florida); the Virginia barrier islands (United States); and Delaware Bay (Delaware and New Jersey, United States). However, large, and small groups of red knots, sometimes numbering in the thousands, may occur in suitable habitats all along the Atlantic and Gulf coasts of South and North America. Available data indicate that red knots wintering in the Southeast use at least two distinct spring migration routes—coastal (moving north along the coast to the mid-Atlantic before departing for the Arctic) and inland (departing overland for the Arctic directly from the Southeast coast).

Fall (Southbound) Migration

Well-known fall stopover sites include southwest Hudson Bay (including the Nelson River delta), James Bay, and the Mingan Archipelago in Canada; the coasts of Massachusetts and New Jersey and the mouth of the Altamaha River in Georgia in the United States; the Caribbean (especially Cuba); and the northern coast of South America from Brazil to Guyana (USFWS 2014).

During both the northbound (spring) and southbound (fall) migrations, red knots use key staging and stopover areas to rest and feed (**Figure 5-3**).

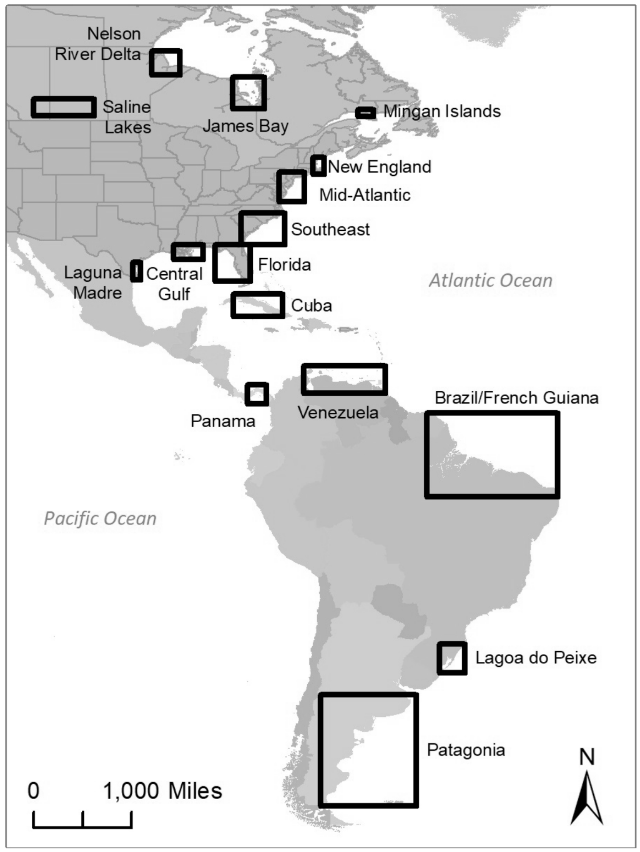


Figure 5-3. Important rufa red knot spring and fall migration stopover areas.

Breeding Range

The red knot breeds in the central Canadian Arctic, from the islands of northern Hudson Bay to the Foxe Basin shoreline of Baffin Island, and west to Victoria Island (Niles *et al.* 2008, Morrison and Harrington 1992). Potential breeding habitat extends farther north the southern Queen Elizabeth Islands (Niles *et al.* 2008) (**Figure 5-4**). Due to the vast size and remoteness of the region and the fact that red knots are solitary nesters, however, only the basics of breeding biology are known, and many presumptions are extrapolated from other subspecies. Smith (pers. comm. 2019) estimates that only about 50 to 75 rufa red knot nests have been directly documented to date, with 80 to 90 percent of those on just one island (USFWS 2014).

Preliminary analysis suggests that an average reproductive rate in the range of 1.5 to 2 chicks per pair may be necessary for a stable population (Wilson and Morrison 2018), but further work is needed to refine this estimate. Productivity trends cannot be determined by direct observation, though attempts are made to infer "good" and "bad" breeding years from the timing and relative abundance of adult males, adult females, and juveniles observed during fall migration surveys.

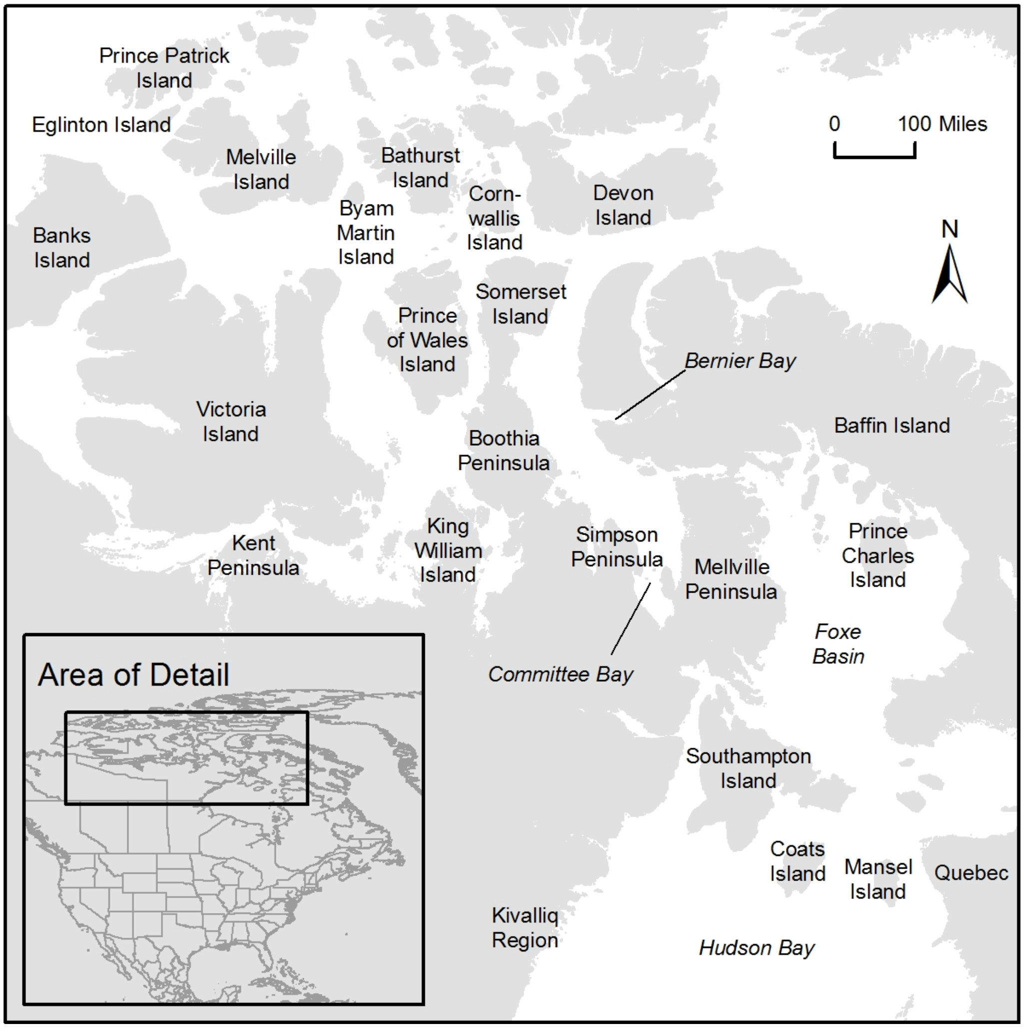


Figure 5-4. Known and potential breeding range of the rufa red knot.

Survival

Studies have shown red knot survival rates are influenced by the condition (weight) of birds leaving the Delaware Bay staging area in spring. Insufficient horseshoe crab eggs are the best supported explanation for the decline in the early 2000s of the Southern wintering population, which is more reliant on Delaware Bay relative to other wintering populations.

Conditions in nonbreeding areas influence survival of juvenile birds as well as adults. Because juveniles do not breed until at least age 2, the recruitment rate into the breeding population depends largely on the food and habitat conditions these young birds encounter in nonbreeding areas during the first 2 years. Modeling by Schwarzer (2011) involving birds banded from 2005 through 2010 found that, across multiple years, the red knot population in Florida (part of the larger Southeast/Caribbean population) was stable at around 8.75 percent juveniles among wintering birds; the population increased with 13 percent juveniles. Other modeling suggests that a higher percentage of juveniles may be needed for population growth (Wilson and Morrison 2018) and may further elucidate whether the prevalence of juveniles is an indicator of population trend.

5.1.4. Conservation Needs and Threats

Conservation Needs

The needs of individual rufa red knots are described above in terms of habitat and food requirements. The timing of food resources (e.g., insect prey on the breeding grounds, horseshoe crab eggs or mollusks at stopover areas) is a critical need for this highly migratory subspecies, and across all habitats red knots require sparse vegetation because open vistas are considered a key element in predator defense. The degree to which juveniles segregate from adults during wintering and migration is poorly known. Although juvenile habitats and diets are thought to be similar to adults, certain nonbreeding areas may be disproportionately important to juvenile birds (USFWS 2020b). **Table 5-4** summarizes the rufa red knot's needs based on the detailed information in the supplemental listing document (USFWS 2014).

Table 5-4. Red knot resource needs.

Season	Life Stage	Needs
Winter	adults	Wide, sparsely vegetated beaches, shoals, tidal mud or sand flats, or mangrove-dominated shorelines, with ample small (generally $\leq$0.8 inch (20 mm) long) mollusk prey (typically snails, clams, and mussels). Arthropods and other invertebrate prey may be locally important.[2] Foraging areas are intertidal, from the **wrack** line seaward to a water depth of 2 to 3 cm, with prey probed from the surface to a depth of 2 to 3 cm. Roosting areas are supratidal areas with open vistas, located near[3] foraging areas.
Migration	adults	- A reliable network of coastal and inland staging areas with abundant, high-quality[4] prey timed to occur when birds are present and allowing particularly high rates of weight gain; AND - An ample supply of other coastal and inland stopover habitats distributed across the range, allowing birds to shift among habitat patches (on daily, seasonal, and annual scales) based on food, predators, disturbance, weather, tides, and other conditions. - Coastal staging and stopover habitats are generally similar to wintering habitats, except that in some areas the primary food shifts from small mollusks to horseshoe crab eggs. - Inland staging and stopover habitats are less well known. Alkaline or saline lakes in the northern plains (U.S. and Canada) may be both staging areas and stopover habitats. Other stopover habitats may include riverine wetlands and sandbars, and manmade impoundments.
Year-round	juveniles, nonbreeding adults	Generally thought to be similar to adult wintering and migration habitats, though juveniles may partially segregate from adults. All juveniles (<2 years old) and some adults (*e.g.*, those that lack adequate fitness to breed in a particular year) do not migrate to the arctic breeding grounds and remain in nonbreeding habitats throughout June and early July.
Breeding	adults, eggs, chicks	Upland tundra for nesting, with low, sparse, herbaceous vegetation (*e.g.*, *Dryas* spp., lichens, moss), located near[5] freshwater wetland or lake-edge foraging areas with suitably timed insect hatch to provide abundant prey when chicks are present. In at least in some years, favorable weather conditions (*e.g.*, suitably timed snowmelt for nesting) and low predation pressure, which together allow high rates of hatching and fledging.

Threats

The rufa red knot faces numerous threats across its range on multiple geographic and temporal scales. These threats are affecting the red knot now and will continue to have subspecies-level effects into the future (79 FR 73705). A framework for classifying threats, and a summary assessment of threats to the red knot, are presented below (**Tables 5-5 and 5-6**) from the 2020 SSA (USFWS 2020). For a complete list of threats within each wintering region and the breeding range, refer to the documents available at [Species Profile for Red knot(Calidris canutus rufa) (fws.gov)].

In the final listing rule, the Service determined that the rufa red knot is threatened under the ESA due to the following primary threats: loss of breeding and nonbreeding habitat (including sea level rise, coastal engineering, coastal development, and arctic ecosystem change); likely effects related to disruption of natural predator cycles on the breeding grounds; reduced prey availability throughout the nonbreeding range; and increasing frequency and severity of asynchronies (mismatches) in the timing of the birds' annual migratory cycle relative to favorable food and weather conditions. These threats that are driving the red knot's status as a threatened species under the ESA are classified as High Severity in **Table 5-6**.

Table 5-5. Threat classification categories (USFWS 2020b)

Life Phase	Breeding (B) Migration (M) Wintering (W)
Severity	High - threat is driving ESA threatened status Moderate - threat causes additive mortality and/or negative synergistic effects Low - minor or potential threat
Certainty	High - Very likely to occur/continue and to impact subspecies in predictable ways Moderate - Very likely to occur/continue, but subspecies impacts are not well known or are unpredictable Low - Likelihood of threat occurring/continuing is uncertain and/or severity of impacts is uncertain
Scope	Rangewide - includes threats that act throughout either the breeding or nonbreeding range, but may not act across both Regional - threats that act across an entire wintering region or migration flyway; or across a substantial portion of a wintering region, flyway, or the breeding range Local - threats that act at the scale of a discrete action or activity, or a geographic clustering of actions or activities
Urgency of Management Response	High - immediate need, 1 to 3 years Moderate - 3 to 5 years Low - 6+ years
Manageability	Short-term - action at a local or regional scale can abate this threat within 10 years Long-term - action at a local or regional scale can abate this threat within 25 years Intractable - this threat cannot be directly abated by action at the geographic and temporal scales considered in recovery plans. However, monitoring may be important, and abating other threats may indirectly help by conserving the subspecies' **adaptive capacity** to cope with this threat (*i.e.*, by sustaining/ enhancing resiliency, representation and/or redundancy)

Table 5-6. Classification of threats to the red knot (USFWS 2020b)

Threat	Life Phase	Severity	Certainty	Scope	Urgency of Management Response*	Manageability
Sea level rise	MW	High	High	Rangewide	NA	Intractable**
Coastal engineering***	MW	High	High	Regional	High	Long-term
Coastal development	MW	High	High	Rangewide	High	Long-term
Beach cleaning	MW	Low	High	Regional	Low	Short-term
Invasive vegetation	MW	Moderate	High	Regional	Moderate	Short-term
Agriculture	MW	Low	Low	Local	Low	Long-term
Aquaculture	MW	Moderate	High	Local	High	Short-term
Arctic ecosystem change	B	High	Moderate	Rangewide	NA	Intractable
Arctic human development	B	Low	Low	Local	Moderate	Long-term
Sport hunting	MW	Low	Moderate	Regional	Low	Short-term
Subsistence hunting	MW	Moderate	Low	Regional	Moderate	Short-term
Research activities	MW	Low	High	Local	Low	Short-term
Parasites	BMW	Low	Low	Rangewide	NA	Intractable
Disease	BMW	Low	Moderate	Rangewide	NA	Intractable
Predation in nonbreeding areas	MW	Moderate	High	Rangewide	Moderate	Short-term
Predation in breeding areas	B	High	Moderate	Rangewide	NA	Intractable
Reduced nonbreeding food availability from marine ecosystem change (*e.g.*, ocean acidification, ocean warming, marine diseases/ parasites/ invasive species)	MW	Moderate	Low	Rangewide	NA	Intractable
Reduced nonbreeding food availability from proximate human activity (*e.g.*, marine harvest, sand placement, beach driving)	MW	High	High	Regional	High	Short-term
Timing asynchronies	BMW	High	Moderate	Rangewide	NA	Intractable
Human disturbance	MW	Moderate	High	Regional	High	Short-term
Competition with gulls	M	Low	Low	Local	Low	Long-term
Wind energy development	MW	Moderate	Moderate	Regional	High	Short-term
Harmful algal blooms	MW	Moderate	Low	Regional	NA	Intractable
Oil spills	MW	Moderate	Moderate	Regional	High	Long-term

* Urgency is not applicable (NA) to intractable threats.

** The accelerating global and regional rates of sea level rise cannot be slowed by direct action under a recovery plan. However, recovery actions can include responses to sea level rise aimed at slowing or offsetting the associated habitat impacts. For example, carefully designed **living shorelines** or **beach nourishment** projects may help retain or restore intertidal habitats impacted by sea level rise.

*** Coastal engineering includes all activities described under Shoreline Stabilization in the supplemental listing document, such as hard structures, beach nourishment, and dredging. Such activities are often, but not always, conducted in response to sea level rise. Hard structures are known to exacerbate losses of intertidal habitats by blocking their migration. When not precluded by human structures or interventions, landward and/or longshore migration of intertidal habitats is the natural, geologic response of many coastal systems under rates of slow to moderate sea level rise (Service 2014, pp. 126-159).

5.1.5. Summary of the Status of the Rufa Red Knot

The 2020 SSA concluded that the Southern wintering population, which had been the largest and disproportionately reliant on Delaware Bay, has since stabilized but shows no sign of recovery to date (USFWS 2020b). Overharvest of the horseshoe crab in Delaware Bay is considered the key causal factor in this decline, though numerous other past, ongoing, and emerging threats have also been identified (USFWS 2014). Although less reliant on Delaware Bay, the Western Gulf of Mexico/Central American wintering population is also thought to have declined in recent decades. Two additional wintering populations, one on the northern coast of South America and another in the Southeast U.S. and the Caribbean, are considered stable relative to the 1980s (USFWS 2014, 2020b). Birds from all four wintering populations face threats from habitat loss and from several pervasive, climate-driven ecosystem changes. Additional threats include hunting, increased predation pressure, harmful algal blooms, human disturbance, oil spills, and wind energy development. Cumulatively, these threats are believed to be impairing the Southern and the Western Gulf of Mexico/Central American wintering populations.

For a more detailed account of the species description, life history, population dynamics, conservation needs, and threats, refer to [Species Profile for Red knot(Calidris canutus rufa) (fws.gov)](fws.gov).

5.2. Environmental Baseline

See **Section 3.2**.

5.2.1. Action Area Numbers and Distribution

The Action Area supports both overwintering and migrant rufa red knots. Available data for the area documented larger winter flock sizes of 110 – 330 birds in 2012, 2013, and 2016 (eBird.org data 2020). Red knots using Litchfield, Huntington Beach State Park, and Garden City beaches during the winter and/or during spring migration before May are likely from the Southeast U.S./Caribbean population (SCDNR 2013, 2019, Pelton *et al*. 2022). Unbanded birds seen in May could be from the Southeast U.S./Caribbean population, Northern South American Coast population, or the Southern population.

5.2.2. Action Area Conservation Needs and Threats

Habitat loss, recreational disturbance, predation, accelerated sea level rise, storms, and severe cold, which are the six most prevalent threats to red knots within their nonbreeding range, are present or possible in the Action Area. Chronic recreational disturbance, which is the most widespread and serious threat in South Carolina, is still present within the Action Area despite conservation efforts. Red knots rest at the water's edge during daytime high tides and flocks can be found foraging on coquina clams (*Donax variabilis*) in the swash zone, particularly on falling tides. These birds need to feed and rest undisturbed particularly during spring migration when they need to build fat reserves.

5.3. Effects of the Action

This section analyzes the direct and indirect effects of the Action on the red knot, which includes the direct and indirect effects of interrelated and interdependent actions. Direct effects are caused by the Action and occur at the same time and place. Indirect effects are caused by the Action but are later in time and reasonably certain to occur.

5.3.1. Effects of Sand Placement

See **Section 3.3.1**. The Service anticipates similar effects to wintering red knots, if present, and their primary prey items, coquina clams (*Donax variabilis*), in the project area, as described for piping plovers. Effects to coquinas can be minimized by scheduling project construction outside of spawning and recruitment windows that occur in late winter and early spring (Ruppert and Fox 1988).

5.4. Cumulative Effects

See **Section 3.4.**

5.5. Conclusion

In this section, the Service summarizes and interprets the findings of the previous sections for the red knot (status, baseline, effects, and cumulative effects) relative to the purpose of a BO under §7(a)(2) of the ESA, which is to determine whether a Federal action is likely to:

a) Jeopardize the continued existence of species listed as endangered or threatened; or
b) Result in the destruction or adverse modification of designated critical habitat.

"Jeopardize the continued existence" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR §402.02).

Status

The 2020 SSA concluded that the Southern wintering population, which had been the largest and disproportionately reliant on Delaware Bay, has since stabilized but shows no sign of recovery to date (USFWS 2020b). Overharvest of the horseshoe crab in Delaware Bay is considered the key causal factor in this decline, though numerous other past, ongoing, and emerging threats have also been identified (USFWS 2014). Although less reliant on Delaware Bay, the Western Gulf of Mexico/Central American wintering population is also thought to have declined in recent decades. Two additional wintering populations, one on the northern coast of South America and another in the Southeast U.S. and the Caribbean, are considered stable relative to the 1980s (USFWS 2014, 2020b). Birds from all four wintering populations face threats from habitat loss and from several pervasive, climate-driven ecosystem changes. Additional threats include hunting, increased predation pressure, harmful algal blooms, human disturbance, oil spills, and

wind energy development. Cumulatively, these threats are believed to be impairing the Southern and the Western Gulf of Mexico/Central American wintering populations.
Baseline

The Action Area supports both overwintering and migrant rufa red knots. Available data for the area documented larger winter flock sizes of 110 – 330 birds in 2012, 2013, and 2016 (eBird.org data 2020). Recreational disturbance, which is the most widespread and serious threat in South Carolina, is present even when minimized at all three sites within the Action Area. Red knots rest at the water's edge during daytime high tides and flocks can be found foraging on coquina clams (*Donax variabilis*) in the swash zone, particularly on falling tides. These birds need to feed and rest undisturbed particularly during spring migration when they need to build fat reserves.

Effects

The proposed action is expected to temporarily disturb wintering red knots present during project construction and temporarily reduce benthic invertebrates in the sand placement areas. Effects to coquinas can be minimized by scheduling project construction outside of spawning and recruitment windows that occur in late winter and early spring (Ruppert and Fox 1988).

After reviewing the current status of the Southern, Northern Coast of South America, Western Gulf of Mexico/Central America, and the Southeastern U.S./Caribbean wintering region populations, the environmental baseline for the action area, and the cumulative effects, it is the Service's biological opinion that the action is not likely to jeopardize the continued existence of the red knot.

6. PROPOSED CRITICAL HABITAT FOR THE RUFA RED KNOT

6.1. Status of Proposed Critical Habitat

The Service proposed to designate critical habitat for the rufa red knot on July 15, 2021, (86 [FR] (Federal Register) 37410). The proposed designation includes 120 units encompassing approximately 649,000 acres along the shorelines of Massachusetts, New York, New Jersey, Delaware, Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas. The designation has not been finalized.

6.1.1. Description

The PBFs for the rufa red knot include: (1) Beaches and tidal flats used for foraging; (2) Upper beach areas used for roosting, preening, resting, or sheltering; (3) Ephemeral and/or dynamic coastal features used for foraging or roosting; (4) Ocean vegetation deposits or surf-cast wrack used for foraging and roosting; (5) Intertidal peat banks used for foraging and roosting; (6) Features landward of the beach that support foraging or roosting; and (7) Artificial habitat mimicking natural conditions or maintaining the physical or biological features 1-6 (86 FR 37418).

6.1.2. Conservation Value

Designation of critical habitat can help focus conservation activities for a listed species by identifying areas that contain PBFs that are essential for the conservation of that species. Recovery of rufa red knots is dependent upon available habitat throughout the range of the species.

6.1.3. Conservation Needs

All critical habitat units were occupied at the time of the proposed rule to designate critical habitat for the rufa red knot. Due to the dynamic nature of these ephemeral habitats, all units are needed for the recovery of the species. Natural coastal processes are also necessary to ensure the existence and functionality of these units in the future. When these processes are limited or altered, habitat quality diminishes.

6.2. Environmental Baseline

See **Section 3.2**.

6.2.1. Action Area Conservation Value

The Action Area overlaps critical habitat unit SC-1 and SC-2 proposed for designation (**Figure 6-1 and 6-2**), which currently contains all PBFs. Each unit within the rufa red knot proposed designation is essential to the recovery of the species. The Action Area supports both overwintering and migrant rufa red knots. Available data for the area documented larger winter flock sizes of 110 – 330 birds in 2012, 2013, and 2016 (eBird.org data 2020). The text descriptions of the proposed units are as follows:

Unit SC-1: Garden City Beach

Unit SC–1 consists of 616 ac (249 ha) of Garden City Beach in Georgetown and Horry Counties, South Carolina. The northern boundary of the unit begins at the Garden City pier in Horry County and extends southwest to the northern side of Murrells Inlet in Georgetown County. The unit includes all emergent land from MLLW (which includes the highly dynamic shoreline and sandy intertidal zone that is covered at high tide and uncovered at low tide) to the toe of the dunes or where densely vegetated habitat, not used by the red knot, begins. This unit also includes the ephemeral, emergent shoals (sand bars) within the flood-tidal and ebb-tidal deltas associated with the northeastern side of Murrells Inlet's navigable channel. Lands within this unit include approximately 267 ac (108 ha; 43 percent) in State ownership and 349 ac (141 ha; 57 percent) in private/other ownership. General land use within this unit includes residential development, tourism, and outdoor recreational use (e.g., beachgoing, boating).

Unit SC–1 is occupied by the species and contains one or more of the physical or biological features essential to the conservation of the species. This unit contains a high concentration of rufa red knots in South Carolina and on the Southeastern U.S. portion of the subspecies range during the winter period, providing important wintering habitat for foraging and roosting during a time of the year when rufa red knots are seeking to build energy sources for migration. Approximately 57 ac (23 ha) of this unit overlap with designated critical habitat for the federally threatened piping plover (66 FR 36038, July 10, 2001).

Threats identified within Unit SC–1 include: (1) Disturbance of foraging and roosting red knots by humans and human activities (e.g., off leash dogs, running/walking/biking through or too close to flocks of red knots, powered boats); (2) depredation by native and nonnative predators; (3) modification or loss of habitat or both due to uncontrolled recreational access, erosion, and sea level rise; and (4) disturbance associated with the response to natural and human-caused disasters (e.g., hurricanes, oil spills). Special management considerations or protection measures to reduce or alleviate the threats may include managing recreational access to key rufa red knot foraging and roosting habitat during migration (through restrictions on timing, locations, and types of activities) and limiting shoreline stabilization project construction windows (e.g., outside of red knot migration windows).

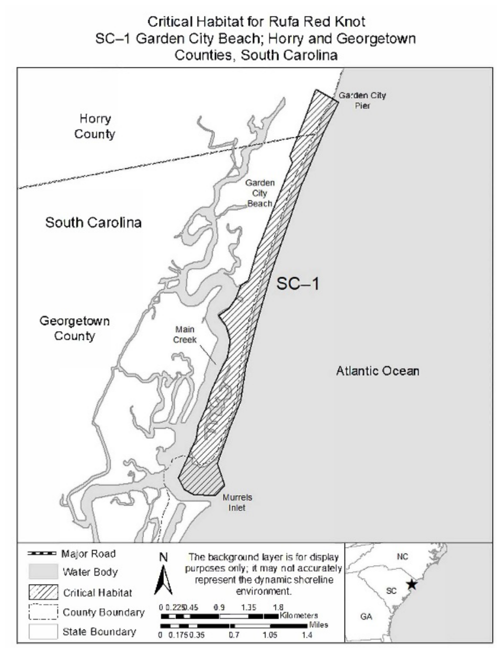


Figure 6-1. Map of rufa red knot proposed designated critical habitat unit SC-1.

Unit SC-2: Huntington Beach State Park/Litchfield Beach

Unit SC–2 consists of 1,634 ac (661 ha) of Huntington Beach State Park and Litchfield Beach in Georgetown County, South Carolina. The unit boundary begins on the southern side of Murrells Inlet southwest and extends southwest to the northern side of Midway Inlet. The unit includes all emergent land from MLLW (which includes the highly dynamic shoreline and sandy intertidal zone that is covered at high tide and uncovered at low tide) to the toe of the dunes or where densely vegetated habitat, not used by the red knot, begins. This unit also includes the ephemeral, emergent shoals (sand bars) within the flood-tidal and ebb-tidal deltas associated with the southwestern side of Murrells Inlet's navigable channel and the northeastern side of Midway Inlet's navigable channel. Lands within this unit include approximately 80 ac (32 ha; 5 percent) in State ownership, which includes Huntington Beach State Park, and 1,554 ac (629 ha; 95 percent) in private/other ownership. General land use within this unit includes residential development, tourism, and outdoor recreational use (e.g., beachgoing, boating, fishing, birdwatching, and hiking).

Unit SC–2 is occupied by the species and contains one or more of the physical or biological features essential to the conservation of the species. This unit contains a high concentration of rufa red knots in South Carolina and on the Southeastern U.S. portion of the subspecies range during the winter period, providing important wintering habitat for foraging and roosting during a time of the year when rufa red knots are seeking to build energy sources for migration. Approximately 371 ac (150 ha) of this unit overlap with designated critical habitat for the federally threatened piping plover (66 FR 36038, July 10, 2001).

Threats identified within Unit SC–2 include: (1) Disturbance of foraging and roosting red knots by humans and human activities (e.g., off leash dogs, powered boats, running/walking/biking through or too close to flocks of rufa red knots); (2) depredation by native and nonnative predators; (3) modification or loss of habitat or both due to uncontrolled recreational access, erosion, and sea level rise; and (4) disturbance associated with the response to natural and human-caused disasters (e.g., hurricanes, oil spills). Special management considerations or protection measures to reduce or alleviate the threats may include managing recreational access to key rufa red knot foraging and roosting habitat during migration (through restrictions on timing, locations, and types of activities) and limiting shoreline stabilization project construction windows (e.g., outside of red knot migration windows). State lands and waters within this unit are managed under the South Carolina Department of Parks, Recreation, and Tourism's (SCDPRT) 2019 South Carolina State Comprehensive Outdoor Recreation Plan (SCDPRT 2019, entire).

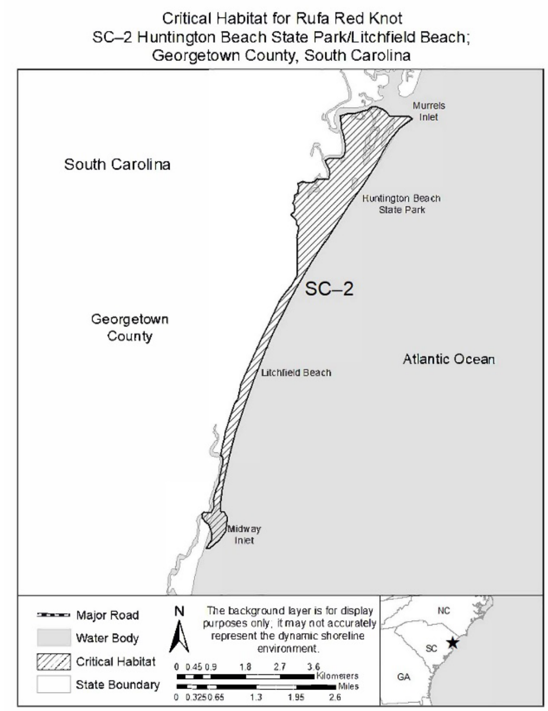


Figure 6-2. **Map of rufa red knot proposed designated critical habitat unit SC-2.**

6.2.2. Action Area Conservation Needs

Minimize Recreational Disturbance

Intense human disturbance in winter habitat can be functionally equivalent to habitat loss. If the disturbance prevents birds from using an area (Goss-Custard *et al*. 1996), this can lead to roost abandonment and population declines (Burton *et al*. 1996). Disturbance from human and pet presence alters red knot behavior and often negatively influences distribution (Burger *et al*. 2007).

6.3. Effects of the Action

This section analyzes the direct and indirect effects of the Action on proposed critical habitat for the rufa red knot, which includes the direct and indirect effects of interrelated and interdependent actions. Direct effects are caused by the Action and occur at the same time and place. Indirect effects are caused by the Action but are later in time and reasonably certain to occur. Our analyses are organized according to the description of the Action in section 2 of this BO.

6.3.1. Effects of Sand Placement

The project will temporarily impact up to 50 acres of foraging habitat by reducing the quality of PBFs within the project footprint. These impacts can be minimized by limiting construction timing and frequency to allow for faster benthic invertebrate recruitment.

6.4. Cumulative Effects

See **Section 3.4.**

6.5. Conclusion

In this section, we summarize and interpret the findings of the previous sections for rufa red knot proposed critical habitat (status, baseline, effects, and cumulative effects) relative to the purpose of a BO under §7(a)(2) of the ESA, which is to determine whether a Federal action is likely to:

a) jeopardize the continued existence of species listed as endangered or threatened; or
b) result in the destruction or adverse modification of designated critical habitat.

"*Destruction or adverse modification*" means a direct or indirect alteration that appreciably diminishes the value of designated critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features (50 CFR §402.02).

After reviewing the current status of the proposed critical habitat, the environmental baseline for the Action Area, the effects of the Action, and the cumulative effects, it is the Service's **conference** opinion (CO) that the Action is not likely to destroy or adversely modify critical habitat as proposed for the rufa red knot because impacts to PBFs that support foraging habitat are expected to recover within one year.

7. LOGGERHEAD SEA TURTLE

The Service and National Marine Fisheries Service (NMFS) share Federal jurisdiction for sea turtles under the ESA. The Service has responsibility for sea turtles on the nesting beach. The NMFS has jurisdiction for sea turtles in the marine environment. In accordance with the ESA, the Service completes consultations with all Federal agencies for actions that may adversely affect sea turtles on the nesting beach. The Service's analysis only addresses activities that may impact nesting sea turtles, their nests and eggs, and hatchlings as they emerge from the nest and crawl to the sea. NMFS assesses and consults with Federal agencies concerning potential impacts to sea turtles in the marine environment, including updrift and downdrift nearshore areas affected by sand placement projects on the beach.

7.1. Status of Species

The Service published its decision to list the loggerhead sea turtle as threatened on July 28, 1978 (43 FR 32800). On September 22, 2011, the loggerhead sea turtle's listing under the ESA was revised from a single threatened species to nine distinct population segments (DPS) listed as either threatened or endangered (76 FR 58868). The nine DPSs and their statuses are: Northwest Atlantic Ocean DPS (threatened); Northeast Atlantic Ocean (endangered); Mediterranean Sea DPS (endangered); South Atlantic Ocean DPS (threatened); North Pacific Ocean DPS (endangered); South Pacific Ocean DPS (endangered); North Indian Ocean DPS (endangered);

Southwest Indian Ocean (threatened); and Southeast Indo-Pacific Ocean DPS (threatened). The geographic delineations given below for each discrete population segment were determined primarily based on nesting beach locations, genetic evidence, oceanographic features, thermal tolerance, fishery bycatch data, and information on loggerhead distribution and migrations from satellite telemetry and flipper tagging studies (**Figure 7-1**).

Map of Loggerhead Sea Turtle DPS Boundaries

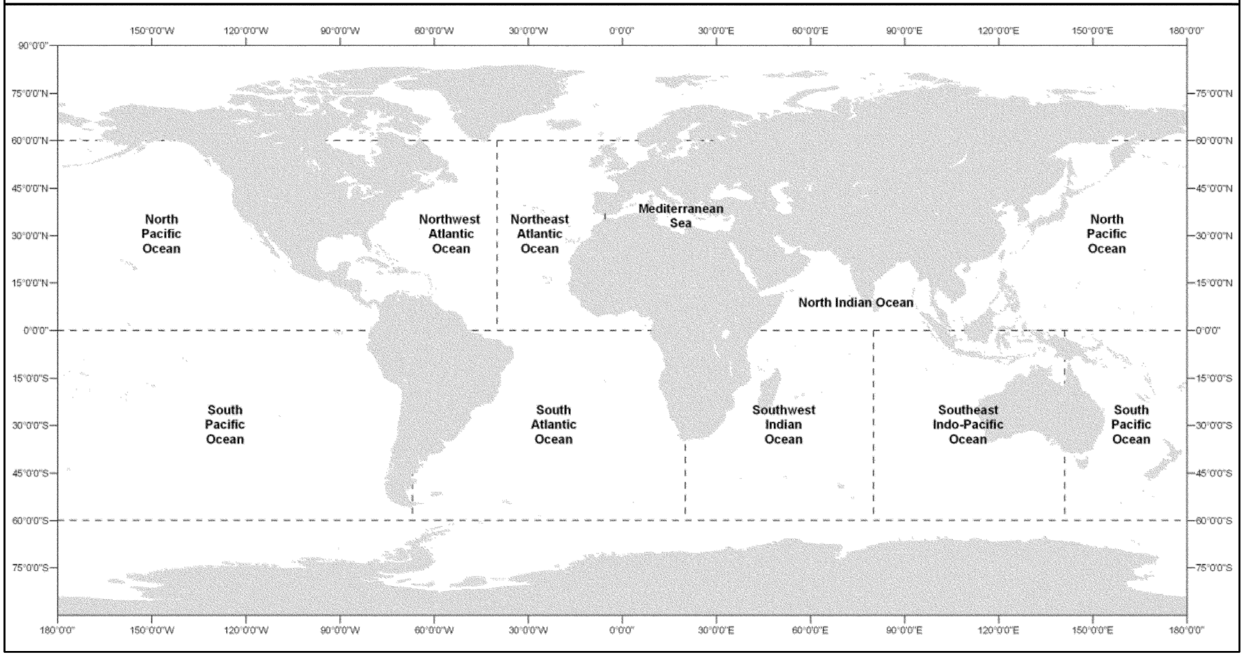


Figure 7-1. Map of Loggerhead Sea Turtle DPS Boundaries.

The loggerhead occurs throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans (Dodd 1988) (**Figure 7-1**). In the North Atlantic, the loggerhead is commonly found in the Gulf of Mexico, the northern Caribbean, the Bahamas archipelago, and eastward to West Africa, the western Mediterranean, and the west coast of Europe. In the Northwest Atlantic, the majority of loggerhead nesting is concentrated along the coasts of the U.S. from southern Virginia through Alabama. Additional nesting beaches are found along the northern and western Gulf of Mexico, eastern Yucatan Peninsula, at Cay Sal Bank in the eastern Bahamas (Addison and Morford, 1996; Addison, 1997), on the southwestern coast of Cuba (F. Moncada-Gavilan, personal communication, cited in Ehrhart *et al.*, 2003), and along the coasts of Central America, Colombia, Venezuela, and the eastern Caribbean Islands. Five recovery units have been identified within the Northwest Atlantic based on genetic differences and a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries (NMFS and USFWS 2008). Recovery units (RU) are subunits of a listed species that are geographically or otherwise identifiable and essential to the recovery of the species. Recovery units are individually necessary to conserve genetic robustness, demographic robustness, important life history stages, or some other feature necessary for long-term sustainability of the species. The five recovery units identified in the Northwest Atlantic are: (1) Northern Recovery Unit (NRU); (2) Peninsula Florida Recovery Unit (PFRU); (3) Dry Tortugas Recovery Unit

(DTRU); (4) Northern Gulf of Mexico Recovery Unit (NGMRU); and (5) Greater Caribbean Recovery Unit (GCRU).

Although none of the RUs have been monitored for more than 50 years, none of them have met the target annual rate of increase (**Table 7-1**) (NMFS and USFWS 2023). Nest trends of the Peninsular Florida RU, which hosts the majority of nesting within the DPS, have not increased over 30 years of monitoring (NMFS and USFWS 2023). The much smaller Northern RU has demonstrated some progress toward its goal, with a statistically significant 1.7% rate of increase over 37 years; genetic analyses of all nests laid in the Northern RU indicated that the number of annual nests since 2010 significantly correlates ($p = 0.004$) to the number of annual nesting females (Shamblin *et al*. 2017; Georgia Department of Natural Resources and University of Georgia, unpublished data 2021). Nesting rates from the NGMRU were not significantly different from zero. Data were insufficient or unavailable from the DTRU and GCRUs (NMFS and USFWS 2023).

Table 7-1. Recovery Plan demographic recovery criteria (i.e., nest trend criteria) Comparison of the 2008 demographic recovery criteria (NMFS and USFWS 2008) and recent nesting data at index beaches (Bolten *et al.* 2019). The p-value indicates statistical significance, and only the Northern Recovery Unit data shows a significant positive trend (NMFS and USFWS 2023).

Recovery Unit	Criteria: Annual Rate of Increase over 50 Years (target number of nests annually)	Estimates of Annual Rate of Increase (p-value) over X Years (year span measured)
Northern	≥ 2% (14,000 nests: 2,000 in NC, 9,200 in SC, and 2,800 in GA)	1.3% ($p = 0.04$) 37 (1983–2019)
Peninsular Florida	1% (106,100 nests)	No significant trend ($p = 0.61$) 30 (1989–2018)
Dry Tortugas	≥ 3% (≥1,100 nests)	Insufficient data
Northern GoM	≥ 3% (≥4,000 nests)	No significant trend ($p = 0.17$) 22 (1997–2018)
Greater Caribbean	Any % (≥100 nests)	Insufficient data

7.1.1. Species Description

The loggerhead sea turtle grows to an average weight of about 200 pounds and is characterized by a large head with blunt jaws. Adults and juveniles have a reddish-brown carapace. Scales on the top of the head and top of the flippers are also reddish-brown with yellow on the borders. Hatchlings are a dull brown color (NMFS 2009).

7.1.2. Life History

Loggerheads are long-lived, slow-growing animals that use multiple habitats across entire ocean basins throughout their life history. The loggerhead may be found hundreds of miles out to sea, as well as in inshore areas such as bays, lagoons, salt marshes, creeks, ship channels, and the mouths of large rivers. Coral reefs, rocky places, and shipwrecks are often used as feeding areas and loggerheads feed on mollusks, crustaceans, fish, and other marine animals.

This complex life history encompasses terrestrial, nearshore, and open ocean habitats. The three basic ecosystems in which loggerheads live are the:

1. Terrestrial zone (supralittoral) - the nesting beach where oviposition (egg laying) and embryonic development and hatching occur.

2. Neritic zone - the inshore marine environment (from the surface to the sea floor) where water depths do not exceed 656 feet. The neritic zone generally includes the continental shelf, but in areas where the continental shelf is very narrow or nonexistent, the neritic zone conventionally extends to areas where water depths are less than 656 feet.

3. Oceanic zone - the vast open ocean environment (from the surface to the sea floor) where water depths are greater than 656 feet.

The generalized life history of Atlantic loggerheads is shown in **Figure 7-2**.

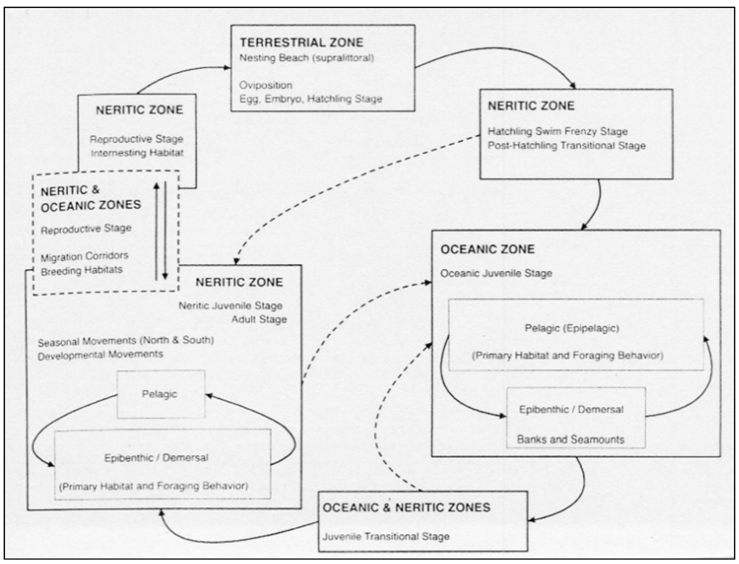


Figure 7-2. Life history stages of a loggerhead turtle. The boxes represent life stages and the corresponding ecosystems, solid lines represent movements between life stages and ecosystems, and dotted lines are speculative (Bolten 2003).

Within the Northwest Atlantic, the majority of nesting activity occurs from April through September, with a peak in June and July (Williams-Walls *et al.* 1983, Dodd 1988, Weishampel *et al.* 2006). Nesting occurs along the coasts of North America, Central America, northern South America, the Antilles, Bahamas, and Bermuda, but is concentrated in the southeastern U.S. and on the Yucatán Peninsula in Mexico on open beaches or along narrow bays having suitable sand (Sternberg 1981, Ehrhart 1989, Ehrhart *et al.* 2003, NMFS and USFWS 2008). Numbers of nests and nesting females are often highly variable from year to year due to a number of factors including environmental stochasticity, periodicity in ocean conditions, anthropogenic effects, and density-dependent and density-independent factors affecting survival, somatic growth, and reproduction (Meylan 1982, Hays 2000, Chaloupka 2001, Solow *et al.* 2002). Despite these sources of variation, a nesting beach survey can provide a valuable assessment of changes in the adult female population. Since female turtles exhibit strong nest site fidelity, nesting beach surveys can track trends over time as long as the study is sufficiently long and effort and methods are standardized (Meylan 1982, Gerrodette and Brandon 2000, Reina *et al.* 2002). **Table 7-1** summarizes key life history characteristics for loggerheads nesting in the U.S.

Table 7-2. Life history parameters for loggerheads nesting in the U.S. (NMFS and Service 2023).

Parameter	Location or RU	Value	Reference
Remigration interval: mean years	Northern RU Archie Carr NWR, FL Keewaydin Island, FL St. Joseph Peninsula, FL Quintana Roo, Mexico Cuba	2.67±0.89 3-5 3.2±1.82 4.4±2.8 1.99 2.77-4.08	Shamblin *et al*. 2021 Ceriani *et al*. 2015 Phillips *et al*. 2014 Lamont *et al*. 2014 González *et al*. 2020 Azanza-Ricardo *et al*. 2020
Clutch frequency: mean nests/year	Northern RU Keewaydin Island, FL St. Joseph Peninsula, FL Quintana Roo, Mexico Cuba	4.3−4.6 3.8 3.1 2.33 1-2	Shamblin *et al*. 2017 Phillips *et al*. 2014 Lamont *et al*. 2014 Cuevas *et al*. 2020 Azanza-Ricardo *et al*. 2020
Clutch size: range eggs/nest	Northern RU Peninsular Florida RU Northern GoM RU Greater Caribbean RU	102.4-114.7 95.4-125 98.6-108 85.9-129.9	Eskew 2012; Lasala *et al*. 2013 Perrault *et al*. 2016; Ceriani *et al*. 2015 Lamont *et al*. 2014; Lamont *et al*. 2012 Azanza-Ricardo *et al*. 2020; Garcia-Cruz *et al*. 2020
Nesting success: mean %	North Carolina Archie Carr NWR, FL Juno Beach, FL St. Joseph Peninsula, FL Quintana Roo, Mexico Cuba	53.9 68±19 42.4 40.6 75.2±23 67	Halls and Randall 2018 Witherington *et al*. 2011 Hirsch *et al*. 2019 Lamont and Fujisaki 2014 González *et al*. 2020 Azanza-Ricardo *et al*. 2020
Hatching success: mean %	Indian River County, FL Boca Raton, FL Keewaydin Island, FL St. Joseph Peninsula, FL Quintana Roo, Mexico	68.6±35.5 42.8, 53.6 55.5±39.7 87.3±17.3 87.2±16.9	Lindborg *et al*. 2016 Bladow and Milton 2019 Shaw 2013 Montero *et al*. 2018 González *et al*. 2020
Emergence success: mean %	Jekyll Island, GA Archie Carr NWR, FL Peninsular Florida RU Northern GoM RU Quintana Roo, Mexico Cuba	69.9 53.3±3.7 45.6 51.6 78.8±24.4 74-82	Holbrook *et al*. 2019 Ehrhart *et al*. 2014 Brost *et al*. 2015 Brost *et al*. 2015 González *et al*. 2020 Medina Cruz *et al*. 2012
Female maturity: mean age (years) and size (cm SCL)	NW Atlantic Ocean	36−38 90.5 (75−101.3)	Avens *et al*. 2015
Male maturity: mean age (years) and size (cm SCL)	NW Atlantic Ocean	37−42 95.8 (80.6−103.8)	Avens *et al*. 2015
Annual adult survival rate: mean % (95% CI)	Bald Head Island, NC Wassaw Island, GA Keewaydin Island, FL St. Joseph Peninsula, FL Juno Beach, FL	85 (78-93) 87 (84-89) 73 (69-76) 86 (75-93) 60 (40-78)	(Monk *et al*. 2011) (Pfaller *et al*. 2013; Pfaller *et al*. 2018) (Phillips *et al*. 2014) (Lamont *et al*. 2014) (Sasso *et al*. 2011)

7.1.3. Numbers, Reproduction, and Distribution

Northern Recovery Unit (NRU)

The geographic boundary is defined as loggerheads originating from nesting beaches from the Florida-Georgia border through southern Virginia (the northern extent of the nesting range). The NRU is the second largest nesting assemblage in the Northwest Altantic and has an annual rate of increase in number of nests of 1.3% ($p = 0.04$) based on a log-linear regression model for 37 years of nesting data (1983-2019) (NMFS and USFWS 2019, 2023). This annual rate of increase is below the 2% criterion for achieving recovery. Although there has been an observed increase in the number of nests for the past decade (total nests exceeded 14,000 for the first time in 2019), looking at short term trends in nesting abundance can be misleading and needs to be considered in the context of one generation (= 50 years for loggerhead sea turtles) as specified in the Demographic Recovery Criteria. Based on genetic analyses of all nests laid in the NRU, the number of annual nests since 2010 significantly correlates to the number of annual nesting females (Shamblin *et al.* 2017) meaning when annual nest numbers increase so do the number of annual nesting females (Bolton *et al*. 2019, NMFS and USFWS 2023).

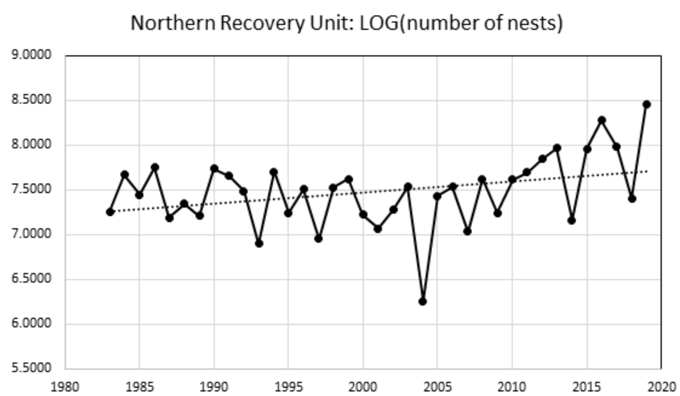


Figure 7-3. Log of annual loggerhead nest counts from NRU beaches, 1983-2019 (Bolton *et al*. 2019, NMFS and USFWS 2023).

7.1.4. Conservation Needs and Threats

Conservation Needs for Nesting Beaches

Loggerhead sea turtles need suitable nesting beach habitat that provides: (1) Relatively unimpeded nearshore access from the ocean to the beach for nesting females and from the beach to the ocean for both post-nesting females and hatchlings; (2) Nesting areas above mean high water to avoid frequent inundation by high tides; (3) Sand that allows for suitable nest construction; (4) Sand that is suitable for facilitating gas diffusion conducive to embryo development; (5) Sand that is able to develop and maintain temperatures and a moisture content conducive to embryo development; (6) Sufficient darkness to ensure nesting turtles are not deterred from emerging onto the beach and hatchlings and post nesting females orient to the sea; and (7) Natural coastal processes or artificially created or maintained habitat mimicking natural conditions.

Threats to Nesting Beaches

Threats to nesting beaches include beach erosion, armoring and nourishment; artificial lighting; beach cleaning; increased human presence; recreational beach equipment; beach driving; coastal construction and fishing piers; exotic dune and beach vegetation; and poaching (NMFS and USFWS 2008). The most prevalent threats to nesting beaches within the NRU are summarized below. For a complete list of threats, refer to the recovery plan and status reviews available at https://ecos.fws.gov/ecp/species/1110.

Erosion of beaches is a result of anthropogenic and natural processes. Erosion is often worsened when man-made coastal and in water structures interfere with natural coastal processes (Von Holle *et al.* 2019). Beach erosion is also one of the most significant threats to loggerheads at the egg life stage (Bolten *et al.* 2011). High tides and tidal washouts can flood and erode nesting beaches, washing eggs into the sea or lethally inundating developing embryos (Brost *et al.* 2015; Butler *et al.* 2020).

Beach renourishment is often used to manage beach erosion by adding or redistributing sand; however, renourishment often results in diminished nesting success (Long *et al.* 2011; Hays 2012). Designed to stabilize shorelines and prevent erosion, beach armoring structures (e.g., revetments and seawalls) decrease nesting activity by preventing females from accessing suitable nesting sites (Rizkalla and Savage 2011). Lamont and Houser (2014) found that alterations to the nearshore environment (e.g., jetties, dredging, or installation of pilings) also alter sea turtle nest distribution. Thus, beach renourishment may result in reduced nesting or force turtles to nest at suboptimal locations.

Coastal development alters nesting habitat, making it less suitable for nesting females, egg incubation, and hatchling emergence. Sella and Fuentes (2019) found that 100% of very high (i.e., top three) and high (i.e., top 25%) loggerhead density nesting beaches were exposed to cumulative coastal modification and construction. Artificial lighting deters females from nesting (Witherington *et al.* 2014), resulting in reduced nest densities (Bonner 2015; Weishampel *et al.* 2016; Hu *et al.* 2018; Linz 2018; Price *et al.* 2018; Windle 2018). Artificial lighting can disrupt or delay hatchlings' sea-orienting ability, which increases nest-to-sea mortality as a result of dehydration, exhaustion, or predation (Witherington *et al.* 2014; Erb and Wyneken 2019; Vindiola 2019; Stanley *et al.* 2020).

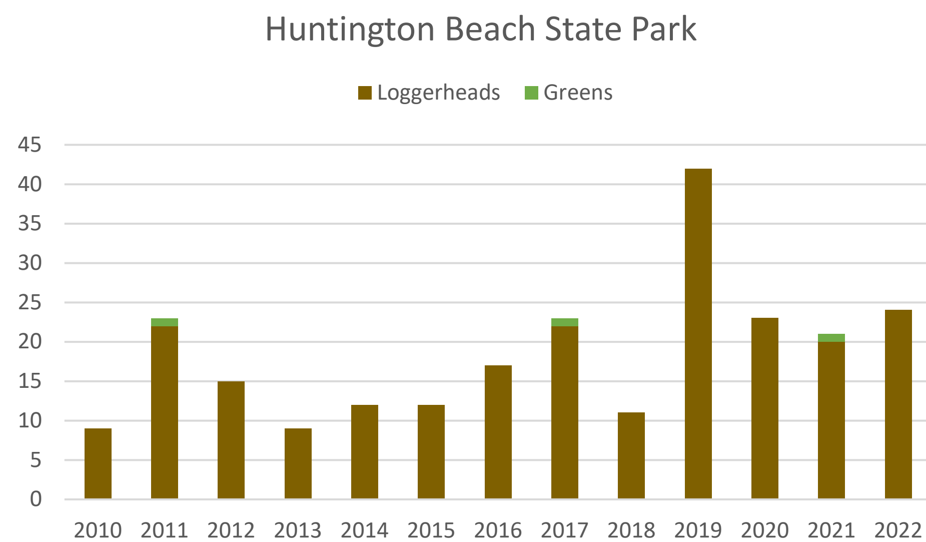
Nesting habitat can also be degraded by the presence of humans and recreational equipment (e.g., tents and furniture). Equipment left on beaches and other beach debris can also deter, impede, and/or entrap nesting females and hatchlings, reducing nesting, and interfering with hatchling emergence and transit to the sea (Martin *et al.* 2019).

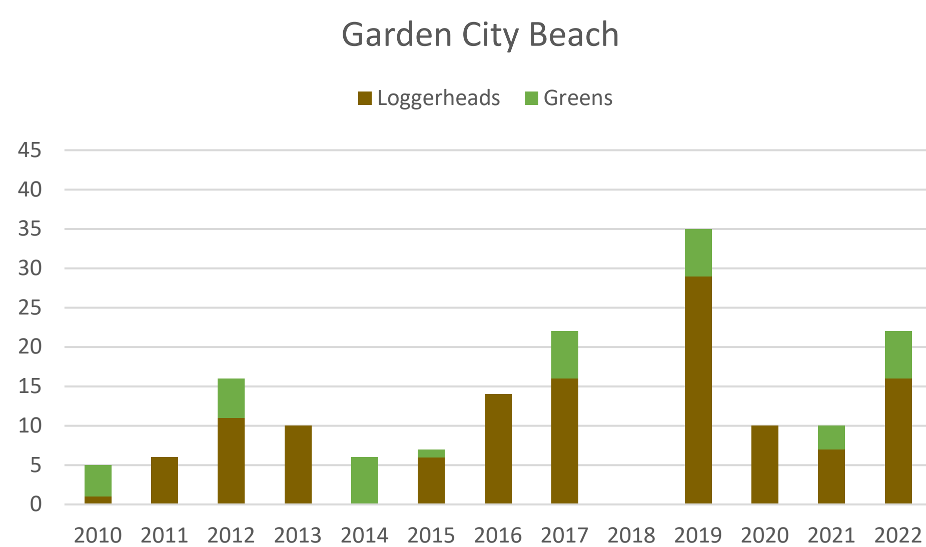
7.2. Environmental Baseline

See **Section 3.2**.

7.2.1. Action Area Numbers, Reproduction, and Distribution

Huntington Beach State Park, Garden City Beach, and Surfside Beach have nest protection projects permitted through the South Carolina Department of Natural Resources (SCDNR) to conduct daily nesting surveys, nest relocations, predator control measures, and nest inventories. Huntington Beach State Park receives most of the loggerhead sea turtle nests of the three projects with nest numbers ranging from 9 to 42 from 2010 to 2022 (**Figure 7-4**). During this same timeframe, Garden City Beach received 0 to 29 nests and Surfside Beach received 1 to 7 nests, respectively (**Figure 7-4**).





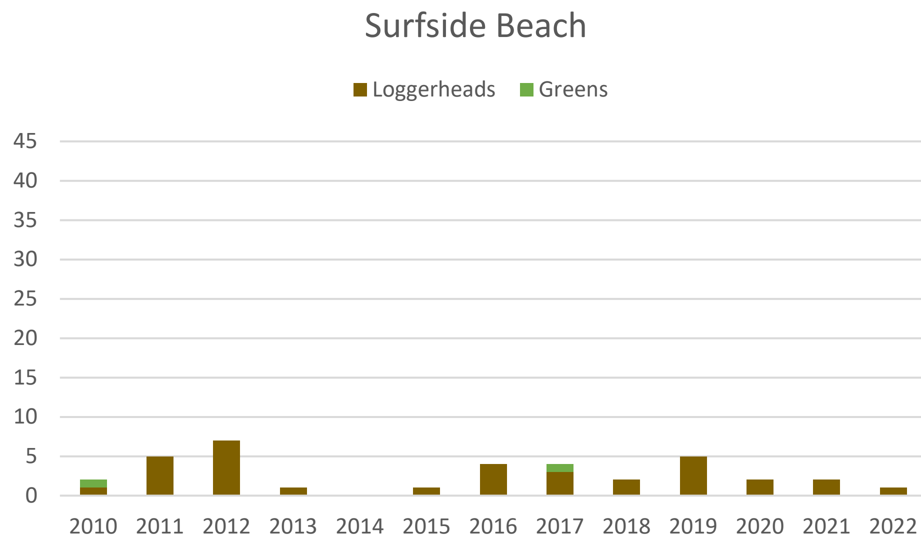


Figure 7-4. Loggerhead and green sea turtle nests within the Action Area from 2010 -2022 (Seaturtle.org 2023).

7.2.2. Action Area Conservation Needs and Threats

Sea turtle nests are subject to severe erosion, tidal inundation, storms, and predation. Sea turtle hatchlings are subject to disorientations caused by artificial lighting, predation, and entrapment. Nesting sea turtles are subject to disorientations due to artificial lighting and entrapment. The SCDNR nest protection projects within the Action Area address some of these threats by relocating and screening nests and promoting lights out for sea turtles. Despite these threats, nesting within the Action Area follows the increasing trend of nesting within the NRU.

7.3. Effects of the Action

This section analyzes the direct and indirect effects of the Action on the loggerhead sea turtle, which includes the direct and indirect effects of interrelated and interdependent actions. Direct effects are caused by the Action and occur at the same time and place. Indirect effects are caused by the Action but are later in time and reasonably certain to occur.

7.3.1. Effects of sand placement

Beneficial Effects

The placement of sand on a beach with reduced dry foredune habitat may increase sea turtle nesting habitat if the placed sand is highly compatible (*i.e.*, grain size, shape, color, etc.) with naturally occurring beach sediments in the area, and compaction and escarpment remediation measures are incorporated into the project. In addition, a nourished beach that is designed and constructed to mimic a natural beach system may benefit sea turtles more than an eroding beach it replaces.

Adverse Effects

Direct effects: Direct effects are those direct or immediate effects of a project on the species or its habitat.

Potential adverse effects during the project construction phase include disturbance of existing nests, which may have been missed by surveyors and thus not marked for avoidance, disturbance of females attempting to nest, and disorientation of emerging hatchlings. In addition, heavy equipment will be required to construct the beach profile. This equipment will have to traverse the beach portion of the Action Area, which could result in harm to nesting sea turtles, their nests, and emerging hatchlings.

Equipment during construction

The use of heavy machinery on beaches during a construction project may also have adverse effects on sea turtles. Equipment left on the nesting beach overnight can create barriers to nesting females emerging from the surf and crawling up the beach, causing a higher incidence of false crawls and unnecessary energy expenditure.

The operation of motor vehicles or equipment on the beach to complete the project work at night affects sea turtle nesting by interrupting or colliding with a nesting turtle on the beach, headlights disorienting or misorienting emergent hatchlings, vehicles running over hatchlings attempting to reach the ocean, and vehicle ruts on the beach interfering with hatchlings crawling to the ocean. Apparently, hatchlings become diverted not because they cannot physically climb out of a rut (Hughes and Caine 1994), but because the sides of the track cast a shadow and the hatchlings lose their line of sight to the ocean horizon (Mann 1977). The extended period of travel required to negotiate tire ruts may increase the susceptibility of hatchlings to dehydration and depredation during migration to the ocean (Hosier *et al.* 1981). Driving directly above or over incubating egg clutches or on the beach can cause sand compaction, which may result in adverse impacts on nest site selection, digging behavior, clutch viability, and emergence by hatchlings, as well as directly kill pre-emergent hatchlings (Mann 1977, Nelson and Dickerson 1987, Nelson 1988).

The physical changes and loss of plant cover caused by vehicles on vegetated areas or dunes can lead to various degrees of instability and cause dune migration. As vehicles move over the sand, sand is displaced downward, lowering the substrate. Since the vehicles also inhibit plant growth, and open the area to wind erosion, the beach and dunes may become unstable. Vehicular traffic on the beach or through dune breaches or low dunes may cause acceleration of overwash and erosion (Godfrey *et al.* 1978). Driving along the beachfront should be between the low and high tide water lines. To minimize the impacts to the beach, dunes, and dune vegetation, transport and access to the construction sites should be from the road to the maximum extent possible. However, if vehicular access to the beach is necessary, the areas for vehicle and equipment usage should be designated and marked.

Missed nests

Although a nesting survey and nest marking program would reduce the potential for nests to be impacted by construction activities, nests may be inadvertently missed (when crawls are obscured by rainfall, wind, and/or tides) or misidentified as false crawls during daily patrols. Even under the best of conditions, about seven percent of the nests can be misidentified as false crawls by experienced sea turtle nest surveyors (Schroeder 1994).

Nest relocation

Besides the potential for missing nests during surveys, there is a potential for eggs to be damaged by nest relocation, particularly if eggs are not relocated within 12 hours of deposition (Limpus *et al.* 1979). Relocated nests can incubate at different temperatures than nests left to incubate in place (*in situ*) (Mrosovosky and Yntema 1980, Hoekert *et al.* 1998, Başkale and Kaska 2005, Tuttle 2007, Bimbi 2009, Tuttle and Rostal 2010, Pintus *et al.* 2009) and cause skewed sex ratios (Morreale *et al.* 1982, Godfrey *et al.* 1997). Relocated nests can also have higher or lower hatch success and hatchling emergence than *in situ* nests (Wyneken *et al.* 1988, Hoekert *et al.* 1998, García *et al.* 2003, Moody 2000, Kornaraki *et al.* 2006, Tuttle 2007, McElroy 2009, Pintus *et al.* 2009) depending on relocation technique and environmental conditions.

Nest relocation can have adverse impacts on gas exchange parameters and the hydric environment of nests (Limpus *et al.* 1979, Ackerman 1980, Parmenter 1980, Spotila *et al.* 1983, McGehee 1990). Nests relocated into sands deficient in oxygen or moisture can result in mortality, morbidity, and reduced behavioral competence of hatchlings. Water availability is known to influence the incubation environment of the embryos and hatchlings of turtles with flexible-shelled eggs, which has been shown to affect nitrogen excretion (Packard *et al.* 1984), mobilization of calcium (Packard and Packard 1986), mobilization of yolk nutrients (Packard *et al.* 1985), hatchling size (Packard *et al.* 1981, McGehee 1990), energy reserves in the yolk at hatching (Packard *et al.* 1988), and locomotory ability of hatchlings (Miller *et al.* 1987).

Indirect effects*:* Indirect effects are effects caused by or result from the proposed action, are later in time, and are reasonably certain to occur.

Many of the direct effects of shoreline stabilization projects may persist over time and become indirect impacts. These indirect effects include increased susceptibility of relocated nests to catastrophic events, the consequences of potential increased beachfront development, changes in the physical characteristics of the beach, and the formation of escarpments.

Increased susceptibility to catastrophic events

Nest relocation within a nesting season may concentrate eggs in an area making them more susceptible to catastrophic events. Hatchlings released from concentrated areas also may be subject to greater predation rates from both land and marine predators because the predators learn where to concentrate their efforts (Glenn 1998, Wyneken *et al.* 1998).

Changes in the physical environment

Poor quality material can alter nest success by altering moisture content and gas exchange (Limpus *et al.* 1979, Ackerman 1980, Parmenter 1980, Spotila *et al.* 1983, McGehee 1990). Additionally, the use of heavy machinery can cause sand compaction (Nelson *et al.* 1987, Nelson and Dickerson 1988a). Significant reductions in nesting success (i.e., false crawls occurred more frequently) have been documented on severely compacted beaches (Fletemeyer 1980, Raymond 1984, Nelson and Dickerson 1987, Nelson *et al.* 1987), and increased false crawls may result in increased physiological stress to nesting females.

Escarpment formation

Escarpments may develop on beaches between groins as the beaches equilibrate to their final profiles. Escarpments can hamper or prevent access to nesting sites (Nelson and Blihovde 1998) and can cause adult females to choose unsuitable nesting areas, such as seaward of an escarpment. These nest sites commonly receive prolonged tidal inundation and erosion, which results in nest failure.

7.3.2. Summary of the Effects of the Action

Beach renourishment will occur within loggerhead sea turtle nesting habitat and construction activities will overlap with the nesting season. Potential effects include destruction of nests deposited within the boundaries of the Action, harassment in the form of disturbing or interfering with female turtles attempting to nest within the construction area or on adjacent beaches as a result of construction activities, disorientation of hatchling turtles on beaches adjacent to the construction area as they emerge from the nest and crawl to the water as a result of project lighting, and behavior modification of nesting females during the nesting season resulting in false crawls or situations where they choose marginal or unsuitable nesting areas to deposit eggs due to escarpment formation within the Action Area.

Some individuals in a population are more "valuable" than others in terms of the number of offspring they are expected to produce. An individual's potential for contributing offspring to future generations is its reproductive value. Because of delayed sexual maturity, reproductive longevity, and low survivorship in early life stages, nesting females are of high value to a population. The loss of a nesting female in a small recovery unit would represent a significant loss to the recovery unit. The reproductive value for a nesting female has been estimated to be approximately 253 times greater than an egg or a hatchling (NMFS and Service 2008).

With regard to indirect loss of eggs and hatchlings, on most beaches, nesting success typically declines for the first year or two following sand placement, even though more nesting habitat is available for turtles (Trindell *et al.* 1998, Ernest and Martin 1999, Herren 1999). Reduced nesting success on constructed beaches has been attributed to increased sand compaction, escarpment formation, and changes in beach profile (Nelson *et al.* 1987, Crain *et al.* 1995, Lutcavage *et al.* 1997, Steinitz *et al.* 1998, Ernest and Martin 1999, Rumbold *et al.* 2001). In addition, even though constructed beaches are wider, nests deposited there may experience higher rates of wash out than those on relatively narrow, steeply sloped beaches (Ernest and

Martin 1999). This occurs because nests on constructed beaches are more broadly distributed than those on natural beaches, where they tend to be clustered near the base of the dune. Nests laid closest to the waterline on constructed beaches may be lost during the first year or two following construction as the beach undergoes an equilibration process during which seaward portions of the beach are lost to erosion. As a result, the project is anticipated to result in decreased nesting and loss of nests that do get laid within the project area for two subsequent nesting seasons following the completion of the proposed sand placement. However, it is important to note that it is unknown whether nests that would have been laid in the Action Area during the two subsequent nesting seasons had the project not occurred are actually lost from the population or if nesting is simply displaced to adjacent beaches.

During construction, direct mortality of the developing embryos in nests within the project area may occur for nests that are missed and not relocated. The exact number of these missed nests is not known. However, in two separate monitoring programs on the east coast of Florida where hand digging was performed to confirm the presence of nests and thus reduce the chance of missing nests through misinterpretation, trained observers still missed about six to eight percent of the nests because of natural elements (Martin 1992, Ernest and Martin 1993). This must be considered a conservative number because missed nests are not always accounted for. In another study, Schroeder (1994) found that even under the best of conditions, about seven percent of nests can be misidentified as false crawls by highly experienced sea turtle nest surveyors. Missed nests are usually identified by signs of hatchling emergences in areas where no nest was previously documented. Signs of hatchling emergence are very easily obliterated by the same elements that interfere with detection of nests.

7.4. Cumulative Effects

See **Section 3.4.**

7.5. Conclusion

In this section, the Service summarizes and interprets the findings of the previous sections for the loggerhead sea turtle (status, baseline, effects, and cumulative effects) relative to the purpose of a BO under §7(a)(2) of the ESA, which is to determine whether a Federal action is likely to:

a) Jeopardize the continued existence of species listed as endangered or threatened; or
b) Result in the destruction or adverse modification of designated critical habitat.

"Jeopardize the continued existence" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR §402.02).

Status

Loggerheads nesting with the Action Area are part of the NRU, the second largest nesting assemblage in the Northwest Altantic. The NRU has had an annual rate of increase in number of nests of 1.3% (p = 0.04) based on a log-linear regression model for 37 years of nesting data (1983-2019) (Bolten *et al*. 2019, NMFS and USFWS 2023). Although there has been an observed increase in the number of nests for the past decade, this annual rate of increase is below the 2% criterion for achieving recovery.

Baseline

Huntington Beach State Park, Garden City Beach, and Surfside Beach have nest protection projects permitted through SCDNR to conduct daily nesting surveys, nest relocations, predator control measures, and nest inventories. Huntington Beach State Park receives most of the loggerhead sea turtle nests of the three projects with nest numbers ranging from 9 to 42 from 2010 to 2022. During this same timeframe, Garden City Beach received 0 to 29 nests and Surfside Beach received 1 to 7 nests, respectively.

Sea turtle nests are subject to severe erosion, tidal inundation, storms, and predation. Sea turtle hatchlings are subject to disorientations caused by artificial lighting, predation, and entrapment. Nesting sea turtles are subject to disorientations due to artificial lighting and entrapment. The SCDNR nest protection projects within the Action Area address some of these threats by relocating and screening nests and promoting lights out for sea turtles. Despite these threats, nesting within the Action Area follows the increasing trend of nesting within the NRU.

Effects

The project will occur within loggerhead sea turtle nesting habitat and construction activities will overlap with the nesting season. Potential effects include: (1) Destruction of nests deposited within the boundaries of the Action Area; (2) Harassment in the form of disturbing or interfering with female turtles attempting to nest within the construction area or on adjacent beaches as a result of construction activities; (3) Disorientation of hatchling turtles on beaches adjacent to the construction area as they emerge from the nest and crawl to the water as a result of project lighting; and (4) Behavior modification of nesting females during the nesting season resulting in false crawls or situations where they choose marginal or unsuitable nesting areas to deposit eggs due to escarpment formation within the Action Area.

After reviewing the current status of the species, the environmental baseline for the Action Area, the effects of the Action and the cumulative effects, it is the Service's biological opinion that the Action is not likely to jeopardize the continued existence of the loggerhead sea turtle.

8. GREEN SEA TURTLE

8.1. Status of Species

The green sea turtle was federally listed on July 28, 1978 (43 FR 32800). On April 6, 2016, the NMFS and Service issued a final rule to list 11 DPSs of the green sea turtle. Three of the DPSs are endangered species (Central South Pacific, Central West Pacific, and Mediterranean Sea), and eight are threatened species (North Atlantic, South Atlantic, Southwest Indian, North Indian, East Indian-West Pacific, Southwest Pacific, Central North Pacific, and East Pacific (81 FR 20058).

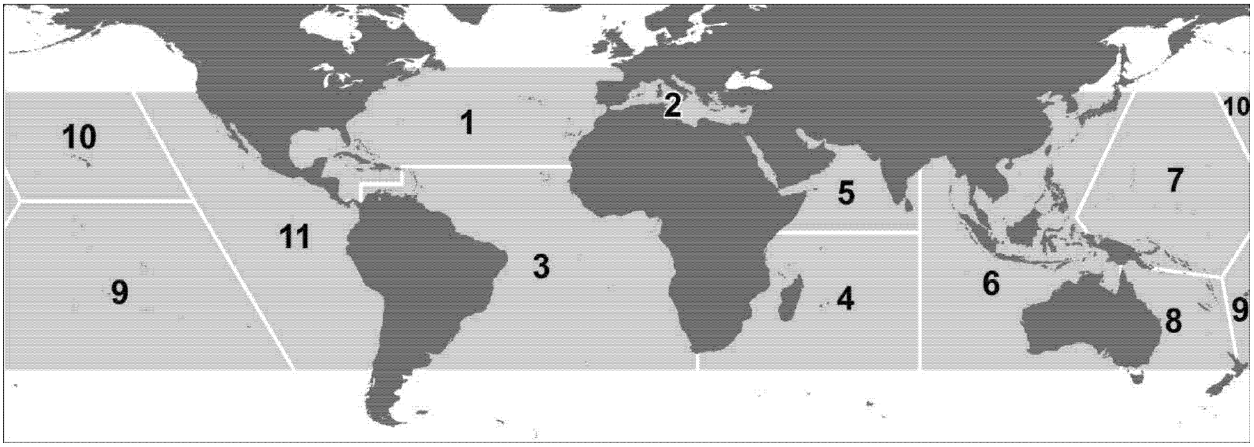


Figure 8-1. Map of the green sea turtle DPSs: (1) North Atlantic, (2) Mediterranean, (3) South Atlantic, (4) Southwest Indian, (5) North Indian, (6) East Indian-West Pacific, (7) Central and West Pacific, (8) Southwest Pacific, (9) Central South Pacific, (10) Central North Pacific, and (11) East Pacific.

In the North Atlantic DPS (**Figure 8-2**), some nesting beaches continue to be severely degraded from a variety of activities. Destruction and modification of green turtle nesting habitat results from coastal development, construction, beachfront lighting, placement of erosion control structures and other barriers to nesting, placement of nearshore shoreline stabilization structures, vehicular and pedestrian traffic, beach erosion, beach sand placement, removal of native vegetation, and planting of non-native vegetation.

Numerous beaches in the North Atlantic DPS are eroding due to both natural (e.g., storms, sea level changes, waves, shoreline geology) and anthropogenic (e.g., construction of armoring structures, groins, and jetties; marinas; coastal development; inlet dredging) factors. Such shoreline erosion leads to a loss of nesting habitat for green turtles.

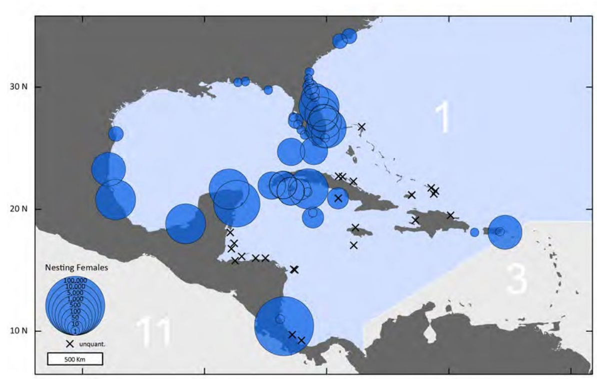


Figure 8-2. Nesting distribution of green sea turtles in the western North Atlantic DPS. Size of circles indicates estimated nester abundance. Locations marked with 'X' indicate nesting sites lacking abundance information (Seminoff *et al*. 2015).

8.1.1. Species Description

The green sea turtle grows to a maximum size of about 4 feet (ft) and a weight of 440 lb. It has a heart-shaped shell, small head, and single-clawed flippers. The carapace is smooth and colored gray, green, brown, and black. Hatchlings are black on top and white on the bottom (NMFS 2009). Hatchling green turtles eat a variety of plants and animals, but adults feed almost exclusively on seagrasses and marine algae. The carapace has five vertebral scutes, four pairs of costal scutes, and 12 pairs of marginal scutes. The head has a single pair of elongate prefrontal scales, four postorbital scales behind each eye, both of which are distinguishing characteristics that set this species apart from other hard-shell sea turtles. Green turtles have a lower jaw-edge that is coarsely serrated, corresponding to strong grooves and ridges on the inner surface of the upper jaw (Carr 1952, Pritchard and Trebbau 1984, and Hirth 1997).

The term "green" refers not to the external coloration, but to the color of the turtle's subdermal fat. The carapace of adult green turtles is light to dark brown, sometimes shaded with olive, with radiating wavy or mottled markings of a darker color or with large blotches of dark brown (Carr, 1952). The carapace coloration changes as the turtle grows from a hatchling to an adult. The dorsal coloration of the green turtle likely has adaptive significance as camouflage from chief predators while the turtle rests motionlessly on the bottom amongst coral and other benthic substrate. The adult plastron ranges from yellowish to orange, although in the East Pacific form there is considerable grayish and charcoal pigment. All hatchling green turtles have a black dorsal surface and a white ventral surface.

8.1.2. Life History

Greens are long-lived, slow-growing animals that use multiple habitats across entire ocean basins throughout their life history encompassing terrestrial, nearshore, and open ocean habitats. Even though sea turtles have been the focus of research and conservation efforts for several decades in various places around the world (Frazier 2003), there are still very large gaps in our understanding of green sea turtle life history and demography. These gaps likely owe to logistical challenges of studying sea turtles when they are dispersed in the open ocean and to the long time spans from hatchling to maturity.

Green sea turtles nest on sandy, ocean-facing mainland and island beaches (Hirth 1997). Although specific characteristics vary between rookeries, green turtle nesting beaches tend to have intact dune structures and native vegetation (Ackerman 1997). Nests are typically laid at night at the base of the primary dune (Hirth 1997, Witherington *et al.* 2006). Sea turtle eggs require a high humidity substrate that allows for sufficient gas exchange and temperatures conducive to embryo development (Miller *et al.* 1997, 2003). Mean clutch size varies greatly among green sea turtle populations, but on average is approximately 100 eggs per clutch (Hirth 1997).

8.1.3. Numbers, Reproduction, and Distribution

The North Atlantic Ocean DPS currently exhibits high nesting abundance, with an estimated total nester abundance of 167,424 females at 73 nesting sites (Seminoff *et al*. 2015). Four regions support high density nesting concentrations including Costa Rica (Tortuguero), Mexico (Campeche,Yucatan, and Quintana Roo), U.S. (Florida), and Cuba. Nesting data indicate long-term increases at all major nesting sites. There is little genetic substructure within the DPS, and turtles from multiple nesting beaches share common foraging areas (81 FR 20058).

In Florida, nesting occurs in coastal areas of all regions except the Big Bend area of west central Florida. The bulk of nesting occurs along the Atlantic coast of eastern central Florida, where a mean of 5,055 nests were deposited each year from 2001 to 2005 (Meylan *et al.* 2006) and 10,377 each year from 2008 to 2012 (B. Witherington, Florida Fish and Wildlife Conservation Commission, pers. comm. 2013). Nesting has increased substantially over the last 20 years and peaked in 2011 with 15,352 nests statewide (Chaloupka *et al.* 2008, B. Witherington, Florida Fish and Wildlife Conservation Commission, pers. comm. 2013). The estimated total nester abundance for Florida is 8,426 turtles and 11 for South Carolina (Seminoff *et al*. 2015). Nesting in South Carolina spiked in 2017 and had 21 nests in 2022, which is the highest number recorded in South Carolina to date (Seaturtle.org 2023).

8.1.4. Conservation Needs and Threats

In the North Atlantic DPS, some nesting beaches continue to be severely degraded from a variety of activities. Destruction and modification of green turtle nesting habitat results from coastal development, construction, beachfront lighting, placement of erosion control structures and other barriers to nesting, placement of nearshore shoreline stabilization structures, vehicular and pedestrian traffic, beach erosion, beach sand placement, removal of native vegetation, and planting of non-native vegetation.

Numerous beaches in the North Atlantic DPS are eroding due to both natural (e.g., storms, sea level changes, waves, shoreline geology) and anthropogenic (e.g., construction of armoring structures, groins, and jetties; marinas; coastal development; inlet dredging) factors. Such shoreline erosion leads to a loss of nesting habitat for green turtles.

8.2. Environmental Baseline

See **Section 3.2**.

8.2.1. Action Area Numbers, Reproduction, and Distribution

Garden City Beach receives most of the green sea turtle nests of the three projects with nest numbers ranging from 0 to 6 from 2010 to 2022 (**Figure 7-4**). During this same timeframe, Huntington Beach State Park and Surfside Beach each received 1 nest (**Figure 7-4**).

8.2.2. Action Area Conservation Needs and Threats

See **Section 7.2.2.**

8.3. Effects of the Action

See **Section 7.3.2**. The Service anticipates similar effects to green sea turtles as described for loggerhead sea turtle.

8.4. Cumulative Effects

See **Section 3.4.**

8.5. Conclusion

In this section, the Service summarizes and interprets the findings of the previous sections for the green sea turtle (status, baseline, effects, and cumulative effects) relative to the purpose of a BO under §7(a)(2) of the ESA, which is to determine whether a Federal action is likely to:

a) Jeopardize the continued existence of species listed as endangered or threatened; or
b) Result in the destruction or adverse modification of designated critical habitat.

"Jeopardize the continued existence" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR §402.02).

Status

The North Atlantic Ocean DPS currently exhibits high nesting abundance, with an estimated total nester abundance of 167,424 females at 73 nesting sites (Seminoff *et al*. 2015). In Florida, nesting has increased substantially over the last 20 years and peaked in 2011 with 15,352 nests statewide (Chaloupka *et al*., 2008; B. Witherington, Florida Fish and Wildlife Conservation Commission, pers. comm., 2013). The estimated total nester abundance for Florida is 8,426 turtles and 11 for South Carolina (Seminoff *et al*. 2015). Nesting in South Carolina spiked in 2017 and had 21 nests in 2022, which is the highest number recorded in South Carolina to date (Seaturtle.org 2023).

In the North Atlantic DPS, some nesting beaches continue to be severely degraded from a variety of activities. Destruction and modification of green turtle nesting habitat results from coastal development, construction, beachfront lighting, placement of erosion control structures and other barriers to nesting, placement of nearshore shoreline stabilization structures, vehicular and pedestrian traffic, beach erosion, beach sand placement, removal of native vegetation, and planting of non-native vegetation.

Numerous beaches in the North Atlantic DPS are eroding due to both natural (e.g., storms, sea level changes, waves, shoreline geology) and anthropogenic (e.g., construction of armoring structures, groins, and jetties; marinas; coastal development; inlet dredging) factors. Such shoreline erosion leads to a loss of nesting habitat for green turtles.

Baseline

Garden City Beach receives most of the green sea turtle nests of the three projects with nest numbers ranging from 0 to 6 from 2010 to 2022. During this same timeframe, Huntington Beach State Park and Surfside Beach each received 1 nest.

Sea turtle nests are subject to severe erosion, tidal inundation, storms, and predation. Sea turtle hatchlings are subject to disorientations caused by artificial lighting, predation, and entrapment. Nesting sea turtles are subject to disorientations due to artificial lighting and entrapment. The SCDNR nest protection projects within the Action Area address some of these threats by relocating and screening nests and promoting lights out for sea turtles. Despite these threats, nesting within the Action Area follows the increasing trend of nesting within the NRU.

Effects

The project will occur within green sea turtle nesting habitat and construction activities will overlap with the nesting season. Potential effects include: (1) Destruction of nests deposited within the boundaries of the Action Area; (2) Harassment in the form of disturbing or interfering with female turtles attempting to nest within the construction area or on adjacent beaches as a result of construction activities; (3) Disorientation of hatchling turtles on beaches adjacent to the construction area as they emerge from the nest and crawl to the water as a result of project lighting; and (4) Behavior modification of nesting females during the nesting season resulting in false crawls or situations where they choose marginal or unsuitable nesting areas to deposit eggs due to escarpment formation within the Action Area.

After reviewing the current status of the species, the environmental baseline for the Action Area, the effects of the Action and the cumulative effects, it is the Service's biological opinion that the Action is not likely to jeopardize the continued existence of the green sea turtle.

9. INCIDENTAL TAKE STATEMENT

ESA §9(a)(1) and regulations issued under §4(d) prohibit the "take" of endangered and threatened fish and wildlife species without special exemption. The term "take" in the ESA means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (ESA §3). In regulations at 50 CFR §17.3, the Service further defines:

- "Harass" as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering;"

- "Harm" as "an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering;" and
- "Incidental take" as "any taking otherwise prohibited, if such taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity."

Under the terms of ESA §7(b)(4) and §7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered prohibited, provided that such taking is in compliance with the terms and conditions of an incidental take statement (ITS).

For the exemption in ESA §7(o)(2) to apply to the Action considered in this BO, the Corps must undertake the non-discretionary measures described in this ITS, and these measures must become binding conditions of any permit, contract, or grant issued for implementing the Action. The Corps has a continuing duty to regulate the activity covered by this ITS. The protective coverage of §7(o)(2) may lapse if the Corps fails to:

- Assume and implement the terms and conditions; or
- Require a permittee, contractor, or grantee to adhere to the terms and conditions of the ITS through enforceable terms that are added to the permit, contract, or grant document.

In order to monitor the impact of incidental take, the Corps must report the progress of the Action and its impact on the species to the Service as specified in this ITS.

9.1. Extent of Take

This section specifies the extent of take of listed wildlife species that the Action is reasonably certain to cause, which we estimated in the "Effects of the Action" section(s) of this BO.

Table 9-1 identifies the species, stage(s) of the annual cycle, estimated number of acres of suitable habitat, the form of take anticipated, and the section of the BO that contains the supporting analysis. We describe procedures for monitoring take that occurs during Action implementation for piping plovers, red knots, loggerhead sea turtles, and green sea turtles in section 9.4.

Surrogate Measures for Monitoring

For the piping plover and red knot, detecting take that occurs incidental to the Action is not practical because it is difficult to determine the number of individuals using a site annually in the absence of consistent surveys during the nonbreeding season using a passage population survey protocol (Lyons *et al.* 2016, Smith *et al.* 2017, Gibson *et al.* 2018, Lyons *et al.* 2018).

For the loggerhead and green sea turtles, detecting take that occurs incidental to the Action is not practical because it is difficult to determine the number of individuals displaced from a site due to project construction, the number of nests missed and not relocated out of the project area prior to sand placement, and the number of hatchlings disoriented by lighting for nighttime construction activities.

When it is not practical to monitor take in terms of individuals of the listed species, the regulations at 50 CFR §402.14(i)(1)(i) indicate that an ITS may express the amount or extent of take using a surrogate (*e.g.,* a similarly affected species, habitat, or ecological conditions), provided that the Service also:

- Describes the causal link between the surrogate and take of the listed species; and
- Sets a clear standard for determining when the level of anticipated take has been exceeded.

We have identified surrogate measures in our analyses of effects that satisfy these criteria for monitoring take of the species named above during Action implementation. Table 9-1 lists the species, stage of the annual cycle, surrogate measure, and the section of the BO that explains the causal link between the surrogate and the anticipated taking. We describe procedures for this monitoring in section 9.4.

Table 9-1. **Surrogate measures for monitoring take of listed wildlife species caused by the Action, based on the cited BO effects analyses.**

Common Name	Stage of Annual Cycle	Surrogate (units)	Quantity	BO Effects Analysis Section
Piping plover	Nonbreeding	Foraging habitat acres (ac)	50 ac	3.3
Red knot	Nonbreeding	Foraging habitat acres (ac)	50 ac	5.3
Loggerhead sea turtle	Breeding	Nesting habitat (lf of shoreline)	9,920 lf	7.3
Green sea turtle	Breeding	Nesting Habitat (lf of shoreline)	9,920 lf	8.3

9.2. Reasonable and Prudent Measures

The Service believes the reasonable and prudent measures (RPMs) we describe in this section for the piping plover and rufa red knot are necessary or appropriate to minimize the impact, *i.e.,* the amount or extent, of incidental take caused by the Action.

RPM#1. Conservation Measures included in the permit application/project plans must be implemented (unless revised below in the Terms and Conditions) in the proposed project.

RPM#2. A meeting/conference call between representatives of the Corps, Corps' contractor, SCESFO, SCDNR, HBSP staff, shorebird surveyor(s) and the permitted sea turtle surveyor(s) must be held prior to the commencement of work on this Action.

RPM#3. The Corps will use beach quality sand for sand placement.

Sea Turtles

RPM#4. The Corps will hire sea turtle monitors to survey the project area daily during the sea turtle nesting season (May 1 – October 31) or until the last nest relocated out of the project area is inventoried. Surveys for nesting sea turtles must be conducted within the project area if work will occur during a portion of the nesting season. If nests are constructed in the project footprint, the eggs must be relocated to minimize sea turtle nest burial, crushing of eggs, or nest excavation. Nest relocation will be on a selected area of beach that is not expected to experience daily inundation by high tides or known to routinely experience severe erosion and egg loss, predation, or subject to artificial lighting.

RPM#5. The Corps' contractor(s) will store construction equipment and materials for project construction in a manner that will minimize impacts to sea turtles to the maximum extent practicable.

RPM#6. The Corps' contractor will install and maintain predator-proof trash receptacles during project construction at all beach access points used for project construction to minimize the potential for attracting predators of sea turtles.

RPM#7. The Corps must hire nighttime monitors with sea turtle experience to patrol the beach at night in the project area if nighttime construction activities and equipment occur during the nesting season.

RPM#8. During the sea turtle nesting season, the Corps' contractor must not extend the beach fill more than 500 feet along the shoreline and must confine work activities within this area between dusk and the following day's nesting survey unless nighttime monitors patrol the beach to reduce the impacts to emerging sea turtles and burial of new nests.

RPM#9. The Corps will monitor sand compaction and conduct tilling (non-vegetated areas) if needed immediately after completion of the sand placement work and prior to the next three nesting seasons to reduce the likelihood of impacting sea turtle nesting and hatching activities.

RPM#10. The Corps will monitor escarpment formation and conduct leveling if needed immediately after completion of the sand placement project and prior to the next three nesting seasons to reduce the likelihood of impacting sea turtles.

Shorebirds

RPM#11. The placement areas must be surveyed for piping plovers and red knots by qualified individuals before project construction to document presence/absence of each species.

RPM#12. Signage delineating shorebird habitat visible at all stages of the tide will be posted on the Huntington Beach State Park (HBSP) side of Murrells Inlet after project construction.

9.3. Terms and Conditions

In order for the exemption from the take prohibitions of §9(a)(1) and of regulations issued under §4(d) of the ESA to apply to the Action, the Corps' Applicant must comply with the terms and conditions (T&Cs) of this statement, provided below, which carry out the RPMs described in the previous section. These T&Cs are mandatory. As necessary and appropriate to fulfill this responsibility, the Corps must require any permittee, contractor, or grantee to implement these T&Cs through enforceable terms that are added to the permit, contract, or grant document.

T&C#1. Conservation Measures included in the permit application/project plans must be implemented in the proposed project. Project construction on the HBSP side of Murrells Inlet will be limited to August 1 through March 15. The beach profile will be modelled after the Crab Bank restoration project specifications.

T&C#2. A conference call between representatives of the Corps, Corps' contractor, SCESFO, SCDNR, HBSP staff, shorebird surveyor(s), and the permitted sea turtle surveyors must be held prior to project construction. At least ten business days advance notice will be provided prior to conducting this meeting/call. The meeting/conference call will provide an opportunity for explanation and/or clarification of the protection measures.

T&C#3. Beach compatible fill must be placed on the beach or in any associated dune system. 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. Such material must be predominately of carbonate, quartz or similar material with a particle size distribution ranging between 0.062mm and 4.76mm (classified as sand by either the Unified Soils or the Wentworth classification), must be similar in color and grain size distribution (sand grain frequency, mean and median grain size and sorting coefficient) to the material in the historic beach sediment at the disposal site, and must not contain:

a. Greater than five percent, by weight, silt, clay or colloids passing the #230 sieve;
b. Greater than five percent, by weight, fine gravel retained on the #4 sieve (-2.25φ);
c. Coarse gravel, cobbles or material retained on the 3/4-inch sieve in a percentage or size greater than found on the native beach;
d. Construction debris, toxic material or other foreign matter; and
e. Material that will result in cementation of the beach.

If rocks or other non-specified materials appear on the surface of the filled beach in excess of 50% of background in any 10,000 square foot area, then surface rock should be removed from those areas. These areas must also be tested for subsurface rock percentage and remediated as required. If the natural beach exceeds any of the limiting parameters listed above, then the fill material must not exceed the naturally occurring level for that parameter on nearby native beaches.

These standards must not be exceeded in any 10,000 square foot section extending through the depth of the nourished beach. If the native beach exceeds any of the limiting parameters listed above, then the fill material must not exceed the naturally occurring level for that parameter on nearby native beaches.

T&C#4. Daily early morning surveys for sea turtle nests will be required if construction overlaps with the sea turtle nesting season (May 1 – October 31). Nesting surveys must be conducted until the last nest relocated out of the project area is inventoried if work will begin before October 31. If nests are constructed in areas where they may be affected by construction activities, the nests must be relocated per the following requirements.

a. Nesting surveys and nest relocation will only be conducted by personnel with prior experience and training in nesting survey and nest marking procedures. Surveyors must have a valid SCDNR permit. Nesting surveys must be conducted daily between sunrise and 9:00 AM.

b. Only those nests that may be affected by sand placement activities will be relocated. Nests requiring relocation will be moved no later than 9:00 AM the morning following deposition to a nearby self-release beach site in a secure setting where artificial lighting will not interfere with hatchling orientation. Relocated nests will not be placed in organized groupings. Relocated nests will be randomly staggered along the length and width of the beach in settings that are not expected to experience daily inundation by high tides or known to routinely experience severe erosion and egg loss, or subject to artificial lighting. Nest relocations in association with construction activities must cease when construction activities no longer threaten nests.

c. Nests deposited within areas where construction activities have ceased or will not occur for 75 days or nests laid in the nourished berm prior to tilling must be marked and left in situ unless other factors threaten the success of the nest. The turtle permit holder will install an on-beach marker at the nest site. No activity will occur within this area nor will any activities occur which could result in impacts to the nest. Nest sites will be inspected daily to assure nest markers remain in place and the nest has not been disturbed by the project activity.

T&C#5. During the sea turtle nesting season, nighttime storage of construction equipment not in use must be off the beach to minimize disturbance to sea turtles. Staging areas for construction equipment must be located off the beach. Nighttime storage of construction equipment not in use must be off the beach to minimize disturbance to sea turtle nesting and hatching activities. In addition, all construction pipes placed on the beach must be located as far landward as possible without compromising the integrity of the dune system. Pipes placed parallel to the dune must be 5 to 10 feet away from the toe of the dune if the width of the beach allows. Temporary storage of pipes must be off the beach to the maximum extent possible. If the pipes are stored on the beach, they must be placed in a manner that will minimize the impact to nesting habitat and must not compromise the integrity of the dune systems.

T&C#6. Predator-proof trash receptacles must be installed and maintained during construction at all beach access points used for the project construction to minimize the potential for attracting sea turtle nest predators. The contractors conducting the work must provide predator-proof trash receptacles for the construction workers. All contractors and their employees must be briefed on the importance of not littering and keeping the project area trash and debris free.

T&C#7. The Corps must hire nighttime monitors to patrol the beach at night in the project area if nighttime construction activities and equipment occur during the nesting season. Monitors must patrol the length of the pipeline within the active nighttime construction area for nesting females May 1 – August 31. Beginning July 1, sea turtle monitors must check all nests on a nightly basis after 9 pm within 1,000 feet of the active nighttime project area that have been incubating for 45 days until three nights after the first sign of emergence or the inventory of the nest contents.

T&C#8. Direct lighting of the beach and nearshore waters must be limited to the immediate construction area during nesting season and must comply with safety requirements. Lighting on all equipment must be minimized through reduction, shielding, lowering, and appropriate placement to avoid excessive illumination of the water's surface and nesting beach while meeting all Coast Guard, Corps EM 385-1-1, and OSHA requirements. Light intensity of lighting equipment must be reduced to the minimum standard required by OSHA for General Construction areas, in order not to misdirect sea turtles. Shields must be affixed to the light housing and be large enough to block light from all on-beach lamps from being transmitted outside the construction area or to the adjacent sea turtle nesting beach (**Figure 9-1**).

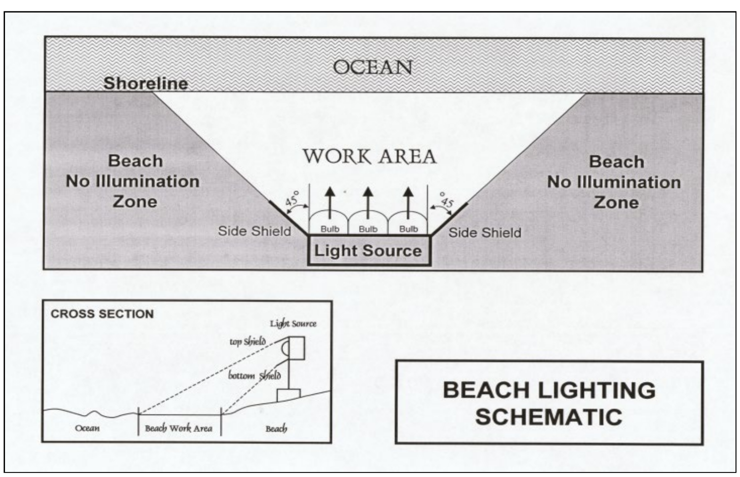


Figure 9-1. Beach lighting schematic.

T&C#9. During the sea turtle nesting season, the contractor must not extend the beach fill more than 500 feet (or other agreed upon length) along the shoreline between dusk and dawn and the following day until the daily nesting survey has been completed and the beach cleared for fill advancement. An exception to this may occur if there is permitted sea turtle surveyor present on-site to ensure no nesting and hatching sea turtles are present within the extended work area. If the 500 feet is not feasible for the project, an agreed upon distance will be decided on during the preconstruction meeting. Once the beach has been cleared and the necessary nest relocations have been completed, the contractor will be allowed to proceed with the placement of fill and work activities during daylight hours until dusk at which time the 500-foot length (or other agreed upon length) limitation must apply. If any nesting turtles are sighted on the beach within the immediate construction area, activities must cease immediately until the turtle has returned to the water and the sea turtle permit holder responsible for nest monitoring has relocated the nest.

T&C#10. Sand compaction must be monitored in the area of sand placement immediately after completion of the project and prior to May 1 for three subsequent years <u>unless compaction results are within the native beach range after the first subsequent year.</u> If tilling is needed, the area must be tilled to a depth of 24 inches. Each pass of the tilling equipment must be overlapped to allow more thorough and even tilling. All tilling activity must be completed at least once prior to nesting season. An electronic copy of the results of the compaction monitoring must be submitted to the SCESFO prior to any tilling actions being taken or if a request not to till is made based on compaction results. The requirement for compaction monitoring can be eliminated if the decision is made to till regardless of post construction compaction levels. Additionally, out-year compaction monitoring and remediation are not required if placed material no longer remains on the dry beach.

a. Compaction sampling stations must be located at 500-foot intervals along the sand placement template. One station must be at the seaward edge of the dune/bulkhead line (when material is placed in this area), and one station must be midway between the dune line and the high-water line (normal wrack line).

b. At each station, the cone penetrometer must be pushed to a depth of 6, 12, and 18 inches three times (three replicates). Material may be removed from the hole if necessary to ensure accurate readings of successive levels of sediment. The penetrometer may need to be reset between pushes, especially if sediment layering exists. Layers of highly compact material may lie over less compact layers. Replicates must be located as close to each other as possible, without interacting with the previous hole or disturbed sediments. The three replicate compaction values for each depth must be averaged to produce final values for each depth at each station. Reports will include all 18 values for each transect line, and the final six averaged compaction values.

c. If the average value for any depth exceeds 500 pounds per square inch (psi) for any two or more adjacent stations, then that area must be tilled immediately prior to May 1.

d. If values exceeding 500 psi are distributed throughout the project area but in no case do those values exist at two adjacent stations at the same depth, then consultation with the SCESFO will be required to determine if tilling is required. If a few values exceeding 500 psi are present randomly within the project area, tilling will not be required.

e. Tilling must occur landward of the wrack line and avoid all vegetated areas three square feet or greater with a one foot buffer around the vegetated areas.

T&C#11. Visual surveys for escarpments along the project area must be made immediately after completion of the sand placement and within 30 days prior to May 1 for three subsequent years if sand in the project area still remains on the dry beach. Escarpments that interfere with sea turtle nesting or that exceed 18 inches in height for a distance of 100 feet must be leveled and the beach profile must be reconfigured to minimize scarp formation by the dates listed above. Any escarpment removal must be reported by location. If the project is completed during the early part of the sea turtle nesting and hatching season, escarpments may be required to be leveled immediately, while protecting nests that have been relocated or left in place. The SCESFO must be contacted immediately if subsequent reformation of escarpments that interfere with sea turtle nesting or that exceed 18 inches in height for a distance of 100 feet occurs during the nesting and hatching season to determine the appropriate action to be taken. If it is determined that escarpment leveling is required during the nesting or hatching season, the SCESFO will provide a brief written authorization within 30 days that describes methods to be used to reduce the likelihood of impacting existing nests. An annual summary of escarpment surveys and actions taken must be submitted to the SCESFO.

Shorebirds

T&C#12. The placement area must be surveyed for piping plovers and red knots by qualified individuals before project construction to document presence/absence of each species. Surveys should be spaced at least 3 days apart so surveys must start at least 10 days before project construction activities begin. Surveys should be scheduled to start two hours after high tide. Piping plovers and red knots will be counted and band combinations (flags, flag color, flag code, band color, and band code) on any banded birds will be recorded. Band combinations must be confirmed through a spotting scope and/or a digital camera. Coordinates will be recorded in decimal degrees for each bird or flock of birds. Survey data must be entered into an Excel spreadsheet provided by the Service's SCESFO.

T&C#13. Signage visible at all stages of the tide will be posted on the Huntington State Park side of Murrells Inlet after project construction. No Dogs Allowed signs will be posted along inlet areas accessible by boat. To prevent people from walking through and disturbing high tide roosts, all sparsely vegetated habitat above the spring high tide line will be posted with symbolic fencing to create rest areas for piping plovers and other shorebirds.

9.4. Monitoring and Reporting Requirements

In order to monitor the impacts of incidental take, the Corps must report the progress of the Action and its impact on the species to the Service as specified in the ITS (50 CFR §402.14(i)(3)). This section provides the specific instructions for such monitoring and reporting (M&R). These M&R requirements are mandatory.

As necessary and appropriate to fulfill this responsibility, the Corps must require any permittee, contractor, or grantee to accomplish the M&R through enforceable terms that the Corps includes in the permit, contract, or grant document. Such enforceable terms must include a requirement to immediately notify the Corps and the Service if the amount or extent of incidental take specified in this ITS is exceeded during Action implementation.

M&R#1. Upon locating a dead or injured sea turtle adult, hatchling, or egg that may have been harmed or destroyed as a direct or indirect result of the project, the Corps, permittee, and/or local sponsor will be responsible for notifying the SCDNR Hotline (1-800-922-5431) and the SCESFO (843-727-4707). Care must be taken in handling injured sea turtles or eggs to ensure effective treatment or disposition, and in handling dead specimens to preserve biological materials in the best possible state for later analysis.

M&R #2. The Corps must provide the results of the shorebird surveys and sea turtle nest monitoring to the SCESFO and SCDNR.

10. CONSERVATION RECOMMENDATIONS

§7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by conducting conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary activities that an action agency may undertake to avoid or minimize the adverse effects of a proposed action, implement recovery plans, or develop information that is useful for the conservation of listed species. The Service offers the following recommendations that are relevant to the listed species addressed in this BO and that we believe are consistent with the authorities of the Corps.

CR #1. Purchase educational and protected area signs for shorebird habitat at Huntington Beach State Park.

CR#2. Purchase supplies for shorebird stewardship programs at Huntington Beach State Park.

11. REINITIATION NOTICE

Formal consultation for the Action considered in this BO and CO for proposed critical habitat for the rufa red knot is concluded. Reinitiating consultation is required if the Corps retains discretionary involvement or control over the Action (or is authorized by law) when:

a. The amount or extent of incidental take is exceeded;
b. New information reveals that the Action may affect listed species or designated critical habitat in a manner or to an extent not considered in this BO;
c. The Action is modified in a manner that causes effects to listed species or designated critical habitat not considered in this BO; or
d. A new species is listed, or critical habitat designated that the Action may affect.

In instances where the amount or extent of incidental take is exceeded, the Corps is required to immediately request a reinitiation of formal consultation.

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