



# United States Department of the Interior

FISH AND WILDLIFE SERVICE  
South Florida Ecological Services Office  
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January 2, 2002

Dale Beter  
U.S. Army Corps of Engineers  
West Palm Beach Regulatory Office  
400 North Congress Avenue, Suite 130  
West Palm Beach, Florida 33401

Service Log No.: 4-1-01-F-652  
Application No.: 199401196(IP-DSG)  
Dated: September 10, 2001  
Project: Boca Raton Beach Renourishment  
Applicant: City of Boca Raton  
County: Palm Beach

Dear Mr. Beter:

This document transmits the Fish and Wildlife Service's (Service) biological opinion based on our review of the proposed beach renourishment project located in Palm Beach County, Florida, and its effects on the threatened loggerhead sea turtle (*Caretta caretta*), the endangered leatherback sea turtle (*Dermochelys coriacea*), and the endangered green sea turtle (*Chelonia mydas*) in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

This biological opinion is based on information provided in the Public Notice referenced above, and provided by the Florida Fish and Wildlife Conservation Commission (FWC). A complete administrative record of this consultation is on file at the South Florida Ecological Services Field Office, Vero Beach, Florida.

## CONSULTATION HISTORY

In the public notice, the U.S. Army Corps of Engineers (Corps) made a determination of "may affect, not likely to adversely affect" the West Indian manatee (*Trichechus manatus*), provided that the standard manatee construction procedures are followed. The Corps also made a determination of "may affect, not likely to adversely affect" nesting sea turtles. In a letter dated November 19, 2001, the Corps requested the Service to initiate formal consultation. In a letter dated December 12, 2001, the Service concurred with the Corps determination for the West Indian manatee. However, the Service did not concur with the determination for sea turtles, and

thus initiated formal consultation pursuant to section 7 of the ESA, as described in 50 CFR§402.14, for the proposed project. In accordance with the ESA, the Service is providing the following Biological Opinion.

## BIOLOGICAL OPINION

### DESCRIPTION OF THE PROPOSED ACTION

The applicant proposes to apply about 300,000 cubic yards of sand to restore and stabilize 5,060 feet of beach. The project would extend the current beach 138 feet seaward and result in a beach with a slope of 1V:10H. The proposed renourishment would affect about 13 acres of unvegetated bottoms and 2.39 acres of nearshore hardbottom reef. The applicant proposes to obtain sand for the project by dredging material from a shoal located about 250 feet east of the Boca Raton Inlet. The dredged material has a mean grain size of 0.38 mm and an estimated silt content of 0.77 percent. Dredging at the borrow site would affect about 28.3 acres of unvegetated bottom. The purpose of the project is to provide storm protection for buildings, a public park, and State Road A1A. To compensate for the burial of nearshore hardbottom reef resulting from the project, the applicant proposes to construct 2.39 acres of artificial reef within 1-year of completion of the project. The project site is located in the Atlantic Ocean from Florida Department of Environmental Protection monuments R-223 to R-227, in Sections 32 and 28, Township 47 South, Range 43 East, Boca Raton, Palm Beach County, Florida. The applicant did not indicate what time of year the project would occur.

### STATUS OF THE SPECIES

#### Species description

##### Loggerhead Sea Turtle

The loggerhead sea turtle (*Caretta caretta*), listed as a threatened species on July 28, 1978 (43 FR 32800), inhabits the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. Loggerhead sea turtles nest within the continental U.S. from Louisiana to Virginia. Major nesting concentrations in the U.S. are found on the coastal islands of North Carolina, South Carolina, and Georgia, and on the Atlantic and Gulf coasts of Florida (Hopkins and Richardson 1984). No critical habitat has been designated for the loggerhead sea turtle.

##### Green Sea Turtle

The green sea turtle (*Chelonia mydas*) was federally listed as a protected species on July 28, 1978 (43 FR 32800). Breeding populations of the green turtle in Florida and along the Pacific Coast of Mexico are listed as endangered; all other populations are listed as threatened. The green turtle

has a worldwide distribution in tropical and subtropical waters. Major green turtle nesting colonies in the Atlantic occur on Ascension Island, Aves Island, Costa Rica, and Surinam. Within the U.S., green turtles nest in small numbers in the U.S. Virgin Islands and Puerto Rico, and in larger numbers along the east coast of Florida, particularly in Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward Counties (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991a). Nesting also has been documented along the Gulf coast of Florida on Santa Rosa Island (Okaloosa and Escambia Counties) and from Pinellas County through Collier County (Florida Department of Environmental Protection, unpublished data). Green turtles have been known to nest in Georgia, but only on rare occasions (Georgia Department of Natural Resources, unpublished data). The green turtle also nests sporadically in North Carolina and South Carolina (North Carolina Wildlife Resources Commission, unpublished data; South Carolina Department of Natural Resources, unpublished data). Unconfirmed nesting of green turtles in Alabama has also been reported (Bon Secour National Wildlife Refuge, unpublished data). Critical habitat for the green sea turtle has been designated for the waters surrounding Culebra Island, Puerto Rico, and its outlying keys.

#### Leatherback Sea Turtle

The leatherback sea turtle (*Dermochelys coriacea*), listed as an endangered species on June 2, 1970 (35 FR 8491), nests on shores of the Atlantic, Pacific and Indian Oceans. Non-breeding animals have been recorded as far north as the British Isles and the Maritime Provinces of Canada and as far south as Argentina and the Cape of Good Hope (Pritchard 1992). Nesting grounds are distributed worldwide, with the Pacific Coast of Mexico supporting the world's largest known concentration of nesting leatherbacks. The largest nesting colony in the wider Caribbean region is found in French Guiana, but nesting occurs frequently, although in lesser numbers, from Costa Rica to Columbia and in Guyana, Surinam, and Trinidad (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1992, National Research Council 1990a).

The leatherback regularly nests in the U.S. in Puerto Rico, the U.S. Virgin Islands, and along the Atlantic coast of Florida as far north as Georgia (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1992). Leatherback turtles have been known to nest in Georgia, South Carolina, and North Carolina, but only on rare occasions (Murphy 1996, Winn 1996, Boettcher 1998). Leatherback nesting also has been reported on the northwest coast of Florida (LeBuff 1990; Florida Department of Environmental Protection, unpublished data); a false crawl (non-nesting emergence) has been observed on Sanibel Island (LeBuff 1990). Marine and terrestrial critical habitat for the leatherback sea turtle has been designated at Sandy Point on the western end of the island of St. Croix, U.S. Virgin Islands.

## Life history

### Loggerhead Sea Turtle

Loggerheads are known to nest from one to seven times within a nesting season (Talbert *et al.* 1980, Richardson and Richardson 1982, Lenarz *et al.* 1981, among others); the mean is approximately 4.1 (Murphy and Hopkins 1984). The interval between nesting events within a season varies around a mean of about 14 days (Dodd 1988). Mean clutch size varies from about 100 to 126 along the southeastern United States coast (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991b). Nesting migration intervals of 2 to 3 years are most common in loggerheads, but the number can vary from 1 to 7 years (Dodd 1988). Age at sexual maturity is believed to be about 20 to 30 years (Turtle Expert Working Group 1998).

### Green Sea Turtle

Green turtles deposit from one to nine clutches within a nesting season, but the overall average is about 3.3. The interval between nesting events within a season varies around a mean of about 13 days (Hirth 1997). Mean clutch size varies widely among populations. Average clutch size reported for Florida was 136 eggs in 130 clutches (Witherington and Ehrhart 1989). Only occasionally do females produce clutches in successive years. Usually 2, 3, 4, or more years intervene between breeding seasons (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991a). Age at sexual maturity is believed to be 20 to 50 years (Hirth 1977).

### Leatherback Sea Turtle

Leatherbacks nest an average of five to seven times within a nesting season, with an observed maximum of 11 (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1992). The interval between nesting events within a season is about 9 to 10 days. Clutch size averages 101 eggs on Hutchinson Island, Florida (Martin 1992). Nesting migration intervals of 2 to 3 years were observed in leatherbacks nesting on the Sandy Point National Wildlife Refuge, St. Croix, U.S. Virgin Islands (McDonald and Dutton 1996). Leatherbacks are believed to reach sexual maturity in 6 to 10 years (Zug and Parham 1996).

## Population dynamics

### Loggerhead Sea Turtle

Total estimated nesting in the Southeast is approximately 50,000 to 70,000 nests per year (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991b). In 1998, there were over 80,000 nests in Florida alone. From a global perspective, the southeastern U.S. nesting aggregation is of paramount importance to the survival of the species and is second in size only to that which nests on islands in the Arabian Sea off Oman (Ross 1982, Ehrhart 1989, National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991b). The status

of the Oman colony has not been evaluated recently, but its location in a part of the world that is vulnerable to disruptive events (e.g., political upheavals, wars, catastrophic oil spills) is cause for considerable concern (Meylan *et al.* 1995). The loggerhead nesting aggregations in Oman, the southeastern U.S., and Australia account for about 88 percent of nesting worldwide (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991b). About 80 percent of loggerhead nesting in the southeastern U.S. occurs in six Florida counties (Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward Counties) (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991b).

### Green Sea Turtle

About 200 to 1,100 females are estimated to nest on beaches in the continental U.S. In the U.S. Pacific, over 90 percent of nesting throughout the Hawaiian archipelago occurs at the French Frigate Shoals, where about 200 to 700 females nest each year. Elsewhere in the U.S. Pacific, nesting takes place at scattered locations in the Commonwealth of the Northern Marianas, Guam, and American Samoa. In the western Pacific, the largest green turtle nesting aggregation in the world occurs on Raine Island, Australia, where thousands of females nest nightly in an average nesting season. In the Indian Ocean, major nesting beaches occur in Oman where 6,000 to 20,000 females are reported to nest annually.

### Leatherback Sea Turtle

Recent estimates of global nesting populations indicate 26,000 to 43,000 nesting females annually (Spotila *et al.* 1996). The largest nesting populations at present occur in the western Atlantic in French Guiana (4,500 to 7,500 females nesting/year) and Colombia (estimated several thousand nests annually), and in the western Pacific in West Papua (formerly Irian Jaya) and Indonesia (about 600 to 650 females nesting/year). In the United States, small nesting populations occur on the Florida east coast (35 females/year), Sandy Point, U.S. Virgin Islands (50 to 100 females/year), and Puerto Rico (30 to 90 females/year).

### Status and distribution

#### Loggerhead Sea Turtle

Genetic research (mtDNA) has identified four loggerhead nesting subpopulations in the western North Atlantic: (1) the Northern Subpopulation occurring from North Carolina to around Cape Canaveral, Florida (about 29° N.); (2) South Florida Subpopulation occurring from about 29° N. on Florida's east coast to Sarasota on Florida's west coast; (3) Northwest Florida Subpopulation occurring at Eglin Air Force Base and the beaches near Panama City; and (4) Yucatán Subpopulation occurring on the eastern Yucatán Peninsula, Mexico (Bowen 1994, 1995; Bowen *et al.* 1993; Encalada *et al.* 1998). These data indicate that gene flow between these four regions is very low. If nesting females are extirpated from one of these regions, regional dispersal will not be sufficient to replenish the depleted nesting subpopulation. The Northern

Subpopulation has declined substantially since the early 1970s, but most of that decline occurred prior to 1979. No significant trend has been detected in recent years (Turtle Expert Working Group 1998, 2000). Adult loggerheads of the South Florida Subpopulation have shown significant increases over the last 25 years, indicating that the population is recovering, although a trend could not be detected from the State of Florida's Index Nesting Beach Survey program from 1989 to 1998. Nesting surveys in the Northwest Florida and Yucatán Subpopulations have been too irregular to date to allow for a meaningful trend analysis (Turtle Expert Working Group 1998, 2000).

Threats include incidental take from channel dredging and commercial trawling, longline, and gill net fisheries; loss or degradation of nesting habitat from coastal development and beach armoring; disorientation of hatchlings by beachfront lighting; excessive nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; watercraft strikes; and disease. There is particular concern about the extensive incidental take of juvenile loggerheads in the eastern Atlantic by longline fishing vessels from several countries.

#### Green Sea Turtle

Total population estimates for the green turtle are unavailable, and trends based on nesting data are difficult to assess because of large annual fluctuations in numbers of nesting females. For instance, in Florida, where the majority of green turtle nesting in the southeastern U.S. occurs, estimates range from 200 to 1,100 females nesting annually. Populations in Surinam, and Tortuguero, Costa Rica, may be stable, but there is insufficient data for other areas to confirm a trend.

A major factor contributing to the green turtle's decline worldwide is commercial harvest for eggs and food. Fibropapillomatosis, a disease of sea turtles characterized by the development of multiple tumors on the skin and internal organs, is also a mortality factor and has seriously impacted green turtle populations in Florida, Hawaii, and other parts of the world. The tumors interfere with swimming, eating, breathing, vision, and reproduction, and turtles with heavy tumor burdens may die. Other threats include loss or degradation of nesting habitat from coastal development and beach armoring; disorientation of hatchlings by beachfront lighting; excessive nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; watercraft strikes; and incidental take from channel dredging and commercial fishing operations.

#### Leatherback Sea Turtle

Declines in leatherback nesting have occurred over the last two decades along the Pacific coasts of Mexico and Costa Rica. The Mexican leatherback nesting population, once considered to be the world's largest leatherback nesting population (65 percent of worldwide population), is now less than one percent of its estimated size in 1980. Spotila *et al.* (1996) recently estimated the number of leatherback sea turtles nesting on 28 beaches throughout the world from the literature

and from communications with investigators studying those beaches. The estimated worldwide population of leatherbacks in 1995 was about 34,500 females on these beaches with a lower limit of about 26,200 and an upper limit of about 42,900. This is less than one third the 1980 estimate of 115,000. Leatherbacks are rare in the Indian Ocean and in very low numbers in the western Pacific Ocean. The largest population is in the western Atlantic. Using an age-based demographic model, Spotila *et al.* determined that leatherback populations in the Indian Ocean and western Pacific Ocean cannot withstand even moderate levels of adult mortality and that even the Atlantic populations are being exploited at a rate that cannot be sustained. They concluded that leatherbacks are on the road to extinction and further population declines can be expected unless we take action to reduce adult mortality and increase survival of eggs and hatchlings.

The crash of the Pacific leatherback population is believed primarily to be the result of exploitation by humans for the eggs and meat, as well as incidental take in numerous commercial fisheries of the Pacific. Other factors threatening leatherbacks globally include loss or degradation of nesting habitat from coastal development; disorientation of hatchlings by beachfront lighting; excessive nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; and watercraft strikes.

#### Analysis of the species likely to be affected

The proposed action has the potential to adversely affect nesting females, nests, and hatchlings within the proposed project area. The effects of the proposed action on sea turtles will be considered further in the remaining sections of this biological opinion. Potential effects include destruction of nests deposited within the boundaries of the proposed project, 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 due to escarpment formation within the project area during a nesting season resulting in false crawls or situations where they choose marginal or unsuitable nesting areas to deposit eggs. The quality of the placed sand could affect the ability of female turtles to nest, the suitability of the nest incubation environment, and the ability of hatchlings to emerge from the nest. Critical habitat has not been designated in the continental United States; therefore, the proposed action would not result in an adverse modification.

## ENVIRONMENTAL BASELINE

### Status of the species within the action area

#### Loggerhead Sea Turtle

The loggerhead sea turtle nesting and hatching season for Palm Beach County extends from March 15 through November 30. Incubation ranges from about 45 to 95 days. The FWC's marine turtle permit holders conduct surveys of sea turtle nesting and nesting activity each year during the nesting season for various sites in Palm Beach County. Nesting and false crawl data for loggerhead sea turtles, for a 1-mile segment of beach from the Boca Raton Inlet to the Broward County line for the years 1995 to 2001, are presented in Table 1. The area surveyed includes the entire project site. The number of loggerhead sea turtle nests observed ranged from 141 in 2001 to 232 in 1995.

#### Green Sea Turtle

The green sea turtle nesting and hatching season for Palm Beach county extends from May 1 through November 30. Incubation ranges from about 45 to 75 days. Nesting and false crawl data for green sea turtles provided by the FWC, for a 1-mile segment of beach from the Boca Raton Inlet to the Broward County line for the years 1995 to 2001, are presented in Table 1. The area surveyed includes the entire project site. The number of green sea turtle nests observed ranged from three in 1998 to 11 in 2000.

#### Leatherback Sea Turtle

The leatherback sea turtle nesting and hatching season for Palm Beach County extends from February 15 through November 15. Incubation ranges from about 55 to 75 days. Nesting and false crawl data for leatherback sea turtles provided by the FWC, for a 1-mile segment of beach from the Boca Raton Inlet to the Broward County line, for the years 1995 to 2001, are presented in Table 1. The area surveyed includes the entire project site. The number of leatherback sea turtle nests observed ranged from 0 in 1995, 1996, and 1998 to two in 1997, 1999, and 2001.



Table 1. Sea turtle nesting and false crawl data\* for the beach from the Boca Raton Inlet to the Broward County line, Boca Raton, Palm Beach County, Florida, for the years 1995 to 2001.

Year	Number of <i>Caretta</i> <i>carretta</i> Nests	Number of <i>C. carretta</i> False Crawls	Number of <i>Chelonia</i> , <i>mydas</i> Nests	Number of <i>C. mydas</i> False Crawls	Number of <i>Dermochelys</i> <i>coriacea</i> Nests	Number of <i>D. coriacea</i> False Crawls
1995	232	259	8	13	0	0
1996	212	204	8	6	0	0
1997	134	129	5	6	2	2
1998	163	233	3	5	0	0
1999	206	176	8	5	2	0
2000	173	148	11	2	1	0
2001	141	116	8	6	2	0

\*Data provided by the FWC.

## EFFECTS OF THE ACTION

### Analyses for effects of the action

#### Beneficial Effects

The placement of sand on a beach with reduced dry fore-dune 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 be more stable than the eroding one it replaces, thereby benefitting sea turtles.

#### Direct Effects

Placement of sand on a beach in and of itself may not provide suitable nesting habitat for sea turtles. Although beach nourishment may increase the potential nesting area, significant negative impacts to sea turtles may result if protective measures are not incorporated during project construction. Nourishment during the nesting season, particularly on or near high density nesting beaches, can cause increased loss of eggs and hatchlings and, along with other mortality sources, may significantly impact the long-term survival of the species. For instance, projects conducted during the nesting and hatching season could result in the loss of sea turtles through disruption of

adult nesting activity and by burial or crushing of nests or hatchlings. While a nest monitoring and egg relocation program would reduce these impacts, nests may be inadvertently missed (when crawls are obscured by rainfall, wind, and/or tides) or misidentified as false crawls during daily patrols. In addition, nests may be destroyed by operations at night prior to beach patrols being performed. Even under the best of conditions, about 7 percent of the nests can be misidentified as false crawls by experienced sea turtle nest surveyors (Schroeder 1994).

### 1. Nest relocation

Besides the potential for missing nests during a nest relocation program, there is a potential for eggs to be damaged by their movement, particularly if eggs are not relocated within 12 hours of deposition (Limpus *et al.* 1979). Nest relocation can have adverse impacts on incubation temperature (and hence sex ratios), gas exchange parameters, hydric environment of nests, hatching success, and hatchling emergence (Limpus *et al.* 1979, Ackerman 1980, Parmenter 1980, Spotila *et al.* 1983, McGehee 1990). Relocating nests 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).

Comparisons of hatching success between relocated and *in situ* nests have noted significant variation ranging from a 21 percent decrease to a 9 percent increase for relocated nests (Florida Department of Environmental Protection, unpublished data). Comparisons of emergence success between relocated and *in situ* nests have also noted significant variation ranging from a 23 percent decrease to a 5 percent increase for relocated nests (Florida Department of Environmental Protection, unpublished data). A 1994 Florida Department of Environmental Protection study of hatching and emergence success of *in situ* and relocated nests at seven sites in Florida found that hatching success was lower for relocated nests in five of seven cases with an average decrease for all seven sites of 5.01 percent (range = 7.19 percent increase to 16.31 percent decrease). Emergence success was lower for relocated nests in all seven cases by an average of 11.67 percent (range = 3.6 to 23.36 percent) (Meylan 1995).

### 2. Equipment

The placement of pipelines and the use of heavy machinery on the beach during a construction project may also have adverse effects on sea turtles. They 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.

### 3. Artificial lighting

Visual cues are the primary sea-finding mechanism for hatchling sea turtles (Mrosovsky and Carr 1967, Mrosovsky and Shettleworth 1968, Dickerson and Nelson 1989, Witherington and

Bjorndal 1991). When artificial lighting is present on or near the beach, it can misdirect hatchlings once they emerge from their nests and prevent them from reaching the ocean (Philbosian 1976; Mann 1977; Florida Department of Environmental Protection, unpublished data). In addition, a significant reduction in sea turtle nesting activity has been documented on beaches illuminated with artificial lights (Witherington 1992). Therefore, construction lights along a project beach and on the dredging vessel may deter females from coming ashore to nest, misdirect females trying to return to the surf after a nesting event, and misdirect emergent hatchlings from adjacent non-project beaches. Any source of bright lighting can profoundly affect the orientation of hatchlings, both during the crawl from the beach to the ocean and once they begin swimming offshore. Hatchlings attracted to light sources on dredging barges may not only suffer from interference in migration, but may also experience higher probabilities of predation to predatory fishes that are also attracted to the barge lights. This impact could be reduced by using the minimum amount of light necessary (may require shielding) or low pressure sodium lighting during project construction.

#### Indirect Effects

Many of the direct effects of beach nourishment 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, the formation of escarpments, and future sand migration.

##### 1. Increased susceptibility to catastrophic events

Nest relocation 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).

##### 2. Increased beachfront development

Pilkey and Dixon (1996) state that beach replenishment frequently leads to more development in greater density within shorefront communities that are then left with a future of further replenishment or more drastic stabilization measures. Dean (1999) also notes that the very existence of a beach nourishment project can encourage more development in coastal areas. Following completion of a beach nourishment project in Miami during 1982, investment in new and updated facilities substantially increased tourism there (National Research Council 1995). Increased building density immediately adjacent to the beach often resulted as older buildings were replaced by much larger ones that accommodated more beach users. Overall, shoreline management creates an upward spiral of initial protective measures resulting in more expensive development which leads to the need for more and larger protective measures. Increased shoreline development may adversely affect sea turtle nesting success. Greater development may support larger populations of mammalian predators, such as foxes and raccoons, than undeveloped areas (National Research Council 1990a), and can also result in greater adverse effects due to artificial lighting, as discussed above.

### 3. Changes in the physical environment

Beach nourishment may result in changes in sand density (compaction), beach shear resistance (hardness), beach moisture content, beach slope, sand color, sand grain size, sand grain shape, and sand grain mineral content if the placed sand is dissimilar from the original beach sand (Nelson and Dickerson 1988a). These changes could result in adverse impacts on nest site selection, digging behavior, clutch viability, and emergence by hatchlings (Nelson and Dickerson 1987, Nelson 1988).

Beach compaction and unnatural beach profiles that may result from beach nourishment activities could negatively impact sea turtles regardless of the timing of projects. Very fine sand and/or the use of heavy machinery can cause sand compaction on nourished beaches (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 nourished 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. Sand compaction may increase the length of time required for female sea turtles to excavate nests and also cause increased physiological stress to the animals (Nelson and Dickerson 1988c). Nelson and Dickerson (1988b) concluded that, in general, beaches nourished from offshore borrow sites are harder than natural beaches, and while some may soften over time through erosion and accretion of sand, others may remain hard for 10 years or more.

These impacts can be minimized by using suitable sand and by tilling compacted sand after project completion. The level of compaction of a beach can be assessed by measuring sand compaction using a cone penetrometer (Nelson 1987). Tilling of a nourished beach with a root rake may reduce the sand compaction to levels comparable to unnourished beaches. However, a pilot study by Nelson and Dickerson (1988c) showed that a tilled nourished beach will remain uncompacted for up to 1 year. Therefore, the Service requires multi-year beach compaction monitoring and, if necessary, tilling to ensure that project impacts on sea turtles are minimized.

A change in sediment color on a beach could change the natural incubation temperatures of nests in an area, which, in turn, could alter natural sex ratios. To provide the most suitable sediment for nesting sea turtles, the color of the nourished sediments must resemble the natural beach sand in the area. Natural reworking of sediments and bleaching from exposure to the sun would help to lighten dark nourishment sediments; however, the timeframe for sediment mixing and bleaching to occur could be critical to a successful sea turtle nesting season.

### 4. Escarpment formation

On nourished beaches, steep escarpments may develop along their water line interface as they adjust from an unnatural construction profile to a more natural beach profile (Coastal Engineering Research Center 1984, Nelson *et al.* 1987). These escarpments can hamper or prevent access to nesting sites (Nelson and Blihovde 1998). Researchers have shown that female turtles coming ashore to nest can be discouraged by the formation of an escarpment, leading to situations where they choose marginal or unsuitable nesting areas to deposit eggs (e.g., in front of

the escarpments, which often results in failure of nests due to prolonged tidal inundation). This impact can be minimized by leveling any escarpments prior to the nesting season.

## 5. Erosion

Future sand displacement on nesting beaches is a potential effect of the nourishment project. Dredging of sand offshore from a project area has the potential to cause erosion of the newly created beach or other areas on the same or adjacent beaches by creating a sand sink. The remainder of the system responds to this sand sink by providing sand from the beach to attempt to reestablish equilibrium (National Research Council 1990b).

### Species' response to the proposed action

Ernest and Martin (1999) conducted a comprehensive study to assess the effects of beach nourishment on loggerhead sea turtle nesting and reproductive success. The following findings illustrate sea turtle responses to and recovery from a nourishment project. A significantly larger proportion of turtles emerging on nourished beaches abandoned their nesting attempts than turtles emerging on Control or pre-nourished beaches. This reduction in nesting success was most pronounced during the first year following project construction and is most likely the result of changes in physical beach characteristics associated with the nourishment project (e.g., beach profile, sediment grain size, beach compaction, frequency and extent of escarpments). During the first post-construction year, the time required for turtles to excavate an egg chamber on the untilled, hard-packed sands of one treatment area increased significantly relative to Control and background conditions. However, in another treatment area, tilling was effective in reducing sediment compaction to levels that did not significantly prolong digging times. As natural processes reduced compaction levels on nourished beaches during the second post-construction year, digging times returned to background levels.

During the first post-construction year, nests on the nourished beaches were deposited significantly farther from both the toe of the dune and the tide line than nests on Control beaches. Furthermore, nests were distributed throughout all available habitat and were not clustered near the dune as they were in the Control. As the width of nourished beaches decreased during the second year, among-treatment differences in nest placement diminished. More nests were washed out on the wide, flat beaches of the nourished treatments than on the narrower steeply sloped beaches of the Control. This phenomenon persisted through the second post-construction year monitoring and resulted from the placement of nests near the seaward edge of the beach berm where dramatic profile changes, caused by erosion and scarping, occurred as the beach equilibrated to a more natural contour.

As with other beach nourishment projects, Ernest and Martin (1999) found that the principal effect of nourishment on sea turtle reproduction was a reduction in nesting success during the first year following project construction. Although most studies have attributed this phenomenon to an increase in beach compaction and escarpment formation, Ernest and Martin indicate that changes in beach profile may be more important. Regardless, as a nourished beach is reworked

by natural processes in subsequent years and adjusts from an unnatural construction profile to a more natural beach profile, beach compaction and the frequency of escarpment formation decline, and nesting and nesting success return to levels found on natural beaches.

### CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. The Service is not aware of any cumulative effects in the project area.

### CONCLUSION

After reviewing the current status of the loggerhead, the leatherback, and the green sea turtle, the environmental baseline for the action area, the effects of the proposed beach nourishment, and the cumulative effects, it is the Service's biological opinion that the beach nourishment project, as proposed, is not likely to jeopardize the continued existence of these three species, and is not likely to destroy or adversely modify designated critical habitat. However, no critical habitat has been designated for the loggerhead, the leatherback, and the green sea turtle in the continental United States; therefore, none will be affected.

The proposed project will affect only 5,060 feet of the approximately 1,400 miles of available sea turtle nesting habitat in the southeastern U.S. Research has shown that the principal effect of beach nourishment on sea turtle reproduction is a reduction in nesting success, and this reduction is most often limited to the first year following project construction. Research has also shown that the impacts of a nourishment project on sea turtle nesting habitat are typically short-term because a nourished beach will be reworked by natural processes in subsequent years, and beach compaction and the frequency of escarpment formation will decline. Although a variety of factors, including some that cannot be controlled, can influence how a nourishment project will perform from an engineering perspective, measures can be implemented to minimize impacts to sea turtles.

### INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered or threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which

include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be implemented by the Corps so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps, (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impacts on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

#### AMOUNT OR EXTENT OF TAKE

The Service anticipates 5,060 feet of nesting beach habitat could be taken as a result of this proposed action. The take is expected to be in the form of: (1) destruction of all nests that may be constructed and eggs that may be deposited from March 1 through April 30 and from September 1 through September 30 and missed by a nest survey and egg relocation program within the boundaries of the proposed project; (2) destruction of all nests deposited from October 1 through February 28 (or 29 as applicable) when a nest survey and egg relocation program is not required to be in place within the boundaries of the proposed project; (3) reduced hatching success due to egg mortality during relocation and adverse conditions at the relocation site; (4) 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; (5) misdirection 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; (6) behavior modification of nesting females due to escarpment formation within the project area during a nesting season, resulting in false crawls or situations where they choose marginal or unsuitable nesting areas to deposit eggs; and (7) destruction of nests from escarpment leveling within a nesting season when such leveling has been approved by the Fish and Wildlife Service.

Incidental take is anticipated for only the 5,060 feet of beach that have been identified for sand placement. The Service anticipates incidental take of sea turtles will be difficult to detect for the following reasons: (1) the turtles nest primarily at night and all nests are not found because [a] natural factors, such as rainfall, wind, and tides may obscure crawls and [b] human-caused factors, such as pedestrian and vehicular traffic, may obscure crawls, and result in nests being destroyed because they were missed during a nesting survey and egg relocation program; (2) the total number of hatchlings per undiscovered nest is unknown; (3) the reduction in percent

hatching and emerging success per relocated nest over the natural nest site is unknown; (4) an unknown number of females may avoid the project beach and be forced to nest in a less than optimal area; (5) lights may misdirect an unknown number of hatchlings and cause death; and (6) escarpments may form and cause an unknown number of females from accessing a suitable nesting site. However, the level of take of these species can be anticipated by the disturbance and renourishment of suitable turtle nesting beach habitat because: (1) turtles nest within the project site; (2) beach renourishment will likely occur during a portion of the nesting season; (3) the renourishment project will modify the incubation substrate, beach slope, and sand compaction; and (4) artificial lighting will deter and/or misdirect nesting females and hatchlings.

## EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species. Critical habitat has not been designated in the project area; therefore, the project will not result in destruction or adverse modification of critical habitat.

## REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of the loggerhead, the leatherback, and the green sea turtle.

1. Beach quality sand suitable for sea turtle nesting, successful incubation, and hatchling emergence must be used on the project site.
2. Beach nourishment activities must not occur from May 1 through October 31, the period of peak sea turtle egg laying and egg hatching, to reduce the possibility of sea turtle nest burial or crushing of eggs.
3. If the beach nourishment project will be conducted during the period from March 1 through April 30, surveys for early nesting sea turtles must be conducted. If nests are constructed in the area of beach nourishment, the eggs must be relocated.
4. If the beach nourishment project will be conducted during the period from November 1 through November 30, surveys for late nesting sea turtles must be conducted. If nests are constructed in the area of beach nourishment, the eggs must be relocated.
5. Immediately after completion of the beach nourishment project and prior to the next three nesting seasons, beach compaction must be monitored and tilling must be conducted as required by March 1 to reduce the likelihood of impacting sea turtle nesting and hatching activities. The March 1 deadline is required to reduce impacts to leatherbacks that nest in greater frequency along the South Atlantic coast of Florida than elsewhere in the continental United States.



6. Immediately after completion of the beach nourishment project and prior to the next three nesting seasons, monitoring must be conducted to determine if escarpments are present and escarpments must be leveled as required to reduce the likelihood of impacting sea turtle nesting and hatching activities.

7. The applicant must ensure that contractors doing the beach nourishment work fully understand the sea turtle protection measures detailed in this incidental take statement.

8. During the early and late portions of the nesting season, construction equipment and pipes must be stored in a manner that will minimize impacts to sea turtles to the maximum extent practicable.

9. During the early and late portions of the nesting season, lighting associated with the project must be minimized to reduce the possibility of disrupting and misdirecting nesting and/or hatchling sea turtles.

#### TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. All fill material placed must be sand that is analogous to a native beach in the vicinity of the site that has not been affected by prior renourishment activities. The fill material must be equivalent in both coloration and grain size distribution to the native beach. All such fill material must be free of construction debris, rocks, or other foreign matter and must not contain, on average, greater than 5 percent fines (i.e., silt and clay) (passing the #200 sieve) and must not contain, on average, greater than 5 percent coarse gravel or cobbles, exclusive of shell material (retained by the #4 sieve).

2. Beach nourishment must be started after October 31 and be completed before May 1. During the May 1 through October 31 period, no construction equipment or pipes will be stored on the beach.

3. If the beach nourishment project will be conducted during the period from March 1 through April 30, daily early morning surveys for sea turtle nests must be conducted from March 1 through April 30 or until completion of the project (whichever is earliest), and eggs must be relocated per the following requirements.

3a. Nesting surveys and egg relocations will only be conducted by personnel with prior experience and training in nesting survey and egg relocation procedures. Surveyors must have a valid FWC permit. Nesting surveys must be conducted daily between sunrise and

9 a.m. Surveys must be performed in such a manner so as to ensure that construction activity does not occur in any location prior to completion of the necessary sea turtle protection measures.

3b. Only those nests that may be affected by construction activities will be relocated. Nests requiring relocation must be moved no later than 9 a.m. the morning following deposition to a nearby self-release beach site in a secure setting where artificial lighting will not interfere with hatchling orientation. Nest relocations in association with construction activities must cease when construction activities no longer threaten nests. Nests deposited within areas where construction activities have ceased or will not occur for 65 days must be marked and left in place unless other factors threaten the success of the nest. Any nests left in the active construction zone must be clearly marked, and all mechanical equipment must avoid nests by at least 10 feet.

4. If the beach nourishment project will be conducted during the period from November 1 through November 30, daily early morning sea turtle nesting surveys must be conducted 65 days prior to project initiation and continue through September 30, and eggs must be relocated per the preceding requirements.

5. Immediately after completion of the beach nourishment project and prior to March 1 for 3 subsequent years, sand compaction must be monitored in the area of restoration in accordance with a protocol agreed to by the Service, the State regulatory agency, and the applicant. At a minimum, the protocol provided under 5a and 5b below must be followed. If required, the area must be tilled to a depth of 36 inches. All tilling activity must be completed prior to March 1. An annual summary of compaction surveys and the actions taken must be submitted to the Service. (NOTE: The requirement for compaction monitoring can be eliminated if the decision is made to till regardless of post-construction compaction levels. Also, out-year compaction monitoring and remediation are not required if placed material no longer remains on the beach.)

5a. Compaction sampling stations must be located at 500-foot intervals along the project area. 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).

At each station, the cone penetrometer will 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 lay over less compact layers. Replicates will be located as close to each other as possible, without interacting with the previous hole and/or disturbed sediments.

The three replicate compaction values for each depth will 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 6 averaged compaction values.

5b. 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 prior to March 1. 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 Fish and Wildlife Service 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.

6. Visual surveys for escarpments along the project area must be made immediately after completion of the beach nourishment project and prior to March 1 for 3 subsequent years. Escarpments that interfere with sea turtle nesting or that exceed 18 inches in height for a distance of 100 feet must be leveled to the natural beach contour by March 1. If the project is completed during the early part of the sea turtle nesting and hatching season (March 1 through April 30), escarpments may be required to be leveled immediately, while protecting nests that have been relocated or left in place. The Service 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 Service will provide a brief written authorization 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 Service. (NOTE: Out-year escarpment monitoring and remediation are not required if placed material no longer remains on the dry beach.)

7. The applicant must arrange a meeting between representatives of the contractor, the Service, the FWC, and the permitted person responsible for egg relocation at least 30 days prior to the commencement of work on this project. At least 10 days advance notice must be provided prior to conducting this meeting. This will provide an opportunity for explanation and/or clarification of the sea turtle protection measures.

8. From March 1 through April 30 and November 1 through November 30, staging areas for construction equipment must be located off the beach to the maximum extent practicable. 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 that are placed on the beach must be located as far landward as possible without compromising the integrity of the existing or reconstructed dune system. Temporary storage of pipes must be off the beach to the maximum extent possible. Temporary storage of pipes

on the beach must be in such a manner so as to impact the least amount of nesting habitat and must likewise not compromise the integrity of the dune systems (placement of pipes perpendicular to the shoreline is recommended as the method of storage).

9. From March 1 through April 30 and November 1 through November 30, all on-beach lighting associated with the project must be limited to the immediate area of active construction only and must be the minimal lighting necessary to comply with safety requirements. Shielded low pressure sodium vapor lights are recommended to minimize illumination of the nesting beach and nearshore waters. Lighting on offshore equipment must be minimized through reduction, shielding, lowering, and appropriate placement of lights to avoid excessive illumination of the water, while meeting all U.S. Coast Guard and OSHA requirements. Shielded low pressure sodium vapor lights are highly recommended for lights on offshore equipment that cannot be eliminated.

10. A report describing the actions taken to implement the terms and conditions of this incidental take statement must be submitted to the South Florida Ecological Services Field Office, Vero Beach, within 60 days of completion of the proposed work for each year when the activity has occurred. This report will include the dates of actual construction activities, names and qualifications of personnel involved in nest surveys and relocation activities, descriptions and locations of self-release beach sites, nest survey and relocation results, and hatching success of nests.

11. In the event a sea turtle nest is excavated during construction activities, the permitted person responsible for egg relocation for the project must be notified so the eggs can be moved to a suitable relocation site.

12. Upon locating a sea turtle adult, hatchling, or egg harmed or destroyed as a direct or indirect result of the project, notification must be made to the FWC Bureau of Marine Enforcement, toll free at (800) 342-5367 or at the Tequesta Field Office at (561) 575-5407. Care should be taken in handling injured 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.

The Service believes that incidental take will be limited to the 5,060 feet of beach that has been identified for sand placement. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. The Service believes that no more than the following types of incidental take will result from the proposed action: (1) destruction of all nests that may be constructed and eggs that may be deposited and missed by a nest survey and egg relocation program within the boundaries of the proposed project; (2) destruction of all nests deposited during the period when a nest survey and egg relocation program is not required to be in place within the boundaries of the proposed project; (3) reduced hatching success due to egg mortality during relocation and adverse conditions at the relocation site; (4) 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; (5) 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; (6) behavior modification of nesting females due to escarpment formation within the project area during a nesting season, resulting in false crawls or situations where they choose marginal or unsuitable nesting areas to deposit eggs; and (7) destruction of nests from escarpment leveling within a nesting season when such leveling has been approved by the Fish and Wildlife Service. The amount or extent of incidental take for sea turtles will be considered exceeded if the project results in more than a one-time placement of sand on the 5,060 feet of beach that has been identified for sand placement. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Corps must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

### CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. Appropriate native salt-resistant dune vegetation should be established on the restored dunes. The Florida Department of Environmental Protection, Office of Beaches and Coastal Systems, can provide technical assistance on the specifications for design and implementation.
2. Surveys for nesting success of sea turtles should be continued for a minimum of 3 years following beach nourishment to determine whether sea turtle nesting success has been adversely impacted.
3. Educational signs should be placed where appropriate at beach access points explaining the importance of the area to sea turtles and/or the life history of sea turtle species that nest in the area.

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

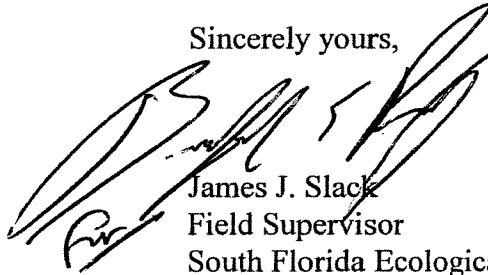
## REINITIATION - CLOSING STATEMENT

This concludes formal consultation on the action outlined in the request. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if:

(1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Should you have additional questions or require clarification, please contact John Wrublik at (561) 562-3909, extension 282.

Sincerely yours,

A handwritten signature in black ink, appearing to read 'James J. Slack', is written over the typed name and title.

James J. Slack  
Field Supervisor  
South Florida Ecological Services Office

cc.

FWS, Jacksonville, FL (Sandy MacPherson)  
FWC, Tallahassee, FL (Robin Trindell)  
NMFS, Habitat Conservation Division, Miami, FL  
NMFS, Protected Resources Division, St. Petersburg, FL  
EPA, West Palm Beach, FL

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