Biological Assessment to
The National Marine Fisheries Service for
Removal of Concrete Sill and Advance Maintenance Dredging
Of the Marine Corps Slipway
US Marine Corps Support Facility - Blount Island
Jacksonville, Duval County, Florida

Description of the Proposed Action – Under the “Interagency and International Services” Program, the U.S. Army Corps of Engineers (USACE) has been contracted by the United States Marine Corps Support Facility - Blount Island (MCSF-BI) to prepare an environmental assessment and obtain the necessary permits to design and build the MCSF-BI proposed deepening of their slipway at Blount Island.

MCSF-BI has requested a permit to remove the concrete sill currently hampering their ability to fully load resupply vessels to their maximum available draft. Additionally, the permit request includes advance maintenance dredging of the slipway to a maximum depth of -47 feet MLLW; this would ensure that operations can be maintained in preparation of the anticipated redeployment of equipment from the Persian Gulf theatre of operations. The advance maintenance dredging may or may not require blasting to remove rock from the slip if it is detected during future geotechnical investigations. The location of the site is in an area prone to extensive silting. Historically, the slip has shallowed quickly, resulting in annual “emergency” maintenance dredging. This shoaling has had, and continues to have an adverse effect on the MCSF-BI mission

Action Area

The project is located in Jacksonville, Duval County, Florida, at the MCSF-BI located on Blount Island along the St. Johns River (Figures 1 and 2). Blount Island was created as a byproduct of USACE post-World War II dredging operations in the St. Johns River. The dredging operations created a new straight line channel (Dames Point-Fulton Cutoff) designed for larger merchant vessels; the dredged material from the operations was deposited on four marsh islands that together formed Blount Island. The MCSF-BI slipway is ten nautical miles west of the St. Johns River outlet, and houses five large vessel berths. The newly deepened slip will continue to be located on the southeast side of Blount Island along the Dames Point-Fulton Cutoff.

Figure 1: St. Johns River Overview photo

Figure 2: MSCF-BI facility overview

Protected Species Included in this Assessment

Of the listed and protected species under NMFS jurisdiction occurring in the action area, the Corps believes that the green turtle (*Chelonia mydas*), loggerhead turtle (*Caretta caretta*), Kemp's ridley turtle (*Lepidochelys kempii*), and shortnose sturgeon (*Acipenser brevirostrum*), may be affected by the implementation of the proposed action.

The endangered Florida manatee (*Trichecus manatus*) also occurs with the action area and the Corps has initiated consultation with the U.S. Fish and Wildlife Service concerning the effects of the proposed action on these species.

Species and Suitable Habitat Descriptions

Loggerhead Turtle (*Caretta caretta*)

The loggerhead sea turtle was listed as a threatened species throughout its global range on July 28, 1978. It was listed because of direct take, incidental capture in various fisheries, and the alteration and destruction of its habitat. Loggerhead sea turtles inhabit the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. In the Atlantic, developmental habitat for small juveniles is the pelagic waters of the North Atlantic and the Mediterranean Sea (NMFS and USFWS, 1991a). Within the continental United States, loggerhead sea turtles nest from Texas to New Jersey. Major nesting areas include coastal islands of Georgia, South Carolina, and North Carolina, and the Atlantic and Gulf of Mexico coasts of Florida, with the bulk of the nesting occurring on the Atlantic coast of Florida.

On 16 November 2007, the NMFS received a petition from Ocean and the Center for Biological Diversity requesting that loggerhead turtles in the western North Atlantic Ocean be reclassified as a Distinct Population Segment (DPS) with endangered status and that critical habitat be designated. On 05 March 2008, the NMFS position finding was published in the Federal Register indicating that a re-classification of the loggerhead in the western North Atlantic Ocean as a DPS and listing of the DPS as endangered may be warranted (Federal Register/Vol. 73, No. 44/Wednesday, March 5, 2008/Proposed Rules). An affirmative 90-day finding requires that the NMFS commence a status review on the loggerhead turtle. Upon completion of this review, the NMFS will make a finding on whether reclassification of the loggerhead in the western North Atlantic Ocean as endangered is warranted, warranted but precluded by higher priority listing actions, or not warranted.

Atlantic Ocean

In the western Atlantic, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf coast of Florida. There are at least five western Atlantic subpopulations, divided geographically as follows: (1) A northern nesting subpopulation, occurring from North Carolina to northeast Florida at about 29ºN; (2) a south Florida nesting subpopulation, occurring from 29ºN on the east coast to Sarasota on the west coast; (3) a Florida Panhandle nesting subpopulation, occurring at Eglin Air

Force Base and the beaches near Panama City, Florida; (4) a Yucatán nesting subpopulation, occurring on the eastern Yucatán Peninsula, Mexico (Márquez, 1990; TEWG, 2000); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NMFS 2001a). Additionally, there is evidence of at least several other genetically distinct stocks, including a Cay Sal Bank, Western Bahamas stock; a Quintana Roo, Mexico stock, including all loggerhead rookeries on Mexico's Yucatan Peninsula; a Brazilian stock; and a Cape Verde stock (SWOT Report, Volume II, The State of the World's Sea Turtles, 2007). The fidelity of nesting females to their nesting beach is the reason these subpopulations can be differentiated from one another. Fidelity for nesting beaches makes recolonization of nesting beaches with sea turtles from other subpopulations unlikely.

Life History and Distribution

Past literature gave an estimated age at maturity of 21-35 years (Frazer and Ehrhart, 1985; Frazer *et al*., 1994), with the benthic immature stage lasting at least 10-25 years. NMFS estimates ages of maturity ranging from 20-38 years with the benthic immature stage lasting from 14-32 years based on data from tag returns, strandings, and nesting surveys (NMFS 2001a).

Mating takes place in late March through early June, and eggs are laid throughout the summer, with a mean clutch size of 100-126 eggs in the southeastern United States. Individual females nest multiple times during a nesting season, with a mean of 4.1 nests/individual (Murphy and Hopkins, 1984). Nesting migrations for an individual female loggerhead are usually on an interval of 2-3 years, but can vary from 1-7 years (Dodd, 1988). Generally, loggerhead sea turtles originating from the western Atlantic nesting aggregations are believed to lead a pelagic existence in the North Atlantic Gyre for as long as 7-12 years or more. Stranding records indicate that when pelagic immature loggerheads reach 40-60 cm straight-line carapace length they begin to live in coastal inshore and nearshore waters of the continental shelf throughout the U.S. Atlantic and Gulf of Mexico, although some loggerheads may move back and forth between the pelagic and benthic environment (Witzell, 2002). Benthic immature loggerheads (sea turtles that have come back to inshore and nearshore waters), the life stage following the pelagic immature stage, have been found from Cape Cod, Massachusetts, to southern Texas, and occasionally strand on beaches in Northeastern Mexico.

Tagging studies have shown loggerheads that have entered the benthic environment undertake routine migrations along the coast that are limited by seasonal water temperatures. Loggerhead sea turtles occur year round in offshore waters off North Carolina where water temperature is influenced by the Gulf Stream. As coastal water temperatures warm in the spring, loggerheads begin to immigrate to North Carolina inshore waters (e.g., Pamlico and Core Sounds) and also move up the coast (Epperly *et al*., 1995a; Epperly *et al.,* 1995b; Epperly *et al*., 1995c), occurring in Virginia foraging areas as early as April and on the most northern foraging grounds in the Gulf of Maine in June. The trend is reversed in the fall as water temperatures cool. The large majority leave the Gulf of Maine by mid-September but some may remain in mid-Atlantic and Northeast areas until late fall. By December loggerheads have emigrated from inshore North Carolina waters and coastal waters to the north to waters offshore North Carolina, particularly off Cape Hatteras, and waters further south where the influence of the Gulf Stream provides temperatures favorable to sea turtles (≥ 11ºC) (Epperly *et al*., 1995a; Epperly *et al*., 1995b; Epperly *et al.,* 1995c). Loggerhead sea turtles are year-round residents of central and south Florida.

Pelagic and benthic juveniles are omnivorous and forage on crabs, mollusks, jellyfish, and vegetation at or near the surface (Dodd, 1988). Sub-adult and adult loggerheads are primarily coastal dwelling and typically prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats.

Population Dynamics and Status

A number of stock assessments (TEWG, 1998; TEWG, 2000; NMFS 2001a; Heppell *et al*. 2003) have examined the stock status of loggerheads in the waters of the United States, but have been unable to develop any reliable estimates of absolute population size. Based on nesting data of the five western Atlantic subpopulations, the south Florida-nesting and the northern-nesting subpopulations are the most abundant (TEWG 2000; NMFS 2001a). Between 1989 and 1998, the total number of nests laid along the U.S. Atlantic and Gulf coasts ranged from 53,014 to 92,182 annually with a mean of 73,751 (TEWG 2000). On average, 90.7 percent of these nests were of the south Florida subpopulation and 8.5 percent were from the northern subpopulation (TEWG 2000). The TEWG (2000) assessment of the status of these two better-studied populations concluded that the south Florida subpopulation was increasing at that time, while no trend was evident (may be stable but possibly declining) for the northern subpopulation. A more recent analysis of nesting data from 1989-2005 by the Florida Wildlife Research Institute indicates there is a declining trend in nesting at beaches utilized by the south Florida nesting subpopulation (McRae letter to NMFS, October 25, 2006). Nesting data obtained for the 2006 nesting season are also consistent with the decline in loggerhead nests (Meylan pers. comm. 2006). It is unclear at this time whether the nesting decline reflects a decline in population, or is indicative of a failure to nest by the reproductively mature females as a result of other factors (resource depletion, nesting beach problems, oceanographic conditions, etc.).

For the northern subpopulations, recent estimates of loggerhead nesting trends in Georgia from standardized daily beach surveys showed significant declines ranging from 1.5 to 1.9 percent annually (Mark Dodd, Georgia Department of Natural Resources, pers. comm., 2006). Nest totals from aerial surveys conducted by the South Carolina Department of Natural Resources showed a 3.3 percent annual decline in nesting since 1980. Another consideration that may add to the importance and vulnerability of the northern subpopulation is the sex ratios of this subpopulation. NMFS scientists have estimated that the northern subpopulation produces 65 percent males (NMFS 2001a). However, new research conducted over a limited time frame has found opposing sex ratios (Wyneken *et al*. 2004) so further information is needed to clarify the issue. Since nesting female loggerhead sea turtles exhibit nest fidelity, the continued existence of the northern subpopulation is related to the number of female hatchlings that are produced. Producing fewer females will limit the number of subsequent offspring produced by the subpopulation.

The remaining three subpopulations – Dry Tortugas, Florida Panhandle, and Yucatán – are much smaller, but also relevant to the continued existence of the species. Nesting surveys for the Dry Tortugas subpopulation are conducted as part of Florida's statewide survey program. Survey effort has been relatively stable during the 9-year period from 1995-2003 (although the 2002 year was missed). Nest counts ranged from 168-270 but with no detectable trend during this period (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, Statewide Nesting Beach Survey Data). Nest counts for the Florida Panhandle subpopulation are focused on index beaches rather than all beaches where nesting occurs. Currently, there is not enough information to detect a trend for the subpopulation (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, Index Nesting Beach Survey Database). Similarly, nesting survey effort has been inconsistent among the Yucatán nesting beaches and no trend can be determined for this subpopulation. However, there is some optimistic news. Zurita *et al.* (2003) found a statistically significant increase in the number of nests on seven of the beaches on Quintana Roo, Mexico, from 1987-2001 where survey effort was consistent during the period.

Loggerhead Sea Turtle within the Action Area

Approximately 90% of all loggerhead nesting in the continental U.S. takes place in Florida. At the conclusion of the 2007 nesting season, it was determined that loggerhead nesting had dropped by 50% since 1998 (FWRI, 2007d). However, loggerhead nesting on Duval County beaches has not shown a decline but has increased from 72 nests in 1998 to 103 nests in 2006, with a high of 119 nests in 1999 and a low of 41 nests in 2004 (Table 1) (FWRI, 2007e).

Loggerheads have nested and continue to nest on Duval county beaches. Although there is an overall decline in nesting of loggerheads in Florida, nesting in Duval County has increased.

The beaches east of the action area are suitable habitat for loggerhead nesting, and the nearshore areas are sufficient for pelagic juvenile habitat and adult feeding activities. Loggerheads are the most commonly sighted sea turtles off the Atlantic coast of north Florida and are expected to occur throughout the year (Navy, 2002). One loggerhead take was recorded during maintenance dredging operations at NAVSTA Mayport in 2002 and one in 2006. In addition, 70 loggerheads were taken during dredging operations from 1986-2007 in the entrance channel to King's Bay, Georgia to the north of the action area (USACE, 2008a).

Threats

The diversity of a sea turtle's life history leaves them susceptible to many natural and human impacts, including impacts while they are on land, in the benthic environment, and in the pelagic environment. Hurricanes are particularly destructive to sea turtle nests. Sand accretion and rainfall that result from these storms as well as wave action can appreciably reduce hatchling success. For example, in 1992, all of the eggs over a 90-mile length of coastal Florida were destroyed by storm surges on beaches that were closest to the eye of Hurricane Andrew (Milton *et al*. 1994). Also, many nests were destroyed during the 2004 hurricane season. Other sources of natural mortality include cold stunning and biotoxin exposure.

Anthropogenic factors that impact hatchlings and adult female turtles on land, or the success of nesting and hatching include: beach erosion, beach 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. An increase in human presence at some nesting beaches or close to nesting beaches has led to secondary threats such as the introduction of exotic fire ants, feral hogs, dogs and an increased presence of native species (e.g*.*, raccoons, armadillos, and opossums) which raid and feed on turtle eggs. Although sea turtle nesting beaches are protected along large expanses of the northwest Atlantic coast (e.g., Merritt Island, Archie Carr, and Hobe Sound National Wildlife Refuges), other areas along these coasts have limited or no protection. Sea turtle nesting and hatching success on unprotected high density east Florida nesting beaches from Indian River to Broward County are affected by all of the above threats.

Loggerhead sea turtles are affected by a completely different set of anthropogenic threats in the marine environment. These include oil and gas exploration, coastal development, and transportation, marine pollution, underwater explosions, hopper dredging, offshore artificial lighting, power plant entrainment and/or impingement, entanglement in debris, ingestion of marine debris, marina and dock construction and operation, boat collisions, poaching, and fishery interactions. Loggerheads in the pelagic environment are exposed to a series of longline fisheries, which include the Atlantic highly migratory species (HMS) pelagic longline fisheries, an Azorean longline fleet, a Spanish longline fleet, and various longline fleets in the Mediterranean Sea (Aguilar *et al*. 1995; Bolten *et al.* 1996). Loggerheads in the benthic environment in waters off the coastal United States are exposed to a suite of fisheries in federal and state waters including trawl, purse seine, hook and line, gill net, pound net, longline, and trap fisheries.

Summary of Status for Loggerhead Sea Turtles

In the Atlantic Ocean, absolute population size is not known, but based on extrapolation of nesting information, loggerheads are likely much more numerous than in the Pacific Ocean. NMFS recognizes five subpopulations of loggerhead sea turtles in the western north Atlantic based on genetic studies. Cohorts from all of these are known to occur within the action area of this consultation. The South Florida subpopulation may be critical to the survival of the species in the Atlantic Ocean because of its size (over 90 percent of all U.S. loggerhead nests are from this subpopulation). In the past, this nesting aggregation was considered second in size only to the nesting aggregation on islands in the Arabian Sea off Oman (Ross, 1979; Ehrhart, 1989; NMFS and USFWS, 1991a). However, the status of the Oman colony has not been evaluated recently and it is located in an area of the world where it is highly vulnerable to disruptive events such as political upheavals, wars, catastrophic oil spills, and lack of strong protections for sea turtles (Meylan *et al*., 1995). Given the lack of updated information on this population, the status of loggerheads in the Indian Ocean basin overall is essentially unknown.

All loggerhead subpopulations are faced with a multitude of natural and anthropogenic effects that negatively influence the status of the species. Many anthropogenic effects occur as a result of activities outside of U.S. jurisdiction (i.e., fisheries in international waters).

Critical Habitat

No critical habitat has been designated by the NMFS for loggerhead sea turtles.

Green Turtle (*Chelonia mydas*)

Federal listing of the green sea turtle occurred on July 28, 1978, with all populations listed as threatened except for the Florida and Pacific coast of Mexico breeding populations, which are endangered. The nesting range of the green sea turtles in the southeastern United States includes sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands between Texas and North Carolina, the U.S. Virgin Islands (USVI) and Puerto Rico (NMFS and USFWS, 1991b). Principal U.S. nesting areas for green sea turtles are in eastern Florida, predominantly Brevard through Broward counties (Ehrhart and Witherington, 1992). Green sea turtle nesting also occurs regularly on St. Croix, USVI, and on Vieques, Culebra, Mona, and the main island of Puerto Rico (Mackay and Rebholz, 1996).

Life History and Distribution

The estimated age at sexual maturity for green sea turtles is between 20-50 years (Balazs, 1982; Frazer and Ehrhart, 1985). Green sea turtle mating occurs in the waters off the nesting beaches. Each female deposits 1-7 clutches (usually 2-3) during the breeding season at 12-14 day intervals. Mean clutch size is highly variable among populations, but averages 110-115 eggs/nest. Females usually have 2-4 or more years between breeding seasons, whereas males may mate every year (Balazs, 1983). After hatching, green sea turtles go through a post-hatchling pelagic stage where they are associated with drift lines of algae and other debris. At approximately 20 to 25 cm carapace length, juveniles leave pelagic habitats and enter benthic foraging areas (Bjorndal, 1997).

Green sea turtles are primarily herbivorous, feeding on algae and sea grasses, but also occasionally consume jellyfish and sponges. The post-hatchling, pelagic-stage individuals are assumed to be omnivorous, but little data are available.

Green sea turtle foraging areas in the southeastern United States include any coastal shallow waters having macroalgae or sea grasses. This includes areas near mainland coastlines, islands, reefs, or shelves, and any open-ocean surface waters, especially where advection from wind and currents concentrates pelagic organisms (Hirth, 1997; NMFS and USFWS, 1991b). Principal benthic foraging areas in the southeastern United States include Aransas Bay, Matagorda Bay, Laguna Madre, and the Gulf inlets of Texas (Doughty, 1984; Hildebrand, 1982; Shaver, 1994), the Gulf of Mexico off Florida from Yankeetown to Tarpon Springs (Caldwell and Carr, 1957; Carr, 1984), Florida Bay and the Florida Keys (Schroeder and Foley, 1995), the Indian River Lagoon System, Florida (Ehrhart, 1983), and the Atlantic Ocean off Florida from Brevard through Broward counties (Wershoven and Wershoven, 1992; Guseman and Ehrhart, 1992). Adults of both sexes are presumed to migrate between nesting and foraging habitats along corridors adjacent to coastlines and reefs.

Population Dynamics and Status

The vast majority of green sea turtle nesting within the southeastern United States occurs in Florida (Meylan *et al.* 1995; Johnson and Ehrhart 1994). Green sea turtle nesting in Florida has been increasing since 1989 (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute Index Nesting Beach Survey Database). Current nesting levels in Florida are reduced compared to historical levels, reported by Dodd (1981). However, total nest counts and trends at index beach sites during the past 17 years suggest the numbers of green sea turtles that nest within the southeastern United States are increasing.

Although nesting activity is obviously important in determining population distributions, the remaining portion of the green turtle’s life is spent on the foraging and developmental grounds. Some of the principal feeding pastures in the western Atlantic Ocean include the upper west coast of Florida and the northwestern coast of the Yucatán Peninsula. Additional important foraging areas in the western Atlantic include the Mosquito and Indian River Lagoon systems and nearshore wormrock reefs between Sebastian and Ft. Pierce Inlets in Florida, Florida Bay, the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Mosquito Coast of Nicaragua, the Caribbean Coast of Panama, and scattered areas along Colombia and Brazil (Hirth, 1997). The summer developmental habitat for green turtles also encompasses estuarine and coastal waters from North Carolina to as far north as Long Island Sound (Musick and Limpus, 1997).

There are no reliable estimates of the number of immature green sea turtles that inhabit coastal areas (where they come to forage) of the southeastern United States. However, information on incidental captures of immature green sea turtles at the St. Lucie Power

Plant (they have averaged 215 green sea turtle captures per year since 1977) in St. Lucie County, Florida (on the Atlantic coast of Florida) show that the annual number of immature green sea turtles captured has increased significantly in the past 26 years (FPL, 2002).

It is likely that immature green sea turtles foraging in the southeastern United States come from multiple genetic stocks; therefore, the status of immature green sea turtles in the southeastern United States might also be assessed from trends at all of the main regional nesting beaches, principally Florida, Yucatán, and Tortuguero. Trends at Florida beaches were previously discussed. Trends in nesting at Yucatán beaches cannot be assessed because of a lack of consistent beach surveys over time. Trends at Tortuguero (ca. 20,000-50,000 nests/year) showed a significant increase in nesting during the period 1971-1996 (Bjorndal *et al.* 1999), and more recent information continues to show increasing nest counts (Troëng and Rankin, 2004). Therefore, it seems reasonable that there is an increase in immature green sea turtles inhabiting coastal areas of the southeastern United States; however, the magnitude of this increase is unknown.

Green Sea Turtles in the Action Area

Although green sea turtles are known to nest in substantial numbers in the southeast U.S., in Florida they typically nest along the beaches from Brevard County south to Broward County, south of the action area (Navy, 2002). However, they do nest in very low numbers along the beaches of Duval County. From 1990 through 2006, only 11 nests were recorded in Duval County (Table 1) (FWRI 2007f). South of North Carolina, green sea turtles are expected to occur year-round in waters between the shoreline and the 50-m isobath. The preferred habitats of this species are seagrass beds and worm-rock reefs, which are located primarily in shallow water environments along the Atlantic coast. Two green sea turtle takes occurred during emergency hopper dredging operations downstream from MSCF-BI at NAVSTA Mayport in 2002, and a total of eight takes were recorded during hopper dredging operations at Kings Bay, Georgia north of the action area from 1980 through 2007 (USACE, 2008c).

Table 1. Sea Turtle Nesting Data for Duval County, Florida (1990-2006)

	Species	
Year	*Loggerhead*	*Green*
1990	43	0
1991	40	0
1992	29	0
1993	30	0
1994	78	0
1995	54	0
1996	69	0
1997	63	0
1998	72	2

1999	119	0
2000	80	1
2001	87	0
2002	55	0
2003	88	0
2004	41	1
2005	67	3
2006	103	4
	1,118	**11**

Threats

The principal cause of past declines and extirpations of green sea turtle assemblages has been the over-exploitation of green sea turtles for food and other products. Although intentional take of green sea turtles and their eggs is not extensive within the southeastern United States, green sea turtles that nest and forage in the region may spend large portions of their life history outside the region and outside U.S. jurisdiction, where exploitation is still a threat. However, there are still significant and ongoing threats to green sea turtles from human-related causes in the United States. These threats include beach armoring, erosion control, artificial lighting, beach disturbance (e.g., driving on the beach), pollution, foraging habitat loss as a result of direct destruction by dredging, siltation, boat damage, other human activities, and interactions with fishing gear. Sea sampling coverage in the pelagic driftnet, pelagic longline, southeast shrimp trawl, and summer flounder bottom trawl fisheries has recorded takes of green turtles. There is also the increasing threat from green sea turtle fibropapillomatosis disease. Presently, this disease is cosmopolitan and has been found to affect large numbers of animals in some areas, including Hawaii and Florida (Herbst, 1994; Jacobson, 1990; Jacobson *et al*., 1991).

Summary of Status for Atlantic Green Sea Turtles

Green turtles range in the western Atlantic from Massachusetts to Argentina, including the Gulf of Mexico and Caribbean, but are considered rare in benthic areas north of Cape Hatteras (Wynne and Schwartz, 1999). Green turtles face many of the same natural and anthropogenic threats as for loggerhead sea turtles described above. In addition, green turtles are also susceptible to fibropapillomatosis, which can result in death. In the continental United States, green turtle nesting occurs on the Atlantic coast of Florida (Ehrhart, 1979), and as far north as North Carolina. Recent population estimates for the western Atlantic area are not available. Between 1989 and 2006, the annual number of green turtle nests at core index beaches ranged from 267 to 7,158 (Florida Marine Research Institute Statewide Nesting Database). While the pattern of green turtle nesting shows biennial peaks in abundance, there is a generally positive trend since establishment of index beaches in Florida in 1989.

Critical Habitat

On 2 September 1998, the NMFS published the final rule for critical habitat designation for the green sea turtle and hawksbill sea turtle (Federal Register / Vol. 63, No. 170 / Wednesday, September 2, 1998) (http://www.nmfs.noaa.gov/pr/pdfs/fr/fr63-46693.pdf) . The geographic limits of critical habitat, designated by the NMFS as habitat necessary for the continued survival and recovery of green turtles in the region, includes the waters surrounding Culebra, Mona, and Monito Islands, Puerto Rico extending seaward 3 nm (5.6 km) from the mean high water line of Culebra Island, Puerto Rico. The proposed action does not encompass critical habitat.

Kemp's Ridley Turtle (*Lepidochelys kempii*)

The Kemp's ridley was listed as endangered on December 2, 1970. Internationally, the Kemp's ridley has been considered the most endangered sea turtle (Zwinenberg, 1977; Groombridge, 1982; TEWG 2000). Kemp's ridleys nest primarily at Rancho Nuevo, a stretch of beach in Mexico, Tamaulipas State. This species occurs mainly in coastal areas of the Gulf of Mexico and the northwestern Atlantic Ocean. Occasional individuals reach European waters (Brongersma, 1972). Adults of this species are usually confined to the Gulf of Mexico, although adult-sized individuals sometimes are found on the east coast of the United States.

Life History and Distribution

The TEWG (1998) estimates age at maturity from 7-15 years. Females return to their nesting beach about every 2 years (TEWG 1998). Nesting occurs from April into July and is essentially limited to the beaches of the western Gulf of Mexico, near Rancho Nuevo in southern Tamaulipas, Mexico. Nesting also occurs in Veracruz, Mexico, and Texas, U.S., but on a much smaller scale. The mean clutch size for Kemp's ridleys is 100 eggs/nest, with an average of 2.5 nests/female/season.

Little is known of the movements of the post-hatchling stage (pelagic stage) within the Gulf of Mexico. Studies have shown the post-hatchling pelagic stage varies from 1-4 or more years, and the benthic immature stage lasts 7-9 years (Schmid and Witzell, 1997). Benthic immature Kemp's ridleys have been found along the eastern seaboard of the United States and in the Gulf of Mexico. Atlantic benthic immature sea turtles travel northward as the water warms to feed in the productive, coastal waters off Georgia through New England, returning southward with the onset of winter (Lutcavage and Musick, 1985; Henwood and Ogren, 1987; Ogren, 1989). Studies suggest that benthic immature Kemp's ridleys stay in shallow, warm, nearshore waters in the northern Gulf of Mexico until cooling waters force them offshore or south along the Florida coast (Renaud, 1995).

Stomach contents of Kemp's ridleys along the lower Texas coast consisted of nearshore crabs and mollusks, as well as fish, shrimp, and other foods considered to be shrimp fishery discards (Shaver, 1991). Pelagic stage Kemp's ridleys presumably feed on the available *Sargassum* and associated infauna or other epipelagic species found in the

Gulf of Mexico.

Population Dynamics and Status

Of the seven extant species of sea turtles in the world, the Kemp's ridley has declined to the lowest population level. Most of the population of adult females nest on the Rancho Nuevo beaches (Pritchard, 1969). When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand, 1963). By the mid-1980s nest numbers were below 1,000 (with a low of 702 nests in 1985). However, observations of increased nesting with 6,277 nests recorded in 2000, 10,000 nests in 2005, and 12,143 nests recorded during the 2006 nesting season (Gladys Porter Zoo nesting database) show the decline in the ridley population has stopped and the population is now increasing.

A period of steady increase in benthic immature ridleys has been occurring since 1990 and appears to be due to increased hatchling production and an apparent increase in survival rates of immature sea turtles beginning in 1990. The increased survivorship of immature sea turtles is attributable, in part, to the introduction of turtle excluder devices (TEDs) in the United States and Mexican shrimping fleets and Mexican beach protection efforts. As demonstrated by nesting increases at the main nesting sites in Mexico, adult ridley numbers have increased over the last decade. The population model used by TEWG (2000) projected that Kemp's ridleys could reach the Recovery Plan's intermediate recovery goal of 10,000 nesters by the year 2015.

Next to loggerheads, Kemp's ridleys are the second most abundant sea turtle in Virginia and Maryland waters, arriving in these areas during May and June (Keinath *et al*., 1987; Musick and Limpus, 1997). The juvenile population of Kemp's ridley sea turtles in Chesapeake Bay is estimated to be 211 to 1,083 turtles (Musick and Limpus, 1997). These juveniles frequently forage in submerged aquatic grass beds for crabs (Musick and Limpus, 1997). Kemp's ridleys consume a variety of crab species, including *Callinectes spp*., *Ovalipes spp*., *Libinia sp*., and *Cancer spp*. Mollusks, shrimp, and fish are consumed less frequently (Bjorndal, 1997). Upon leaving Chesapeake Bay in autumn, juvenile ridleys migrate down the coast, passing Cape Hatteras in December and January (Musick and Limpus, 1997). These larger juveniles are joined there by juveniles of the same size from North Carolina sounds, as well as smaller juveniles from New York and New England, to form one of the densest concentrations of Kemp's ridleys outside of the Gulf of Mexico (Musick and Limpus, 1997; Epperly *et al*., 1995a; Epperly *et al*., 1995b).

Kemp's Ridley Sea Turtle within the Action Area

From 1979 through 2006 there have been no records of Kemp's ridley nesting in Duval County (FWRI, 2007c). Part of the post-juvenile distribution does include the Atlantic coast through Florida, and occurrence is mainly seasonal for feeding. The shallow waters of the southeast U.S. are suitable habitat for all life stages of this species throughout much of the year and Kemp's ridley sea turtles are expected to occur year-round in waters between the shoreline and the 50-meter (m) isobath. The waters off the Atlantic coast of north Florida are most suitable for Kemp's ridley sea turtles from May through October (Navy, 2002). Maintenance hopper dredging operations at Kings Bay, Georgia north of the project area, led to a total of nine Kemp's ridley takes from 1988 to 2006 (USACE, 2008b).

Threats

Kemp's ridleys face many of the same natural threats as loggerheads, including destruction of nesting habitat from storm events, natural predators at sea, and oceanic events such as cold stunning. Although cold stunning can occur throughout the range of the species, it may be a greater risk for sea turtles that utilize the more northern habitats of Cape Cod Bay and Long Island Sound. For example, in the winter of 1999-2000, there was a major cold-stunning event where 218 Kemp's ridleys, 54 loggerheads, and 5 green turtles were found on Cape Cod beaches (R. Prescott, pers. comm., 2001). Annual cold-stunning events do not always occur at this magnitude; the extent of episodic major cold-stunning events may be associated with numbers of turtles utilizing Northeast waters in a given year, oceanographic conditions, and the occurrence of storm events in the late fall. Many cold-stunned turtles can survive if found early enough, but cold-stunning events can still represent a significant cause of natural mortality.

Although changes in the use of shrimp trawls and other trawl gear have helped to reduce mortality of Kemp's ridleys, this species is also affected by other sources of anthropogenic impacts similar to those discussed above. For example, in the spring of 2000, five Kemp's ridley carcasses were recovered from the same North Carolina beaches where 275 loggerhead carcasses were found. Cause of death for most of the turtles recovered was unknown, but the mass mortality event was suspected to have been from a large-mesh gill net fishery operating offshore in the preceding weeks. The five ridley carcasses that were found are likely to have been only a minimum count of the number of Kemp's ridleys that were killed or seriously injured as a result of the fishery interaction because it is unlikely that all of the carcasses washed ashore.

Summary of Kemp's Ridley Status

The only major nesting site for ridleys is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr, 1963). The number of nests observed at Rancho Nuevo and nearby beaches increased at a mean rate of 11.3 percent per year from 1985 to 1999. Current totals are 12,059 nests in Mexico in 2006 (August 8, 2006, e-mail from Luis Jaime Peña - Conservation Biologist, Gladys Porter Zoo). Kemp's ridleys mature at an earlier age (7-15 years) than other chelonids, thus "lag effects" as a result of unknown impacts to the non-breeding life stages would likely have been seen in the increasing nest trend beginning in 1985 (NMFS and USFWS, 1992).

The largest contributors to the decline of Kemp's ridleys in the past were commercial and local exploitation, especially poaching of nests at the Rancho Nuevo site, as well as the Gulf of Mexico trawl fisheries. The advent of TED regulations for trawlers and protections for the nesting beaches has allowed the species to begin to rebound. Many threats to the future of the species remain, including interactions with fishery gear, marine pollution, foraging habitat destruction, illegal poaching of nests and potential threats to the nesting beaches from such sources as global climate change, development, and tourism pressures.

Critical Habitat

No critical habitat has been designated by the NMFS for Kemp's ridley sea turtles.

Shortnose Sturgeon

Life History and Distribution

The shortnose sturgeon is an anadromous species restricted to the east coast of North America. Throughout its range, shortnose sturgeon occur in rivers, estuaries, and the sea; however, it is principally a riverine species and is known to use three distinct portions of river systems: (1) non-tidal freshwater areas for spawning and occasional overwintering; (2) tidal areas in the vicinity of the fresh/saltwater mixing zone, year-round as juveniles and during the summer months as adults; and (3) high salinity estuarine areas (15 parts per thousand (ppt.) salinity or greater) as adults during the winter. The majority of populations have their greatest abundance and are found throughout most of the year in the lower portions of the estuary and are considered to be more abundant now than previously thought (NMFS, 1998).

The shortnose sturgeon is a suctorial feeder and its preferred prey is small gastropods. Sturgeon forage by slowly swimming along the bottom, lightly dragging their barbels until they feel something that may resemble food at which time they suck it up in their protrusible mouths. The non-food items are expelled through their gills. Juveniles may be even more indiscriminate, and just vacuum their way across the bottom. Soft sediments with abundant prey items such as macroinvertebrates are thought to be preferred by shortnose sturgeon for foraging, so established benthic communities are likely important. They are thought to forage for small epifaunal and infaunal organisms over gravel and mud by sucking up food. A few prey studies have been conducted and prey include small crustaceans, polychaetes, insects, and mollusks (Moser and Ross 1995; NMFS, 1998) but they have also been observed feeding off plant surfaces and on fish bait (Dadswell *et al.* 1984).

The species' general pattern of seasonal movement appears to involve an upstream migration from late January through March when water temperatures range from 9º C to 12º C. Post-spawning fish begin moving back downstream in March and leave the freshwater reaches of the river in May. Juvenile and adult sturgeon use the area located 1 to 3 miles from the freshwater/saltwater interface throughout the year as a feeding ground. During the summer and winter, adult shortnose sturgeon occur in freshwater reaches of rivers or river reaches that are influenced by tides; as a result, they often occupy only a few short reaches of a river's entire length (Buckley and Kynard, 1985). During the summer, this species tends to use deep holes at or just above the freshwater/saltwater boundary (Flournoy *et al*., 1992; Rogers and Weber; 1994, Hall *et al.*, 1991). Juvenile shortnose sturgeon generally move upstream for the spring and summer seasons and downstream for fall and winter; however, these movements usually occur above the salt- and freshwater interface of the rivers they inhabit (Dadswell *et al.* 1984, Hall *et al.* 1991). Adult shortnose sturgeon prefer deep, downstream areas with soft substrate and vegetated bottoms, if present. Because they rarely leave their natal rivers, Kieffer and Kynard (1993) considered shortnose sturgeon to be freshwater amphidromous (*i.e.* adults spawn in freshwater but regularly enter saltwater habitats during their life).

Shortnose sturgeons in the northern portion of the species' range live longer than individuals in the southern portion of the species' range (Gilbert, 1989). The maximum age reported for a shortnose sturgeon in the St. John River in New Brunswick is 67 years (for a female), 40 years for the Kennebec River, 37 years for the Hudson River, 34 years in the Connecticut River, 20 years in the Pee Dee River, and 10 years in the Altamaha River (Gilbert 1989 using data presented in Dadswell *et al.* 1984). Male shortnose sturgeon appear to have shorter life spans than females (Gilbert, 1989).

Spawning Life Stage.

As with most fish, southern populations of shortnose sturgeon mature earlier than northern ones: females reach sexual maturity at approximately 6 years, and males reach it at 3 years. In early February to late March, shortnose sturgeon spawn far upstream in freshwater. In most population segments, sturgeon spawn at the uppermost river reaches that are accessible in channels and curves in gravel, sand, and log substrate; however, many spawning grounds are blocked by dams (Hall *et al*. 1991). Other suitable substrates include riffles near limestone bluffs with gravel to boulder-sized substrate (Rogers and Weber 1995). Spawning lasts for about 3 weeks, beginning when water temperatures are at about 8 to 9° C, and ending when it reaches approximately 12 to 15° C. The spent fish migrate downriver from March to May, and spend the summer from June to December in the lower river (Hall *et al*. 1991). Females likely do not spawn every year, while males may do so. The demersal, adhesive eggs hatch in freshwater, and develop into larvae within 9 to 12 days. Larvae start swimming and initiate their slow downstream migrations at about 20 mm in length (Richmond and Kynard, 1995).

Adult Life Stage.

Adult shortnose sturgeons migrate extensively throughout an individual river system and may also migrate between different river basins (Wrona *et al*., 2007; Cooke and Leach, 2004). In 1999 and 2000, Collins *et al.* (2001) tracked adult and juvenile sturgeon in the Savannah River and identified distinct summer and winter habitats in terms of location and water quality (Table 2). Observations indicate that they seek relatively deep, cool holes upriver for sanctuary from warm temperatures (and possibly to escape low dissolved oxygen coupled with salinity stress), and in the winter, they migrate downstream to the estuary, perhaps to feed or escape extreme cold. When temperatures are below 22° C, it appears that both adult and juvenile sturgeon stay in the lower river and during warmer periods when temperatures exceed 22° C, telemetry observations and gill net surveys indicate that sturgeon use the upper estuary. While they are known to occur in 4 to 33° C, sturgeon show signs of stress at temperatures above 28°, and this stress may be exacerbated by low dissolved oxygen conditions during summer critical months. Sturgeon may seek thermal refuges during these periods, deep cool waters where salinity conditions are appropriate and food is available with minimal foraging movements. For example, Flournoy *et al*. (1992) found that sturgeon may use spring-fed areas for summer habitat in the Altamaha River system. The synergistic effects of high temperatures and low dissolved oxygen should be considered in any impact analysis. Based on work done in the Chesapeake Bay, sturgeon may suffer an "oxygen squeeze" in the summer when they seek deep cool areas that also have low dissolved oxygen (Secor and Niklitschek, 2001).

Table 2. Mean water temperature, salinity, and dissolved oxygen (D.O.) by season at locations where adult shortnose sturgeon were found. Reproduced from Collins *et al*. 2001.

Season	**°C**	**Salinity (ppt)**	**D.O. (mg/L)**
Spring	19.9	1.4	7.84
Summer	27.3	2.0	6.36
Fall	21.1	3.3	7.06
Winter	12.3	5.4	8.36

Juvenile Life Stage.

Juvenile shortnose sturgeon mature at approximately 3 to 6 years of age, and they live in the salt/fresh interface in most rivers. After spending their first year in the upper freshwater reaches, they adopt the adult migratory lifestyle and go upriver in the summer and down in the winter. Like adults, they need sand or mud substrate for foraging (Hall *et al.* 1991). They are less tolerant of low dissolved oxygen and high salinity than the adults and appear to migrate accordingly within the river system. According to Collins *et al.* (2001), when temperatures exceeded 22° C in the Savannah River, juveniles spent the summer in deep (5 to 7 m) holes with 0 to 1 ppt salinity levels (Table 3). During the winter, they use the warmer estuarine-influenced lower river. For example, they move into more saline areas (0 to 16 ppt) when temperatures dropped below 16° C in the Ogeechee River. Warm summer temperatures over 26° limit movement of juveniles who may not be able to forage extensively during summers. Tolerance to both dissolved oxygen and salinity is thought to increase with age; very young sturgeon are known to be extremely sensitive to both (Jenkins *et al*., 1993). Jenkins *et al* (1993) reported that in a 6-hour test, fish 64 days old exhibited 86% mortality when exposed to dissolved oxygen concentrations of 2.5 mg/L. However, sturgeon >100 days old were able to tolerate concentrations of 2.5 mg/L with<20% mortality. Jenkins also reported that dissolved oxygen at less than 3 mg/L causes changes in sturgeon behavior: Fish hold still and pump water over their gills, an apparent adaptation to survive low dissolved oxygen conditions. If fish spawn in the spring, it is believed that late age individuals encounter these low dissolved oxygen conditions in the lower estuary. Environmental Protection Agency (Chesapeake Bay Program Office) recently revised its D.O. criteria for living resources in Chesapeake Bay tributaries from 2.0 mg/L to 3.5 mg/L to be protective of sturgeons (Secor and Gunderson, 1998; Niklitschek and Secor, 2000). It is possible that 3.5 mg/L may be acceptable, but 4.0 mg/L would be safer for the higher temperatures in this southern river. As with adults, temperatures above 28° reduce tolerance to low dissolved oxygen (Flournoy *et al*. 1992).

Table 3. Mean water temperature, salinity, and dissolved oxygen by season at locations where juvenile shortnose sturgeon were found. Reproduced from Collins *et al*. 2001.

Season	°C	Salinity	D.O.
Spring	20.4	2.4	7.58
Summer	28.5	0.3	6.8
Fall	21.7	4.7	6.45
Winter	12.5	8.6	8.63

Species' Description, Distribution, and Population Structure

Shortnose sturgeon occur within most major river systems along the Atlantic Coast of North America, from the St. John River in Canada to the St. Johns River in Florida. In the southern portion of the range, they are found in the St. Johns River in Florida; the Altamaha, Ogeechee, and Savannah Rivers in Georgia; and, in South Carolina, the river systems that empty into Winyah Bay and the Santee/Cooper River complex that forms Lake Marion. Data are limited for the rivers of North Carolina. In the northern portion of the range, shortnose sturgeon are found in the Chesapeake Bay system, Delaware River from Philadelphia, Pennsylvania to Trenton, New Jersey; the Hudson River in New York; the Connecticut River; the lower Merrimack River in Massachusetts and the Piscataqua River in New Hampshire; the Kennebec River in Maine; and the St. John River in New Brunswick, Canada (http://www.nmfs.noaa.gov/pr/species/fish/shortnosesturgeon.htm#distribution). The Shortnose sturgeon recovery plan describes 20 shortnose sturgeon population segments that exist in the wild. Two additional, geographically distinct populations occur behind dams in the Connecticut River (above the Holyoke Dam) and in Lake Marion on the Santee-Cooper River system in South Carolina (above the Wilson and Pinopolis Dams). Although these populations are geographically isolated, genetic analyses suggest that individual shortnose sturgeon move between some of these populations each generation (Quattro *et al.* 2002, Wirgin *et al.* 2005).

At the northern end of the species' distribution, the highest rate of gene flow (which suggests migration) occurs between the Kennebec and Androscoggin Rivers. At the southern end of the species' distribution, populations south of the Pee Dee River appear to exchange between 1 and 10 individuals per generation, with the highest rates of exchange between the Ogeechee and Altamaha Rivers (Wirgin *et al.* 2005). Wirgin *et* *al.* (2005) concluded that rivers separated by more than 400 km were connected by very little migration while rivers separated by no more than 20 km (such as the rivers flowing into coastal South Carolina) would experience high migration rates. Coincidentally, at the geographic center of the shortnose sturgeon range, there is a 400 km stretch of river with no known populations occurring from the Delaware River, New Jersey to Cape Fear River, North Carolina (Kynard, 1997). However, shortnose sturgeon are known to occur in the Chesapeake Bay, and may be transients from the Delaware River via the Chesapeake and Delaware Canal (Skjeveland *et al.* 2000, Welsh *et al.* 2002) or remnants of a population in the Potomac River.

Several authors have concluded that shortnose sturgeon populations in the southern end of the species geographic range are extinct. Rogers and Weber (1994), Kahnle *et al.* (1998), and Collins *et al.* (2000) concluded that shortnose sturgeon are extinct from the St. Johns River in Florida and the St. Marys River along the Florida and Georgia border. Rogers and Weber (1995) also concluded that shortnose sturgeon have become extinct in Georgia's Satilla River. Historical distribution has been in major rivers along the Atlantic seaboard from the St. John River in Canada, south to the St. Johns River in Florida and rarely in the off-shore marine environment. Currently, shortnose sturgeon are more prominent in northern river systems and severely depleted in southern river systems. A recovery plan was completed for shortnose sturgeon with little to no population data available for the St. Johns River in Florida (NMFS, 1998). Beginning in spring of 2001, the Florida Fish and Wildlife Research Institute (FWRI) and USFWS began research on the population status and distribution of the species in St. Johns River. After approximately 4,500 hours of gill-net sampling from January through August of 2002 and 2003, only one shortnose sturgeon was captured in 2002. In addition, after 21,381 hours of gill-net sampling for other species from 1980 through 1993, there were no incidental captures of sturgeon (FWRI, 2007)

Population Dynamics and Status

Shortnose sturgeon were listed as endangered on March 11, 1967 (32 FR 4001) pursuant to the Endangered Species Preservation Act of 1966. Shortnose sturgeon remained on the list as endangered with the enactment of the ESA in 1973. Shortnose sturgeon were first listed on the International Union for Conservation of Nature and Natural Resources Red List in 1986 where it is still listed as vulnerable and facing a high risk of extinction based in part on: an estimated range reduction of greater than 30% over the past three generations, irreversible habitat losses, effects of habitat alteration and degradation, degraded water quality and extreme fluctuations in the number of mature individuals between rivers. As of 30 November 2007, the NMFS initiated a status review of the shortnose sturgeon under the ESA; however, no report had been published by the time this assessment was developed. .

Despite the longevity of adult sturgeon, the viability of sturgeon populations are highly sensitive to juvenile mortality that result in reductions in the number of sub-adults that recruit into the adult, breeding population (Anders *et al.,* 2002; Gross *et al.,* 2002; Secor *et al.,* 2002). Sturgeon populations can be grouped into two demographic categories: populations that have reliable (albeit periodic) natural recruitment and those that do not. The shortnose sturgeon populations without reliable natural recruitment are at the greatest risk (Secor *et al.,* 2002).

Several authors have also demonstrated that sturgeon populations generally, and shortnose sturgeon populations in particular, are much more sensitive to adult mortality than other species of fish (Boreman, 1997; Gross *et al.,* 2002; Secor *et al.,* 2002). These authors concluded that sturgeon populations cannot survive fishing related mortalities that exceed five percent of an adult spawning run and they are vulnerable to declines and local extinction if juveniles die from fishing related mortalities.

Shortnose Sturgeon within the Action Area

Beginning in spring of 2001, the Florida Fish and Wildlife Research Institute (FWRI) and USFWS began research on the population status and distribution of the species in the St. Johns River. After approximately 4,492 hours of gill-net sampling from January through August of 2002 and 2003 in the upper river and estuarine area, only one shortnose sturgeon was captured. In addition, after 21,381 hours of gill-net sampling for other species from 1980 through 1993, there were no incidental captures of sturgeon. Shortnose sturgeon are known to use warm-water springs in other southern rivers, but only eight individual fish have been observed in the numerous warmwater springs found upstream in the St. Johns River system, and these sightings occurred in the 1970s and early 1980s. The FWRI concluded that with the lack of current sightings in surveys, the patchy and extremely infrequent catch of small individuals, and the historic low numbers, it is highly unlikely that a significant population of shortnose sturgeon currently resides within the St. Johns River (FWRI, 2007).

Because the St. Johns River is heavily industrialized and has been for many years, shortnose sturgeon populations may have suffered due to habitat degradation and blocked access to historic spawning grounds in the upstream reaches of the river. Spawning habitat for this species is rock or gravel substrate near limestone outcroppings, which is very rare in the St. Johns River and associated tributaries. Reproduction of shortnose sturgeon has not been documented in the St. Johns River, and in fact, no large adults (> 10 pounds) have been sighted in this area (FWRI, 2007). Due to the limited catch of shortnose sturgeon in the vicinity of the St. Johns River, the occurrence of shortnose sturgeons within the MSCF-BI slipway is considered very unlikely.

Threats

The construction of dams throughout the shortnose sturgeon’s range probably reduced their reproductive success. Dredging activities have been known to take individual sturgeon and have the potential to alter the quality of their feeding, rearing, and overwintering habitat. More recently, larval and juvenile shortnose sturgeon in the different populations along the Atlantic have been killed after being impinged on the intake screens or entrained in the intake structures of power plants on the Delaware, Hudson, Connecticut, Savannah and Santee rivers (Dadswell *et al.,* 1984). Sturgeon populations have also been reduced further by habitat fragmentation and loss, siltation, water pollution, decreased water quality (low DO, salinity alterations), bridge construction, and incidental capture in coastal fisheries (Dadswell *et al.,* 1984; Collins *et al.,* 1996; NMFS, 1998a; Secor and Gunderson, 1998; Collins *et al.,* 2000; Newcomb and Fuller, 2001).

Construction of dams and pollution of many large northeastern river systems during the period of industrial growth in the late 1800's and early 1900's may have resulted in substantial loss of suitable habitat. In addition, habitat alterations from discharges, dredging or disposal of material into rivers, or related development activities involving estuarine/riverine mudflats and marshes, remain constant threats. Commercial exploitation of shortnose sturgeon occurred throughout its range starting in colonial times and continued periodically into the 1950's.

Critical Habitat

No critical habitat has been designated for the shortnose sturgeon.

Protective Measures Taken in the Project Area Separate from Conservation Measures the Corps will Undertake as Part of the Proposed Action

Other consultations of Federal actions in the area to date

The Corps has been working with the citizens of Duval County since 1907 on expanding and maintaining Jacksonville Harbor. None of the projects authorized by Congress prior to 1973 were required to consult under the Endangered Species Act of 1973 (ESA). There are currently a variety of federally authorized studies for various projects within Jacksonville Harbor. Detailed information regarding these studies can be found in the "Jacksonville Harbor Navigation Study and Environmental Assessment" found on the Corps' environmental documents website at the following link - http://www.saj.usace.army.mil/Divisions/Planning/Branches/Environmental/DOCS/OnLine/Duval/JAXHarborNavigationStudy.pdf. The applicable discussion begins on page 7, paragraph 11 and continues through page 12 and paragraph 28.

In addition, the US Navy recently completed a Final EIS for the homeporting of additional vessels at NAVSTA Mayport and signed a Record of Decision for that action on 14 January 2009. The FEIS and ROD can be reviewed at http://www.mayporthomeportingeis.com/EISDocuments.aspx.

Protective Measures Taken in the Project Area as Part of the Proposed Action

Consideration of Plans and Methods to Minimize/Avoid Environmental Impacts. Conservation measures were a major focus during the plan formulation phase for the proposed project. Avoiding and minimizing some potential impact areas significantly decreased the risk of indirect effects on managed and protected species, and a great deal of consideration was given to the utilization of rock/concrete removal methods to decrease the likelihood of incidental take, injury, and behavioral modification of protected species. It was determined that rock/concrete removal options not involving blasting were possibly more detrimental to populations and individuals of protected species. One alternative option was the use of a punchbarge/piledriver to break rock. However, it was determined that the punchbarge, which would work for 12-hour periods, strikes the rock approximately once every 60-seconds. This constant pounding would serve to disrupt animal behavior in the area, and result in adverse effects on the mission of MSCF-BI since the sill removal would not be completed in the required six week timeframe. Using the punchbarge would also extend the length of the project, thus increasing any potential impacts to all fish and wildlife resources in the area. The Corps believes that blasting is actually the least environmentally impactful method for removing the rock in the slipway. Each blast will last no longer than five (5) seconds in duration, and may even be as short as 2 seconds each. Additionally, the blasts are confined in the rock/concrete substrate. Boreholes are drilled into the rock below, the blasting charge is set, and then the chain of explosives is detonated. Because the blasts are confined within the rock structure, the distance of the blast effects is reduced as compared to an unconfined blast (see discussion below).

Development of Protective Measures. The proposed project includes measures to conserve sea turtles and shortnose sturgeon. Foremost among the measures are protective actions to ensure that sea turtles and shortnose sturgeon are not killed if in fact such methods are required as a part of the overall dredging operation. Development of the measures involved consideration of past practices and operations, anecdotal observations, and the most current scientific data. The discussion below summarizes the development of the conservation measures, which, although developed for marine mammals, will also be utilized to protect such species as sea turtles and shortnose sturgeon.

Blasting

To achieve the deepening of the MSCF-BI slipway from the existing depth of -38 feet to a maximum project depth of -47 feet MLLW, pretreatment of the rock/concrete sill areas may be required. Blasting is anticipated to be required for some or all of the deepening and extension of the channel, where standard construction methods are unsuccessful. The total volume to be removed in these areas is up to 130,000 cubic yards of rock and 875,000 sq feet of reinforced concrete. USACE has used two criteria to determine which areas are most likely to need blasting for the MCSF-BI slipway:

1. Areas documented by core borings to contain hard massive rock
2. Concrete sill that is too hard to dredge without pre-treatment.

Based on evaluations of the core boring logs, and as-built information for the sill provided by MCSF-BI, the following is an evaluation of the blasting requirements for the current project. Areas currently identified as having the hardest rock and most likely in need of blasting prior to dredging include the concrete sill and the mouth of the slipway. Additional core borings were collected in October 2008. The results of recent core borings have identified an area of 875,000 square feet of cemented rock within the proposed dredging template in addition to the concrete sill. The cemented rock is highly dense and likely in need of blasting prior to dredging. Based on evaluations of the core boring logs, and as-built information for the sill provided by MCSF-BI, the blasting requirements for the current project will include removal of existing sill and 130,000 CYs cemented sedimentary rock. The pretreatment of the cemented rock will need to occur between Station 22+00 to Station 43+00 of the existing channel baseline. The concrete sill is located approximately at Station 7+00 (Figure 3).

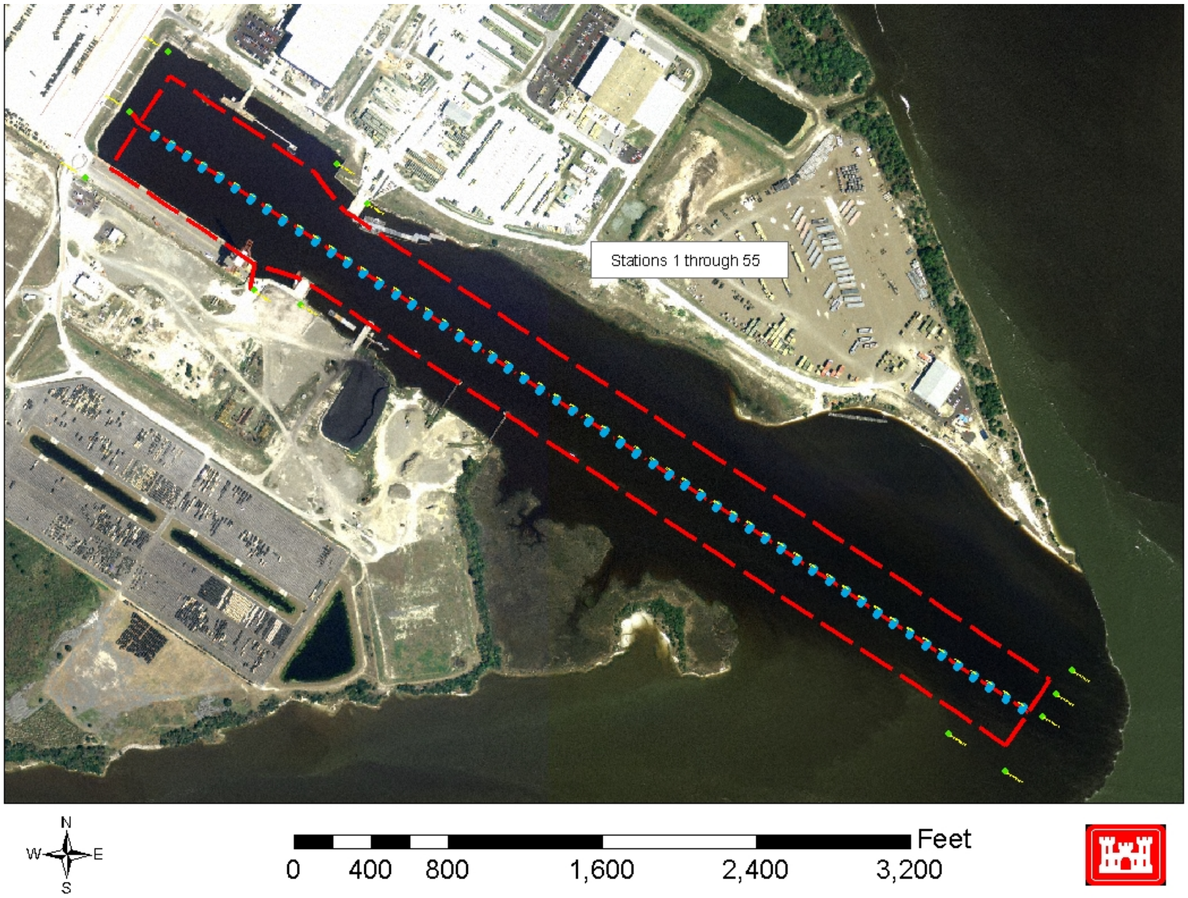

Figure 3: Blount Island slipway station markers

The focus of the proposed blasting work at the Blount Island slipway is to pre-treat the concrete sill and any hard rock prior to removal by a dredge. The pre-treatment would utilize “confined blasting,” meaning the shots would be “confined” in the rock. In confined blasting, each charge is placed in a hole drilled in the rock approximately five to ten feet deep, depending on how much rock needs to be broken and the intended project depth. The hole is capped with an inert material, such as crushed rock. This process is referred to as “stemming the hole” (Figure 3). For the Port of Miami expansion that used confined blasting as a pre-treatment technique, the stemming material was angular crushed rock. The optimum size for stemming material is an average diameter of approximately 0.05 times the diameter of the blast hole. Material must be angular to perform properly (Konya, 2003). For the MCSF-BI project, the geotechnical branch of the USACE Jacksonville District will prepare project specific specifications.

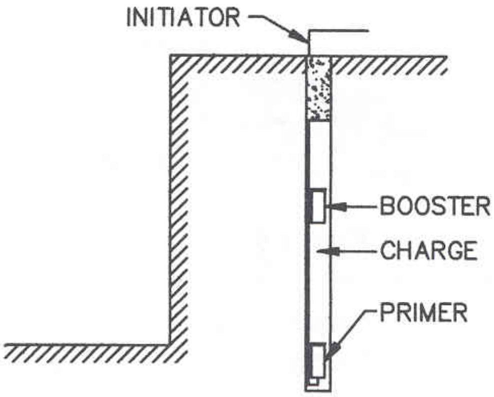

Figure 4: Typically stemmed hole

Figure 5: Stemming material utilized; bag is approximate volume of material used

In the recently completed Miami Harbor project, the following requirements were in the specifications regarding stemming material:

> 1.22.9.20 Stemming
> All blast holes shall be stemmed. The Blaster or Blasting Specialist shall determine the thickness of stemming using blasting industry conventional stemming calculations. The minimum stemming shall be 2 feet thick. Stemming shall be placed in the blast hole in a zone encompassed by competent rock. Measures shall be taken to prevent bridging of explosive materials and stemming within the hole. Stemming shall be clean, angular to subangular, hard stone chips without fines having an approximate diameter of 1/2-inch to 3/8-inch. A barrier shall be placed between the stemming and explosive product, if necessary, to prevent the stemming from settling into the explosive product. Anything contradicting the effectiveness of stemming shall not extend through the stemming.

It is expected that the specifications for any construction utilizing blasting at Blount Island would have similar stemming requirements as those that were used for the Miami Harbor project. The length of stemming material will vary based on the length of the holes drilled, however minimum lengths will be included in the project specific specifications. Studies have shown that stemmed blasts have up to a 60-90% decrease in the strength of the pressure wave released, compared to open water blasts of the same charge weight (Nedwell and Thandavamoorthy, 1992; Hempen *et al*., 2005; Hempen *et al*., 2007). However, unlike open water blasts, very little documentation exists on the effects that confined blasting can have on marine animals near the blast (Keevin *et al*., 1999).

Figure 6 - Unconfined blast of seven pounds of explosives

Figure 7 - Confined blast of 3,000 pounds

The work may be completed in the following manner:

- Contour dredging with either bucket, hydraulic or excavator dredges to remove material that can be dredged conventionally and determine what areas require blasting.

- Pre-treating (blasting) the remaining above grade rock, drilling and blasting the "Site Specific" areas where rock could not be conventionally removed by the dredges.

- Excavating with bucket, hydraulic or excavator dredges to remove the pre-treated rock areas to grade.

- All drilling and blasting will be conducted in strict accordance with local, state and federal safety procedures. Marine Wildlife Protection, Protection of Existing Structures, and Blasting Programs coordinated with federal and state agencies.

- Based upon industry standards and USACE, Safety & Health Regulations, the blasting program may consist of the following:

  The weight of explosives to be used in each delay will be limited to the lowest poundage of explosives that can adequately break the rock/concrete. The blasting would consist of up to two blasts per day.

The following safety conditions are standard in conducting underwater blasting:

- Drill patterns are restricted to a minimum of 8 ft separation from a loaded hole.
- Hours of blasting are restricted from 2 hours after sunrise to 1 hour before sunset to allow for adequate observation of the project area for protected species.
- Selection of explosive products and their practical application method must address vibration and air blast (overpressure) control for protection of existing structures and marine wildlife.
- Loaded blast holes will be individually delayed to reduce the maximum pounds per delay at point detonation, which in turn will reduce the mortality radius.
- The blast design will consider matching the energy in the “work effort” of the borehole to the rock mass or target for minimizing excess energy vented into the water column or hydraulic shock.

As part of the development of the protected species protection and observation protocols, which will be incorporated into the plans and specifications for the project, USACE and MCSF-BI will work with agencies and non-governmental organizations (NGOs) to address concerns and potential impacts associated with the blasting.
In addition to coordination with the agencies and NGOs, any new scientific studies regarding the effects of blasting (confined or unconfined) on species that may be in the area (marine mammals, sea turtles, and fish (both with a swim bladder and without) will be incorporated into the design of the protection measures that will be employed with confined blasting activities during the project. Examples of these studies may include:

Analysis being conducted for the Navy at Woods Hole Oceanographic Center on the effects of unconfined blast pressures on marine mammals (specifically whales, dolphins and seals; manatee carcasses were not made available to the researchers at Woods Hole despite requests from the researchers to FWC) (pers comm. Dr. Ketten, 2005).

As part of the August 1 and 2, 2006 after action review conducted for the Miami Harbor

Phase II dredging project, which included confined blasting as a construction technique, USACE in partnership with FWC, committed to conduct a study (“Caged Fish Study”) on the effects of blast pressures on fin fish with air bladders in close proximity to the blast. This study would attempt to answer questions regarding injury and death associated with proximity to a confined blast, not resolved with research conducted during the Wilmington Harbor 1999 blasting (Moser, 1999a and Moser, 1999b).

Other blasting project monitoring reports (completed prior to development of plans and specifications for the MCSF-BI project) for projects, both from inside and outside of Florida, using confined underwater blasting as a construction technique.

As part of these protective measures, USACE and MCSF-BI will develop three safety radii based on the use of an unconfined blast. The use of an unconfined blast to develop safety radii for a confined blast will increase the protections afforded marine species in the area since it doesn’t give any credit of the pressure reduction caused by the confining of the blast. These three zones are referred to as the “Danger zone,” which is the inner most zone, located closest to the blast; the “Safety zone,” which is the middle zone; and the “watch zone,” which is the outer most zone. These zones are described further in subsequent paragraphs and illustrated in Figure 8. Since the slipway is a dead-end canal, the focus of these radii will be the distance animals are up and downstream from the mouth of the slip.

The danger zone radius will be calculated to determine the maximum distance from the blast at which mortality to protected marine species is likely to occur. The danger zone is determined by the amount of explosives used within each delay (which can contain multiple boreholes). An explosive delay is division of a larger charge into a chain of smaller charges with more than eight milliseconds between each of the charges. This break in time breaks up the total pressure of the larger charge into smaller amounts, which makes the rock fracture more efficient and also decreases impacts to aquatic organisms. These calculations are based on impacts to terrestrial animals in water when exposed to a detonation suspended in the water column (unconfined blast) as researched by the U.S. Navy in the 1970s (Yelverton *et al*., 1973; Richmond *et al.,* 1973), as well as observations of sea turtle injury and mortality associated with unconfined blasts for the cutting of oil rig structures in the Gulf of Mexico (Young, 1991; O’Keefe and Young, 1994). The reduction of impact by confining the shots would more than compensate for the presumed higher sensitivity of marine species. The USACE and MCSF-BI believe that the danger zone radius, coupled with a strong protected species observation and protection plan is a conservative, but prudent, approach to the protection of marine wildlife species. Based on a review of the Miami Harbor project, NMFS and FWS found these protective measures sufficient to protect marine mammals under their respective jurisdictions (NMFS, 2005b; FWS, 2002). In addition, monitoring of the Miami blast pressures found these calculations to be extremely conservative and protective (Jordan *et al*., 2007 and Hempen *et al*., 2007).

These zone calculations will be included as part of the specifications package that the contractors will bid on before the project is awarded. The calculations are as follows:

1) Danger Zone (NMFS has referred to this as the Caution Zone in previous authorizations): the radius in feet from the detonation beyond which no mortality or injury from an open water explosion is expected (NMFS 2005). The danger zone (feet) = 260 [79.25 m] X the cube root of weight of explosives in pounds per delay (equivalent weight of TNT).

2) The Safety Zone (sometimes referred to as the Exclusion Zone) is the approximate distance in feet from the detonation beyond which injury (Level A harassment as defined in the MMPA) is unlikely from an open water explosion (NMFS 2005b). The safety zone (feet) = 520 [158.50 m] X cube root of weight of explosives in pounds per delay (equivalent weight of TNT). Ideally, the safety radius should be large enough to offer a wide buffer of protection for marine animals while still remaining small enough that the area can be intensely surveyed.

3) The Watch Zone is three times the radius of the Danger Zone to ensure animals entering or traveling close to the safety zone are spotted and appropriate actions can be implemented before or as they enter any impact areas (i.e., a delay in blasting activities).

To estimate the maximum poundage of explosives that may be utilized for this project, USACE has reviewed two previous blasting projects, one at San Juan Harbor, Puerto Rico in 1994 and the Miami Harbor project in 2005. The heaviest delay used during the San Juan Harbor project was 375 pounds per delay and during the Miami Harbor project, 376 pounds per delay. Based on discussions with USACE geotechnical engineers, the maximum weight of delays for Blount Island is expected to be smaller than the delays in either the San Juan Harbor or Miami Harbor projects since the majority of the material to be removed is concrete and not dense rock. The maximum delay weight for the Blount Island project will be determined during the test blast program.

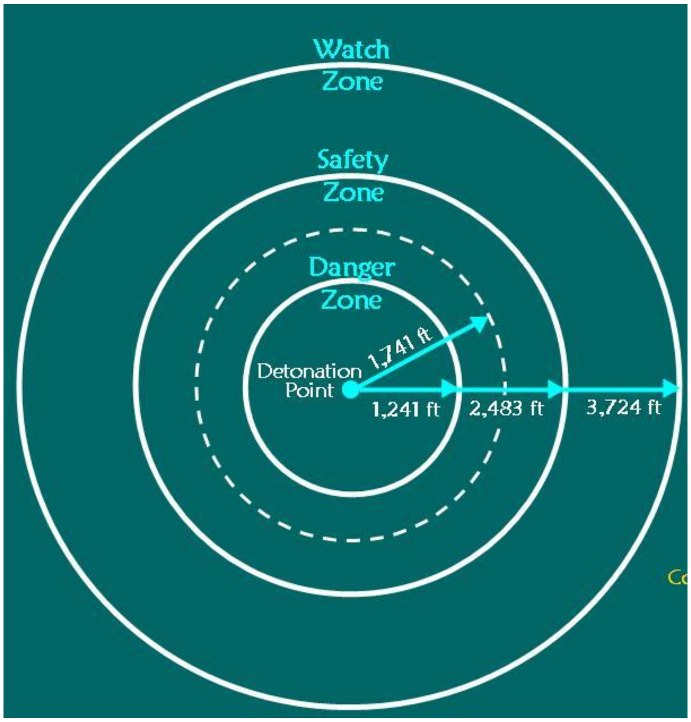

Figure 8: Example safety radii from Miami Harbor

The weight of explosives to be used in each blast will be limited to the lowest poundage of explosives that can adequately break the rock. The blasting program may consist of the following safety conditions that are based on industry standards in conducting confined underwater blasting, as well as USACE Safety & Health Regulations:

- Drill patterns are restricted to a minimum of an eight-foot separation from a loaded hole.

- Hours of blasting are restricted from two hours after sunrise to one hour before sunset to allow for adequate observation of the project area for protected species.

- Selection of explosive products and their practical application method must address vibration and air blast (overpressure) control for protection of existing structures and marine wildlife.

- Loaded blast holes will be individually delayed to reduce the maximum pounds per delay at point detonation, which in turn will reduce the mortality radius.

- The blast design will consider matching the energy in the “work effort” of the borehole to the rock mass or target for minimizing excess energy vented into the water column or hydraulic shock.

- Delay timing ensuring at least eight ms between delays to break larger blast weights into smaller blasts increasing blast efficiency while reducing pressure released into the water column.

Because of the potential duration of the blasting and the proximity of the inshore blasting to known manatee use areas, a number of issues will need to be addressed. Due to the likelihood of large numbers of manatees in the area during the summer months, USACE and MSCF-BI have agreed as part of the ESA consultation with FWS to limit blasting activities to November 1 – March 31. In addition, by limiting the blasting activities to the winter months, the project is less likely to impact sea turtles. Sea turtles tend to be present in lower concentrations in the river in the winter months due to the lower water temperatures. Other dredging activities will be taking place inside the slipway and basin during this period of time, but blasting will not be utilized outside of the November 1 – March 31 timeframe.

Conservation Measures

It is crucial to balance the demands of the blasting operations with the overall safety of the species. A radius that is excessively large can result in a significant number of project suspensions prolonging the blasting, construction, traffic and overall disturbance to the area. A radius that is too small puts the animals at too great of a risk should one go undetected by the observers and move into the blast area. As a result of these factors, the goal is to establish the smallest radius possible without compromising animal safety, and to provide adequate observer coverage for the agreed upon radius.

A watch plan will be formulated based on the required safety zones and optimal observation locations. The watch plan will be consistent with the program that was utilized successfully at Miami Harbor in 2005 and will consist of six observers including at least one aerial observer (Figures 9 and 11), two boat-based observers (Figure 12), and two observers stationed on the drill barge (Figure 10). The sixth observer will be placed in the most optimal observation location (boat, barge or aircraft) on a day-by-day basis depending on the location of the blast and the placement of dredging equipment. This process will ensure complete coverage of the three zones. The watch will begin at least one hour prior to each blast and continue for one-half hour after each blast (Jordan *et al*., 2007).

Figure 9: Typical height of aerial observation

Figure 10: Observer on the drill barge

Figure 11: Aerial observer

Figure 12: Vessel-based observer

In addition to monitoring for protected marine mammals and sea turtles during blasting operations, USACE will work with the resource agencies to develop a monitoring plan for fish kills associated with each blasting event. This effort may be similar to the effort that was developed by FWC in association with the Miami Harbor project. The fish-monitoring plan will include collection, enumeration and identification of dead and injured fish floating on the surface after each blast. In addition, blast data will be collected from daily blasting reports provided by the blasting contractor (recorded after each shot), as well as environmental data such as tidal currents (in-going or out-going). Due to health and safety restrictions, all collections of fish will be made from the surface only; no diving to recover fish carcasses will be authorized.

Test Blast Program

Prior to implementing a blasting program a Test Blast Program will be completed. The purpose of the Test Blast Program is to demonstrate and/or confirm the following:

- Drill boat capabilities and production rates
- Ideal drill pattern for typical boreholes
- Acceptable rock breakage for excavation
- Tolerable vibration level emitted
- Directional vibration
- Calibration of the blasts to the surrounding environment

The Test Blast Program begins with a single range of individually delayed holes and progresses up to the maximum production blast intended for use. Each Test Blast is designed to establish limits of vibration and airblast overpressure, with acceptable rock breakage for excavation. The final test event simulates the maximum explosive detonation as to size, overlying water depth, charge configuration, charge separation, initiation methods, and loading conditions anticipated for the typical production blast.

The results of the Test Blast Program will be formatted in a regression analysis with other pertinent information and conclusions reached. This will be the basis for developing a completely engineered procedure for Blasting Plan. During the testing the following data will be used to develop a regression analysis:

- Distance
- Pounds per delay
- Peak Particle Velocities (TVL)
- Frequencies (TVL)
- Peak vector sum
- Air blast, overpressure

The Corps believes that blasting is actually the least environmentally impactful method for removing the rock in the MSCF-BI slipway. Each blast will last no longer than 5-seconds in duration, and may even be as short as 2 seconds, occurring no more than three times per day. As stated previously, the blasts are confined in the rock/concrete substrate. Boreholes are drilled into the substrate below, the blasting charge is set and then the chain of explosives is detonated. Because the blasts are confined within the concrete/rock structure, the distance of the blast effects are reduced as compared to an unconfined blast.

Effects of the Action on Protected Species

Sea Turtles

Direct Effects of Dredging

The impacts of dredging operations on sea turtles have been assessed by NMFS (NMFS, 1991; NMFS, 1995; NMFS, 1997a; NMFS, 1997b; NMFS, 2003) in the various versions of the South Atlantic Regional Biological Opinion (SARBO) and the 2003 (revised in 2005 and 2007) Gulf Regional Biological Opinion (GRBO). The life history of the four sea turtle species commonly found in north Florida, and the four most likely to be affected by in-water construction activities is found in the GRBO; in addition, the species' individual recovery plans are incorporated by reference (NMFS, 2003; NMFS and FWS, 1991; NMFS and FWS, 1991a; NMFS and FWS, 1991b; NMFS and FWS, 1992; NMFS and FWS, 1993; NMFS and FWS, 1995). Removal of the sill after pre-treatment, and removal of dredged material during advance maintenance will be done by mechanical dredge like a clamshell dredge or a cutterhead dredge. The 1991 SARBO states "clamshell dredges are the least likely to adversely affect sea turtles because they are stationary and impact very small areas at a given time. Any sea turtle injured or killed by a clamshell dredge would have to be directly beneath the bucket. The chances of such an occurrence are extremely low…" (NMFS, 1991). NMFS also determined that "of the three major dredge types, only the hopper dredge has been implicated in the mortality of endangered and threatened sea turtles." NMFS repeated the 1991 determination in the 1995 and 1997 SARBOs (NMFS, 1995 and 1997a and b). Based on these determinations, USACE believes that the use of a mechanical and/or cutterhead dredge for removal of the concrete sill and for advance maintenance dredging, may affect, but is not likely to adversely affect listed sea turtles.

As part of the standard plans and specifications for the project, USACE and MCSF-BI have agreed to implement the NMFS "Sea Turtle and Smalltooth Sawfish Construction Conditions:"

a. The permittee shall instruct all personnel associated with the project of the potential presence of these species and the need to avoid collisions with sea turtles and smalltooth sawfish. All construction personnel are responsible for observing water-related activities for the presence of these species.

b. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or smalltooth sawfish, which are protected under the Endangered Species Act of 1973.

c. Siltation barriers shall be made of material in which a sea turtle or smalltooth sawfish cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. Barriers may not block sea turtle or smalltooth sawfish entry to or exit from designated critical habitat without prior agreement from the National Marine Fisheries Service's Protected Resources Division, St. Petersburg, Florida.

d. All vessels associated with the construction project shall operate at "no wake/idle" speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes (e.g., marked channels) whenever possible.

e. If a sea turtle or smalltooth sawfish is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet of a sea turtle or smalltooth sawfish. Operation of any mechanical construction equipment shall cease immediately if a sea turtle or smalltooth sawfish is seen within a 50-foot radius of the equipment. Activities may not resume until the protected species has departed the project area of its own volition.

f. Any collision with and/or injury to a sea turtle or smalltooth sawfish shall be reported immediately to the National Marine Fisheries Service's Protected Resources Division (727-824-5312) and the local authorized sea turtle stranding/rescue organization.

g. Any special construction conditions, required of your specific project, outside these general conditions, if applicable, will be addressed in the primary consultation.

Direct Effects of Blasting

The highest potential impact to sea turtles may result from the use of explosives to remove areas of rock within the project area. Due to the presence of safety zones and measures associated with all proposed blasting activities, it is highly unlikely that blasting will have an adverse effect on listed sea turtles. However, it is extremely likely that both the pressure and noise associated with blasting would physically damage sensory mechanisms and other physiological functions of individual sea turtles. Impacts associated with blasting can be broken into two categories: direct impacts and indirect impacts.

To date, there has not been a single comprehensive study to determine the effects of underwater explosions on reptiles that defines the relationship between distance/pressure and mortality or damage (Keevin and Hempen, 1997). However, there have been studies that demonstrate that sea turtles are killed and injured by underwater explosions (Keevin and Hempen, 1997). Sea turtles with untreated internal injuries would have increased vulnerability to predators and disease. Nervous system damage was cited as a possible impact to sea turtles caused by blasting (U.S. Department of Navy 1998 as cited in USACE, 2000). Damage of the nervous system could kill sea turtles through disorientation and subsequent drowning. The Navy's review of previous studies suggests that rigid masses such as bone (or carapace and plastron) could protect tissues beneath them; however, there are no observations available to determine whether turtle shells would indeed afford such protection.

Christian and Gaspin's (1974) estimates of safety zones for swimmers found that beyond a cavitation area, waves reflected off a surface have reduced pressure pulses;

therefore, an animal at shallow depths would be exposed to a reduced impulse. Studies conducted by Klima *et al*., (1988) evaluated unconfined blasts of approximately 42 pounds (a low number) on sea turtles placed in surface cages at varying distances from the explosion (four ridley and four loggerhead sea turtles). The findings of the Christian and Gaspin 1974 study, which only considered very small unconfined explosive weights, imply that the turtles in the Klima *et al*. (1988) study would be under reduced effects of the shock wave. Despite this possible lowered level of impact, five of eight turtles were rendered unconscious at distances of 229 to 915 meters from the detonation site. Unconscious sea turtles that are not detected, removed and rehabilitated likely have low survival rates. Such results would not have resulted given blast operations confined within rock substrates rather than unconfined blasts.

The proposed action will use confined blasts, which will significantly reduce the pressure wave strength and the area around the discharge where injury or death could occur (Hempen *et al*., 2007). USACE assumes that tolerance of turtles to blast overpressures is approximately equal to that of marine mammals (Department of the Navy 1998 in USACE, 2000), that is death would not occur to individuals farther than 400 feet from a confined blast (Konya, 2003).

For assessing impacts of blasting operations on sea turtles, USACE relied on the previous analyses conducted by NMFS-Protected Resources Division as part of their ESA consultations on the Miami Harbor GRR (NMFS Consult #F/SER/2002/01094 – Feb 26, 2003) (NMFS, 2003a) and the Miami Harbor Phase II project (NMFS, Consult #I/SER/2002/00178 dated Sept 23, 2002) (NMFS, 2002). The results from 38 days of blasting conducted in Miami indicated that 16 sea turtles were recorded in the action area, without a single stranding of an injured or dead turtle reported (Trish Adams, FWS pers.com, 2005; and Wendy Teas, NMFS, pers.com 2005). In the ESA consultations for the two projects in Miami, with regard to impacts on sea turtles, NMFS found that "NOAA Fisheries believes that the use of the mitigative measures above in addition with capping the hole the explosives are placed in (which will greatly reduce the explosive energy released into the water column) will reduce the chances of a sea turtle being adversely affected by explosives to discountable levels." (NMFS, 2003a).

Pressure data collected during the Miami Harbor Phase II project by USACE geophysicists and biologists indicated that using the three zones previously described, the pressures associated with the blasts return to background levels (one to two psi) at the margin of the danger zone. This means that any animal located inside the safety zone, but outside the danger zone, would not be exposed to any additional pressure effects from a confined blast (Hempen *et al*., 2007).

Protection. Based on the protective measures proposed for this project, in concert with the reduction in pressure from the blast due to the confinement of the pressure in the substrate, the impacts to sea turtles associated with blasting should be minimal. USACE has concluded that blasting is the *least* environmentally impactful method for removing the concrete sill and rock in the slipway. Each blast will last no longer than 5 seconds in duration, and may even be as short as two seconds. Additionally, the blasts are confined in rock substrate with stemming. Because the blasts are confined within the rock structure, the distance of the blast effects are reduced significantly as compared to an unconfined blast (Nedwell and Thandavamoorthy, 1992; Hempen *et al*., 2005; Hempen *et al*., 2007).

Indirect Effects

Indirect impacts on sea turtles due to dredging/blasting and construction activities in the project area include alteration of behavior and autecology. For example, daily movements of sea turtles may be impeded or altered. These effects would be temporary, only lasting as long as the dredging and sill removal activities.

The Corps believes that turtles that may be near the project area may be harassed acoustically as a result of the blast detonations. The harassment is expected to be in the form of a temporary threshold shift.

Interrelated and Interdependent Effects

The regulations for interservice consultation found at 50 CFR 402 define interrelated actions as “those that are part of a larger action and depend on the larger action for their justification” and interdependent actions as “those that have no independent utility apart from the action under consideration.”

The Corps does not believe that there are any interrelated actions for this proposed project.

Cumulative Effects

The regulations for interservice consultation found at 50 CFR 402 define cumulative effects as “those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consideration.” The Corps is not aware of any future state or provate activites, not involving Federal activities that are reasonably certain to occur within the action area.

Take Analysis

Due to the restrictions and special conditions placed in the construction specifications for the proposed project, the Corps does not anticipate any injurious or lethal take of endangered/threatened sea turtles, or endangered shortnose sturgeon. The Corps does expect take through harassment in the form of TTS for sea turtles that may be near the action area.

Determination

The Corps has determined that the removal of the concrete sill and advance maintenance dredging of the MCSF-BI slipway is likely to affect, but not likely to adversely affect listed species within the action area. The Corps believes that the restrictions placed on the blasting previously discussed in this assessment will diminish/eliminate the effect of the project on protected species within the action area.

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