



## United States Department of the Interior

FISH AND WILDLIFE SERVICE  
South Florida Ecological Services Office  
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February 23, 2005

Colonel Robert M. Carpenter  
District Engineer  
U.S. Army Corps of Engineers  
701 San Marco Boulevard, Room 372  
Jacksonville, Florida 32207-8175

Service Log No.: 4-1-05-PL-9706  
Corps Application No.: SAJ-2004-6411 (LOP-CDC)  
Date Received: October 21, 2004  
Applicant: Back Bay Improvement Group, LLC  
County: Collier

Dear Colonel Carpenter:

This document is the Fish and Wildlife Service's (Service) biological opinion for the multi-slip dock project listed above resulting in no additional slips within Reach 30 of the U.S. Army Corps of Engineers' (Corps) Reach Characterization for Florida Waters (Corps 2001) in Collier County, Florida. Reach 30 encompasses the waters of Estero Bay, Big Hickory Bay and all connecting tributaries and residential canal systems, including Hendry Creek, Ten Mile Canal, Mullock Creek, Spring Creek, and the Imperial River in Lee County, Florida, and Little Hickory Bay, Wiggins Bay, Wiggins Pass, Water Turkey Bay, and the Cocohatchee River in Collier County, Florida.

### DESCRIPTION OF PROPOSED ACTION

Back Bay Improvement Group, LLC proposes to renovate an existing commercial dock facility. The existing facility includes a multi-slip dock with 49 wet slips and a dry storage facility with 60 dry slips. The existing marina currently contains 109 boat slips. Specifically, the applicant proposed to remove the existing 49-slip dock facility, dredge 908 cubic-yards of silt from the existing marina basin, and reconstruct the 49-slip dock. The reconstructed dock will include 35-foot finger piers, and eight 3-foot by 30-foot finger piers. No modifications are proposed for the existing upland dry storage facility. The project will provide no additional watercraft. The Corps has assigned application number SAJ-2004-6411 (LOP-CDC) to this project. The proposed project is located on Back Bay, Section 5, Township 48 South, Range 25 East, Collier County, Florida.



## CONSULTATION HISTORY

On the date listed above, the Service received a public notice from the Corps requesting concurrence on their “may affect” determination for the West Indian (= Florida) manatee (*Trichechus manatus*) (manatee) and initiation of formal consultation for the proposed action. The proposed action would authorize the reconfiguration and dredging of an existing multi-slip dock project resulting in no new slips.

## BIOLOGICAL OPINION

This biological opinion addresses the potential effects of this project on the Southwest subpopulation of the manatee within Reach 30 in accordance with section 7 of the Endangered Species Act of 1973, as amended (ESA) (16 U.S.C. 1531 *et seq.*) and the Marine Mammal Protection Act of 1972, as amended (MMPA) (16 U.S.C. 1461 *et seq.*). No other listed species will be affected by the proposed action.

This biological opinion was prepared based on information provided by the Corps, the Corps’ Reach Characterization (Corps 2001), the *Florida Manatee Recovery Plan* (Service 2001), the *South Florida Multi-Species Recovery Plan* (Service 1999), data supplied by the Florida Fish and Wildlife Conservation Commission (FWC) and by the Florida Marine Research Institute (FMRI), and other sources of information. A complete administrative record of this consultation is on file at the Service’s South Florida Ecological Services Office in Vero Beach, Florida.

On the date listed above, the Service received a public notice from the Corps requesting concurrence on “may affect” determination for the manatee and initiation of formal consultation for the proposed action. The proposed action would authorize the reconfiguration of a multi-slip dock project resulting in no new slips in Reach 30, in Collier County, Florida.

To reduce direct construction-related impacts to the manatee, the Corps has agreed to include, as a condition of the permit, the *Standard Manatee Construction Conditions* (FWC 2001). Indirect effects of the project to the manatee have been ameliorated by the establishment and posting of manatee speed zones in the project vicinity and the enforcement of these zones by Federal, State, and local law enforcement agencies. There will be no seagrass or dredging impacts associated with this project.

We selected the Corps’ Reach Characterization as the basis for our geographic area analysis. The Corps compiled existing data relevant to the evaluation of the potential effects of watercraft access projects on manatees. The information contained in the Reach Characterization included manatee use data such as aerial surveys and radio telemetry; manatee habitat characteristics such as warmwater sites, seagrass distributions, and bathymetry; human use characteristics such as relative dock densities, boat densities, and navigation channels; and existing manatee protection measures (speed zones). Throughout Florida, the Corps defined 80 segments or “reaches” based on manatee use, manatee habitat characteristics, and human use characteristics and compiled this

information into its Geographic Information System (GIS) database. The Corps also provided the Service with the applicant's completed Manatee Checklist which provides additional site-specific information on the factors defined in the Reach Characterization database.

The action area is determined by the reach boundaries that best encompass the direct and indirect effects of the project under consideration. This reach analysis is supplemented with a county review approach because many factors important to manatee protection are provided at the county level. Manatee Protection Plans (MPP) are produced by counties, manatee speed zones are designated by the State with county participation or by counties directly, and county sheriffs' departments provide enforcement within county boundaries. This combined analysis provides a more holistic evaluation of factors affecting manatees than a piecemeal project-by-project review and also identifies localized threats and options that may be applied to minimize these threats.

### Action Area

The proposed project is located on Back Bay within Reach 30. Vessels using the new multi-slip facility would likely travel through waters of Estero Bay, Big Hickory Bay and all connecting tributaries and residential canal systems, including Hendry Creek, Ten Mile Canal, Mullock Creek, Spring Creek, and the Imperial River in Lee County, Florida, and Little Hickory Bay, Wiggins Bay, Wiggins Pass, Water Turkey Bay, and the Cocohatchee River in Collier County, Florida. These waters closely correspond to the area defined as Reach 30 by the Corps' Reach Characterization for Florida waters (Corps 2001). Therefore, for the purposes of this consultation, the Service defines the action area for this biological opinion as all waters within Reach 30, in Collier County, Florida.

New watercraft access projects may have a number of direct and indirect effects on manatees and manatee habitat. Direct impacts include potential direct harm or harassment of manatees during construction activities and are generally addressed through application of the *Standard Manatee Construction Conditions* (<http://www.floridaconservation.org/psm/permit/construct.htm>) codeveloped by the Corps, Service, and FWC. Anticipated direct impacts to habitat, such as the presence of seagrasses within the project footprint are minimized through modifications in the project design during the permit review process and/or the application of *Dock Construction Guidelines for Florida* developed by the Corps and NOAA Fisheries (Corps and NOAA Fisheries 2001). These two minimization efforts are routinely included as conditions of Department of the Army permits issued for construction projects in manatee habitat and have previously undergone section 7 consultation.

Indirect effects to manatees include effects to routine movement and migration patterns to freshwater, foraging, calving, and breeding areas, and associated behavior patterns. Indirect effects also include effects to manatee habitat caused by operation of the proposed watercraft access project. Construction of the proposed watercraft access project may provide increased access by watercraft to areas frequented by manatees or may alter watercraft traffic patterns in such a way as to increase watercraft-manatee interactions. The lack of protective measures for manatees, such as speed zones, signage, and enforcement, may lead to increased harassment of manatees or increased watercraft collisions with manatees. Depending on the location,

construction of watercraft access projects may encourage watercraft to travel through important manatee habitat features such as submerged aquatic vegetation, warmwater refugia, and freshwater, foraging, calving, and breeding areas, thereby potentially altering manatee habitat and manatee habitat use patterns.

## STATUS OF THE SPECIES/CRITICAL HABITAT

### Species/Critical Habitat Description

Manatees are massive fusiform-shaped mammals with skin that is uniformly dark grey, wrinkled, sparsely haired, and rubber-like. Manatees possess paddle-like forelimbs, no hind limbs, and a spatulate, horizontally flattened tail. Females have two axillary mammae, one at the posterior base of each forelimb. Their bones are massive and heavy with no marrow cavities in the ribs or long bones of the forearms (Odell 1982). Adults average about 10 feet in length and 2,200 pounds in weight, but may reach lengths of up to 15 feet (Gunter 1941) and weigh as much as 3,570 pounds (Rathbun et al. 1990). Newborns average 4 to 4.5 feet in length and weigh about 66 pounds (Odell 1981). The nostrils located on the upper snout, open and close by means of muscular valves as the animal surfaces and dives (Husar 1977; Hartman 1979). A muscular flexible upper lip is used with the forelimbs to manipulate food into the mouth (Odell 1982). Bristles are located on the upper and lower lip pads. Molars designed to crush vegetation form continuously at the back of the jaw and move forward as older ones wear down (Domning and Hayek 1986). The eyes are very small, close with sphincter action, and are equipped with inner membranes that can be drawn across the eyeball for protection. The ears are external, minute, with no pinnae. The anatomy of the internal ear structure indicates that they can hear sounds within a relatively narrow low frequency range, that their hearing is not acute, and that they have difficulty in localizing sound (Ketten et al. 1992). However, Gerstein (1995) suggested that manatees may have a greater low-frequency sensitivity than other marine mammal species that have been tested.

Critical habitat for any species is described as the specific area within the geographic area occupied by the species, at the time it is listed under the provisions of section 4 of the ESA, on which are found those physical or biological features (*i.e.*, constituent elements): (1) essential to the conservation of the species; and (2) which may require special management considerations or protection [ESA §3 (5)(A)].

Critical habitat for this species was designated in 1976 (50 CFR 17.95). Designated critical habitat on the west coast of Florida includes Crystal River in Citrus County, portions of the Little Manatee River in Hillsborough County, the Manatee River in Manatee County, the Myakka River in Sarasota and Charlotte Counties, the Peace River in DeSoto and Charlotte Counties, and the Caloosahatchee River in Lee County. It also includes all the coastal waters in Lee, Collier, and Monroe Counties between Gordon's Pass (Collier County) and Whitewater Bay (Monroe County).

Designated manatee critical habitat on the east coast of Florida includes those intracoastal waters connecting rivers and bays from the Florida/Georgia border south to Key Largo in Monroe County, excluding those waters in Broward County, Florida. Manatees also have critical habitat designated between Key Largo and mainland Miami-Dade County in Florida Bay.

Constituent elements for any designated critical habitat include those physical and biological features essential to the conservation of the species. No specific primary or secondary constituent elements were included in the critical habitat designation. However, researchers agree that essential habitat features for the manatee include seagrasses for foraging, shallow areas for resting and calving, channels for travel and migration, warmwater refuges during cold weather, and fresh water for drinking (Service 2001).

### Life History

Manatees are herbivores that feed opportunistically on a wide variety of aquatic vegetation. Feeding rates and food preferences depend, in part, on the season and available plant species. Manatees frequently feed in water depths of 3 to 9 feet where aquatic vegetation is abundant. Seagrasses appear to be a staple of the manatee diet in coastal areas (Ledder 1986; Provancha and Hall 1991; Kadel and Patton 1992; Koelsch 1997; Lefebvre et al. 2000). Manatees can remain submerged for several minutes with the longest submergence record lasting 24 minutes (Reynolds 1981).

Breeding takes place when one or more males (ranging from 5 to 22 individuals) are attracted to an estrous female to form a temporary mating herd (Rathbun et al. 1995). Mating herds can last up to 4 weeks, with different males joining and leaving the herd daily (Hartman 1979; Bengston 1981; Rathbun et al. 1995; Rathbun 1999). Permanent bonds between males and females do not form. During peak activity, the males in mating herds compete intensely for access to the female (Hartman 1979). Successive copulations involving different males have been reported. Some observations suggest that larger, presumably older, males dominate access to females early in the formation of mating herds and are responsible for most pregnancies (Rathbun et al. 1995). Although breeding has been reported in all seasons, Hernandez et al. (1995) reported that histological studies of reproductive organs from carcasses of males found evidence of sperm production in 94 percent of adult males found between March and November. Females appear to reach sexual maturity by about age 5 but have given birth as early as 4 (Marmontel 1995; Odell et al. 1995; O'Shea and Hartley 1995; Rathbun et al. 1995), and males may reach sexual maturity at 3 to 4 years of age (Hernandez et al. 1995). Manatees may live in excess of 50 years (Marmontel 1995), and evidence for reproductive aging is unclear (Marmontel 1995; Rathbun et al. 1995).

Calf dependency usually lasts 1 to 2 years after birth (Hartman 1979; O'Shea and Hartley 1995; Rathbun et al. 1995; Reid et al. 1995). Calving intervals vary greatly among females, with an average birth cycle of 2 to 2.5 years, but may be considerably longer depending on age and perhaps other factors (Marmontel 1995; Odell et al. 1995; Rathbun et al. 1995; Reid et al. 1995).

Females that abort or lose a calf due to perinatal death (small manatees, less than 60 inches in length) (O'Shea and Hartley 1995), may become pregnant again within a few months (Odell et al. 1995) or even weeks (Hartman 1979).

Manatees often use secluded canals, creeks, embayments, and lagoons, particularly near the mouths of coastal rivers and sloughs, for feeding, resting, playing, mating, and calving (Marine Mammal Commission [MMC] 1986 and 1988). Manatees frequent coastal, estuarine, and riverine habitats and are capable of extensive north-south migrations. Based on telemetry, aerial surveys, photo-identification sighting records, and other studies over the past 20 years, manatee distribution in the southeastern United States is better understood (Beeler and O'Shea 1988; O'Shea 1988; MMC 1984 and 1986; Lefebvre et al. 1989). In general, the data reveal that manatees exhibit opportunism as well as predictable patterns in their distribution and movement.

They are able to undertake extensive north-south migrations with seasonal distribution determined by water temperature below 68°F (20°C). Manatees depend on areas with access to natural springs, manmade warmwater refugia, areas with vascular plants, and freshwater sources. Manatees normally migrate along shorelines and use deeper corridors to access shallow water feeding and resting areas. When ambient water temperatures drop below 68°F in autumn and winter, manatees aggregate within the confines of natural or artificial warmwater refuges (Lefebvre et al. 1989) or move to the southern tip of Florida (Snow 1991). Most warmwater artificial refuges are created by outfalls from power plants or paper mills. As water temperatures rise, manatees disperse from these winter aggregation areas. While some remain near their winter refuges, others undertake extensive migrations along the coast of Florida and far up rivers and canals. Most manatees return to the same warmwater refuges each year. However, some manatees use different refuges in different years, and others use two or more refuges in the same winter (Reid and Rathbun 1984; Rathbun et al. 1990; Reid et al. 1991). There are numerous lesser known, minor aggregation areas used as temporary thermal refuges. Many of these areas are canals or boat basins where warmwater temperatures persist as temperatures in adjacent bays and rivers decline.

Natural causes of death include disease, parasitism, reproductive complications, and other nonhuman-related injuries as well as occasional exposure to cold and red tide (O'Shea et al. 1985; Ackerman et al. 1995). Human-related causes of death, excluding watercraft collisions, include manatees crushed in water control structures and navigational locks, poaching and vandalism, entanglement in shrimp nets, monofilament line and other fishing gear, entrapment in culverts and pipes, and ingestion of debris. Human-related causes of death accounted for at least 6 percent of deaths from 1978 through January 2003. Watercraft-related mortality for the same time period accounted for 25 percent of the total mortality.

### Population Dynamics

Long-term studies suggest four regional populations of manatees in Florida: (a) the Northwest subpopulation, comprising approximately 12 percent of the total manatee population, and consisting of the counties along the Gulf of Mexico from Escambia County east and south to Hernando County, Lafayette, and Gilchrist Counties, and Marion County adjacent to the

Withlacoochee River; (b) the Upper St. Johns River subpopulation, comprising approximately 4 percent of the total manatee population, and consisting of Putnam County from Palatka south, Volusia, Flagler, and Marion Counties adjacent to the St. Johns River or its tributaries, and Lake and Seminole Counties; (c) the Atlantic subpopulation, comprising approximately 42 percent of the total manatee population, and consisting of counties along the Atlantic coast from Nassau County south to Miami-Dade County, the portion of Monroe County adjacent to the Florida Bay and the Florida Keys, Okeechobee County, and counties along the lower portion of the St. Johns River north of Palatka, which includes Putnam, St. Johns, Clay, and Duval Counties; and (d) the Southwest subpopulation, comprising approximately 42 percent of the total manatee population and consisting of the counties along the Gulf of Mexico from Pasco County south to Whitewater Bay in Monroe County and DeSoto, Glades, and Hendry Counties. These regional units are based primarily on documented manatee use of wintering sites and from radio-tracking studies of individuals' movements (Bengston 1981; MMC 1988; Rathbun et al. 1990; Beck and Reid 1995; Rathbun et al. 1995; Reid et al. 1995; Deutsch et al. 1998; Service 2001).

The previous recovery plan (Service 1996) identified the need for a population status working group to assess manatee population size and trends. The first meeting of the Manatee Population Status Working Group (MPSWG), a subcommittee of the Recovery Team, was held in March 1998. The goals of the MPSWG are to: (1) assess the status of the manatee population; (2) advise the Service on population recovery criteria for determining when recovery has been achieved; (3) provide interpretation of available information on manatee population biology to managers; (4) make recommendations concerning needed research directions and methods; and (5) obtain rigorous external review of manatee population data, conclusions, and research methods by independent researchers with expertise in population biology.

In 2001, the MPSWG provided a statement summarizing what they believed to be the status of the Florida manatee at that time (Wildlife Trust 2001). The MPSWG stated that, for the Northwest and Upper St. Johns River subpopulations, available evidence indicated that there had been a steady increase in animals over the last 25 years. The statement was less optimistic for the Atlantic subpopulation due to an adult survival rate that was lower than the rate necessary to sustain population growth. The MPSWG believed that this region had likely been growing slowly in the 1980s, but since then may have leveled off or even possibly declined. They considered the status of the Atlantic subpopulation to be "too close to call." Such finding was consistent with high levels of human-related and, in some years, cold-related deaths in this region.

Regarding the Southwest subpopulation, the MPSWG acknowledged that further data collection and analysis would be necessary to provide an assessment of the manatee's status in this region. Preliminary estimates of adult survival available to the MPSWG at that time indicated that the Southwest subpopulation was similar to the Atlantic subpopulation and "had substantially lower [adult survival estimates] than for the Northwest and Upper St. Johns River [subpopulations]." The Southwest subpopulation was noted for having high levels of watercraft-related manatee deaths and injuries and natural mortality events (*i.e.*, red tide and cold stress).

As stated previously, natural causes of death include disease, parasitism, reproductive complications, and other nonhuman-related injuries as well as occasional exposure to cold and red tide (O'Shea et al. 1985; Ackerman et al. 1995). These natural causes of death accounted for 13 percent of all deaths between 1976 and 2002 (FWC unpublished data). Perinatal deaths accounted for 20 percent of all deaths in the same period. A prominent natural cause of death in some years is exposure to cold. Following a severe winter cold spell at the end of 1989, at least 46 manatee carcasses were recovered in 1990; cause of death for each was attributed to cold stress. Exposure to cold is believed to have caused many deaths in the winters of 1977, 1981, 1984, 1990, 1996, and 2001; and have been documented as early as the 19th century (Ackerman et al. 1995; O'Shea et al. 1985; FWC unpublished data).

In 1982, a large number of manatees also died coincidentally with a red tide dinoflagellate (*Gymnodinium breve*) outbreak between February and March in Lee County, Florida (O'Shea et al. 1991). At least 37 manatees died, perhaps in part, due to incidental ingestion of filter-feeding tunicates that had accumulated the neurotoxin-producing dinoflagellates responsible for causing the red tide. In 1996, from March to May, at least 149 manatees died in a red tide event over a larger region of southwest Florida (Bossart et al. 1998; Landsberg and Steidinger 1998). Although the exact mechanism of manatee exposure to the red tide brevetoxin is unknown in the 1982 and 1996 outbreaks, ingestion, inhalation, or both are suspected (Bossart et al. 1998). Since January 2003, the current red tide outbreak has been responsible for the deaths of 75 manatees (<http://www.floridamarine.org>). The critical circumstances contributing to red tide-related deaths are concentration and distribution of the red tide, timing and scale of manatee aggregations, salinity, and timing and persistence of the outbreak (Landsberg and Steidinger 1998).

Perinatal deaths include aborted fetuses, stillborn, or those that die of natural causes within a few days of birth. Some may die from disease, reproductive complications, and/or congenital abnormalities. The cause of many perinatal deaths cannot be determined, because these carcasses are generally in an advanced state of decomposition at the time of recovery. Additionally, watercraft-related manatee injuries or disturbance or other human-related factors affecting pregnant and nursing mothers may also be responsible for some of the perinatal deaths. It has been suggested that some may die from harassment by adult males (O'Shea and Hartley 1995). Between 1976 and 2002, perinatal deaths increased at an average of 9.2 percent per year (Ackerman et al. 1995; FWC unpublished data).

Data on manatee deaths in the Southwest subpopulation have been collected since 1974 (O'Shea et al. 1985; Ackerman et al. 1995; FWC unpublished data). Data since 1976 were used in the following summary as carcass collection efforts were more consistent following that year. These data indicate an increase in manatee deaths over the last 26 years. This increase can be attributed to increases in watercraft-related manatee mortality and perinatal deaths (MMC 1993), which also corresponds to an increase in the human population and registered watercraft (Wright et al. 1995).



Between 1976 and 2003, 2,223 manatee deaths were recorded within the Southwest subpopulation. The cause of death categories include watercraft, flood gate/canal lock, other human causes, perinatal, cold stress, natural, and undetermined. Death category quantities for the period above are as follows:

watercraft	gate/lock	other human	perinatal	cold stress	natural	undetermined
504	32	38	363	89	476	721

Another threat includes the uncertainty in the availability of warmwater refuges as deregulation of the power industry in Florida occurs. We believe that an increasing human population and intensive coastal development are also long-term threats to the manatee. As Florida's human population increases, particularly in coastal counties, threats to submerged aquatic vegetation communities may increase. These submerged aquatic vegetation communities are an important component in the survival and recovery of the manatee. The combined effects of propeller scarring of seagrass beds, water pollution from stormwater discharges, new docks, dredging, and filling may further degrade seagrasses, thereby, reducing foraging opportunities for manatees.

#### Protection Measures

With more than 960,000 vessels registered in the State of Florida and an estimated 400,000 out-of-state vessels, over 1.3 million watercraft use Florida's waterways annually, and the popularity of watercraft recreation continues to grow. While every new watercraft access facility may not directly equate to a watercraft added to the water, cumulatively, the addition of watercraft access points result in increased watercraft use and, in some cases, changes in watercraft travel patterns and modification of manatee behavior.

Watercraft speed zones were established in some coastal Florida counties with high manatee-watercraft collision rates to slow watercraft to reduce collisions. Anecdotal information indicates that when manatees detect the presence of an oncoming boat, they often but not always dive and/or swim rapidly out of its path. Their ability to effectively elude the oncoming boat is largely determined by the speed of the approaching boat. Given ample time, manatees should be able to avoid lethal and injurious encounters with boats. As such, slow-moving boats are less of a threat to manatees. To control boat speeds and limit boater access to sensitive manatee areas, the State's "Florida Manatee Sanctuary Act" was enacted in 1978. This act designated the State of Florida as a manatee sanctuary and allowed for the regulation of boating activity within State waters. Since its inception, manatee protection zones have been established in 22 counties.

Prior to Shapiro (FWC 2001), there were no definitive studies assessing the effectiveness of the protection zones during the more than 20 years that some of the zones have been in place. Initially, the manatee carcass salvage program was used as a measure to gauge the effectiveness of these zones. The results were very discouraging with watercraft-related deaths continue to occur and increase in excessive numbers in the counties with manatee speed zones.

When gauging the effectiveness of these zones, other factors in addition to the number of watercraft-related deaths must be included in any such evaluation. These factors include, but are not limited to: (1) the types of zones, (2) the volume of vessel traffic, (3) vessel type and size, (4) season/day of week/time of day, and (5) the presence of enforcement [*i.e.*, compliance].

To date, seven compliance studies have been conducted to measure the extent to which boaters comply with manatee protection zones. These studies were conducted in Brevard, Lee, and Sarasota Counties as well as several sites throughout peninsular Florida and demonstrated compliance rates ranging from a low of 26 percent compliance within study areas to a high of 78.6 percent compliance within study areas for the duration of the various monitoring periods. Four of the studies concluded that the presence of law enforcement officers on the water during their sampling period increased levels of compliance. Furthermore, one researcher concluded that “consistent law enforcement presence will ensure consistent compliance.” Another researcher concluded that low levels of enforcement, few citations, and poor signage were responsible for poor compliance.

- Kinnaird (1983) reviewed protection strategies for manatees by examining the number of watercraft-related deaths that had occurred in certain areas before and after they were designated as protection zones. Because the number of deaths was relatively unchanged, she was not able to conclude that they were an effective means to reduce these collisions. However, she believed that the zones “are of critical importance in the reduction of manatee harassment and injury and the prevention of habitat degradation.” Furthermore, she believed that the zones “may be the most effective short-term strategy for reducing [harassment] and the number of manatee/boat collisions.” She encouraged an increase in funding for enforcement and sign maintenance and recommended measures for enhancing the effectiveness of law enforcement activities.
- Morris (1994) conducted the first boater compliance survey to assess boater compliance with manatee protection zones. The surveys were conducted in Brevard County from April 1993 to April 1994. Morris believed that, based on the low number of observations of law enforcement vessels in certain areas and the fact that few citations had been issued in these same areas, boater compliance with these protection zones was poor. He further attributed poor compliance with unclear and confusing signage in manatee protection zones.
- Gorzelany (1996) monitored boater compliance with manatee protection zones in Sarasota County during January-December 1995. Conclusions reached as a result of this study include: (1) areas with a frequent law enforcement presence have the highest level of boater compliance; and (2) observed levels of compliance were higher (74 percent versus 61 percent) and levels of blatant noncompliance lower (8 percent versus 18 percent) in the presence of enforcement vessels. A “cautious” interpretation of other data appears to demonstrate that, when a law enforcement vessel was present in a protection zone, average boat speeds were lower, suggesting an overall slow down in aggregate boat speeds. Gorzelany concludes that “a larger allocation of funds, personnel, and resources toward enhancing marine enforcement in Florida” are necessary to promote “effective coastal waterway management.”

- Gorzelany (1998) monitored boater compliance in Lee County during 1997-1998. General trends and problem areas were identified in the report. Statistically significant comparisons between compliance levels and the presence and absence of law enforcement activities were determined. Specifically, Gorzelany demonstrated that “the presence of a law enforcement vessel influenced the speed and compliance of vessels.”
- Tyson and Combs (1999) conducted a 6-month assessment of boater compliance in Brevard County during May-October 1997 and concluded that (1) compliance was best when law enforcement officers were on the water and (2) consistent law enforcement presence will result in consistent compliance. Tyson and Combs urged the Service to continue its task force initiatives to supplement local law enforcement activities and, thereby, reduce the threat of speeding vessels to manatees.
- Shapiro (2001) focused on boater compliance in evaluating the effectiveness of speed zones at several sites throughout Florida from July 2000 to June 2001. This approach was designed to provide a synoptic view of statewide vessel traffic and boater compliance data. The study consisted of two components: (1) a baseline evaluation that assessed the number of vessels in compliance with posted speed zones, including the size and types of vessels, the season, and time of day; and (2) an enforcement evaluation that assessed how the presence of law enforcement affects boater behavior and compliance. Shapiro reported that (1) compliance increased with increasing vessel size; (2) sailboats were the most compliant, whereas, personal watercraft were the least compliant; (3) compliance was lower when vessel traffic was greater in the afternoon, on weekdays, and during the fall [for those sites along the Atlantic Intracoastal Waterway]; and (4) compliance increased significantly (as high as 89 percent at one location) when law enforcement was present.
- Gorzelany (2002) evaluated boater compliance with two new speed zones in Lee County between February and August 2002 and, similar to Shapiro (2001), observed that (1) compliance increased with increasing boat size and (2) levels of compliance varied with boat types [*i.e.*, personal watercraft the least compliant]. Gorzelany also found that while compliance was 66 percent with one newly established speed zone, compliance was only 26 percent at the second new speed zone and concluded the absence of law enforcement was the reason for the high level of non-compliance.

## Manatee Protection Plans

Concerned with an increased number of manatee mortalities and boating accidents, the Governor and Cabinet directed the Florida Department of Natural Resources (DNR) in June 1989 to make recommendations for specific actions to protect the manatee and its habitat and to make the State’s waterways safer for the boating public. DNR’s final report, *Recommendations to Improve Boating Safety and Manatee Protection on Florida Waterways*, found that over 80 percent of all watercraft-related manatee mortality occurred in 10 counties: Brevard, Broward, Citrus, Collier, Dade (now Miami-Dade), Duval, Lee, Martin, Palm Beach, and

Volusia. Though watercraft-related mortality was not high for St. Lucie, Indian River, and Sarasota, these three counties were considered important areas as travel corridors as well as foraging and resting areas for manatees.

Subsequent to this report, the Governor and Cabinet directed each of these 13 coastal (= key) counties to develop an MPP. The purpose of an MPP is to present a summary of existing information about manatee use and watercraft use within the county and to develop strategies to balance manatee protection, resource protection, waterway uses, boating facility siting, speed zones and signage, boating safety, and to educate the boating public. The final report recommended new or expanded boating facilities in these key counties should be limited to one powerboat slip per 100 linear feet of shoreline (the 1:100 ratio) until the county implements its State-approved MPP, including a boating facility siting component. Watercraft access projects that are consistent with a county's MPP provides a level of boater access and activity that is within the capacity of the manatee protection measures provided. Projects that are not consistent with an MPP may exceed the capacity of the protective measures and, therefore, may result in incidental take of manatees. Countywide MPPs are identified in the *Florida Manatee Recovery Plan* (Service 2001) as a method for protecting manatees and manatee habitat.

Citrus County was the first county to have a State-approved MPP in 1991. The county's MPP identified actions that address manatee mortality and included a boating facility siting plan. The MPP also discussed conservation measures to protect manatee habitat. Subsequent to its approval, the State established regulatory speed zones for watercraft. The State of Florida subsequently approved MPPs for Collier County in May 1995 followed by Miami-Dade County in December 1995; Duval County in June 1999; Indian River County in August 2000 which was amended in February 2002; St. Lucie County in March 2002; Martin County in June 2002; Brevard County in February 2003; Sarasota County in February 2004; and Lee County in August 2004.

The Florida Legislature recognized the importance of site planning for marinas in passing Chapter 296-2002, Laws of Florida, which became effective on May 31, 2002. This law amended Section 380.06(24), Florida Statutes, to establish a process for exempting marinas from the Development of Regional Impact (DRI) review process, provided that certain planning requirements are met. Specifically, marinas are exempt if the local government comprehensive plan includes a boating facility siting plan that incorporates appropriate siting criteria as referenced in the statute. A boating facility siting plan allows local governments to direct marinas, boat ramps and other boating facilities to suitable locations that minimize impacts to marine resources. Rather than addressing the impacts of a proposed marina through the DRI process, the new law establishes a process for adopting criteria to ensure marinas are sited in a manner that minimizes regional impacts to marine resources. Through a boating facility siting plan, local governments can encourage marinas at appropriate locations, while directing marinas away from sites that would adversely impact important resources.

The Service believes that county MPPs are one of the best vehicles to address such issues as boating facilities (marinas, docks, boat ramps, and dry storage areas); boating activity patterns; manatee information; a boat facility siting plan; manatee protection measures; and an education

and awareness program for the boating public. They are valuable planning tools and provide an excellent venue for local manatee protection efforts. In addition, it is our view that an effective MPP must contain components that address manatee protection areas (*e.g.*, manatee refuges), speed zone enforcement, funding for manatee protection efforts, and a reporting/monitoring element. Implementation of a State-approved MPP will have met State standards and addressed our concerns in maximizing benefits to the manatee while providing regulatory certainty to the public.

#### Analysis of the Species/Critical Habitat Likely to be Affected

Due to the new boat access resulting from the proposed action, the Corps has determined that the proposed project “may affect” the manatee. We concur with the Corps’ determinations and have performed a more comprehensive analysis of the effects of the proposed action in order to determine whether or not the proposed activity is likely to jeopardize the continued existence of the Southwest subpopulation of manatees.

The construction of this multi-slip dock project may affect the manatee and its critical habitat by modifying watercraft and human presence in the action area, and increasing the potential to adversely affect submerged aquatic resources (*i.e.*, seagrasses). These actions may disrupt, disturb, or delay manatee migration to warmwater refugia, freshwater drinking sources, and cause additional stress to manatees and calves present in the action area. An analysis of these project-related effects and impacts to seagrasses will be considered further in the remaining sections of this document.

#### ENVIRONMENTAL BASELINE

This section analyzes all past and ongoing human and natural factors leading to the current status of the manatee and its critical habitat in the action area. In the previous discussion of the threats to the species, the Service identified specific human-related actions that combined have both negative and positive benefits to the manatee, and the Service believes that the best method to address these threats is through a comprehensive Reach analysis.

In 2000, the Save the Manatee Club, other environmental groups, and several individuals filed suit in the District of Columbia against the Corps and the Service. Plaintiffs alleged violations of the ESA, the National Environmental Policy Act, the MMPA, and the Administrative Procedure Act, with regard to the manatee, and alleged that the Clean Water Act Section 404 permitting of Florida boating facilities was responsible for watercraft-related manatee mortality in Florida’s coastal counties.

A settlement agreement was signed by all parties of the lawsuit on January 5, 2001, containing the following elements to which the Service agreed to complete and/or implement: (1) revision of the manatee recovery plan; (2) designation of manatee refuges and sanctuaries as manatee protection areas in peninsular Florida; (3) promulgation of a rule for incidental take of manatees under the MMPA; and (4) development of an interim guidance document to be used in section 7 consultations pending completion of the MMPA rule. The designation of refuges and sanctuaries

as well as the interim strategy were short-term measures intended to address recent levels of mortality and that a long-term solution to address historic levels of mortality depended on the development of small take regulations under the MMPA.

Within the Southwest subpopulation, the Service, based on an analysis of manatee mortality data, identified four prerequisites necessary to ensure that incidental take would be unlikely to occur. These four prerequisites are: (1) appropriate speed zones; (2) appropriate signage; (3) speed zone enforcement to prevent watercraft collisions with manatees from occurring as a result of the proposed project; and (4) placement of these measures prior to project implementation. If these prerequisites are not met, the Service believes that a new watercraft facility in this area would result in the take of manatees and identified the area as an “area of inadequate protection.”

Within the range of the Southwest subpopulation, the Service designated in 2001 several locations as areas with “inadequate protection” including a portion of Lemon Bay and Peace River in Charlotte County; a portion of Chokoloskee Bay in Collier County; and the Caloosahatchee River, the Mullock Creek/Ten Mile Canal waterway, and the western and northern waters of Pine Island Sound (known as Bokeelia) in Lee County. In particular, the Mullock Creek/Ten Mile Canal waterway was categorized as an “area of inadequate protection” because of inconsistent and incorrect signage associated with the existing speed zones established in the waterway as well as the absence of enforcement. Since designating these waterways as “areas of inadequate protection” for the manatee, the Service has been working with the State and county entities to ameliorate the watercraft collision threats specific to these regions.

#### Status of the Species Within the Action Area

All waters within Reach 30 are designated as critical habitat for the manatee. The critical habitat designation does not include specific primary or secondary constituent elements. However, important components of manatee critical habitat include areas of submerged vegetation for foraging, shallow areas for resting and calving, channels for travel and migration, warmwater refugia for cold weather events, and fresh water for drinking.

The Southwest subpopulation of manatees migrates through the waters of Collier County. Manatee distribution and dispersal patterns as well as numbers of individuals within an area can vary considerably from year-to-year and season-to-season. This variability in dispersal patterns is dependent on a variety of biotic and abiotic factors, such as warmwater discharges, freshwater sources, foraging areas, and mating season.

Manatee abundance in Collier County has been documented repeatedly through aerial surveys conducted from 1995 to 2002; however, the survey data do not indicate the number of manatees observed in Reach 30. During January 2003 there were three synoptic aerial surveys covering Florida. Each survey counted 1,166; 1,299; and 1,324 manatees on the west coast of Florida. These surveys did not delineate how many manatees were seen within Collier County.

Results of aerial surveys and anecdotal evidence indicate that manatees exhibit seasonal movements within Collier County. Manatees respond to cool ambient temperatures during the winter by aggregating within deeper water such as the Faka Union Canal area. However, during mild winters ( $> 68^{\circ}\text{F}$  ambient temperature), manatees may remain in the action area. Throughout the warm season, manatees are widely dispersed within the action area and known to use the large beds of seagrasses located throughout Collier County's waterways.

The nearest primary warmwater refuge to the project sites is the Faka Union Canal. Many of the artificial waterways (*i.e.*, manmade canals) in the action area are known to be used by manatees for resting and calving.

#### Factors Affecting Species environment Within the Action Area

##### Watercraft

Commercial and recreational boat use in the action area is increasing. According to information provided by the State of Florida, the total number of registered vessels in Collier County since 2000 is as follows:

Year	2000	2001	2002	2003
Registered vessels	19,232	19,182	22,332	22,581

Lee County, along with the West Coast Inland Navigation District and the University of Florida Sea Grant Program, conducted a waterway management evaluation of Estero Bay and its adjoining tributaries and canal systems (Swett et al. 2000). This evaluation was designed to analyze the human ecosystem (= watercraft user) and the environment (= waterway system) to facilitate boating safety and reduce boating impacts on natural resources. The study measured several variables including the number of moorings within this regional waterway. For the purposes of the study, moorings were defined as anchorage, boat lift, davits, dry stack, hoist, mooring, ramp, seawall, trailer, and wet slip. Of the 5,386 moorings identified in the action area, only 3,412 (63 percent) were occupied by watercraft. Of this total, there were 461 moorings and 321 vessels recorded for the Mullock Creek/Ten Mile Canal waterway.

New watercraft resulting from the proposed project will likely travel within the waters of Rookery Bay, Naples Bay, and the Gulf of Mexico, in Collier County Florida. The most likely effects to manatees caused by increased watercraft traffic are deaths or injuries from collisions with watercraft and alteration of seagrass beds used as feeding or resting areas.

##### Mortality

Through an analysis of threats to the manatee, the Service designated waterways in the vicinity of Chokoluskee and Everglades City as an "area of inadequate protection" for manatees in February 2002. In accordance with the final interim strategy implemented on August 21, 2001 (66 FR 43885), the Service assessed the effectiveness of the State's law enforcement efforts by

comparing watercraft-related manatee mortality data for 2001 with mortality data for 2000. From December 31, 2000, to December 31, 2001, manatee mortality increased from 5 to 8 individuals in Collier County. From January 1, 1999, through April 1, 2004, 43 manatees died as a result of a watercraft collision in the Collier.

Year	1999	2000	2001	2002	2003	2004
Collier County	10	5	8	6	7	5

### Speed Zones

On November 30, 1999, Florida Administrative Code 68C-22.007 established manatee speed zones on Collier County waterways. The zones were established for the purpose of regulating the speed and operation of motorboats within Collier County, including all associated and navigable tributaries, lakes, creeks, coves, bends, backwaters, canals, channels and boat basins, unless otherwise designated or excluded.

Watercraft speed zones within Collier County include “No Entry” zones, “Idle Speed/Channel Included” zones, “Slow Speed/Channel Included” zones, “25 mph in Marked Channel/Slow Speed Outside of Channel” zones, “35 mph” zones, and areas of open water that are unregulated. These zones were established by the DEP in Rule 62N-22.010. Zone types and locations were based on manatee congregation data, manatee death data, watercraft usage data, and other manatee natural resource needs. The DEP and the West Coast Inland Navigation District install and maintain speed zone signs in Collier County waters. The Collier County Department of Natural Resources is responsible for placement and maintenance of manatee signs throughout Collier County. Manatee speed zone areas are inspected by Collier County to ensure that adequate marking is present, and that no hazards to navigation exist. The zones were established for the purpose of regulating the speed and operation of motorboats within Collier County, including all associated and navigable tributaries, lakes, creeks, coves, bends, backwaters, canals, channels and boat basins, unless otherwise designated or excluded.

For a speed zone to be enforced the zone must be correctly signed and the signs must be in compliance with State-approved design parameters. The first manatee speed zones were established in the action area in October 1999 with speed zone signs in compliance with State-approved design parameters (68D-23 Florida Administrative Code).

### Enforcement

Enforcement of posted speed zones in Collier County is provided by the FWC, local city enforcement officers, Collier County Sheriff Deputies, and the U.S. Coast Guard. The FWC has 14 officers that patrol the waters of Collier County. Designated manatee speed zones are enforced by members of all duly authorized law enforcement agencies within the county. The U.S. Coast Guard and the Service also provide speed zone enforcement through special task force events.



Gorzelay (1998) monitored boater compliance in Lee County during 1997-1998. General trends and problem areas were identified in the report. Statistically significant comparisons between compliance levels and the presence and absence of law enforcement activities were determined. Specifically, Gorzelany demonstrated that “the presence of a law enforcement vessel influenced the speed and compliance of vessels.”

Enforceability of designated speed zones in Lee County has been substantially reduced by a Lee County Circuit Court ruling in 2003. William Wilkinson and nine other Lee County boaters were cited for speeding in manatee speed zones in 2002 (dates unknown). Wilkinson et al. sued FWC claiming that the speed zones were unconstitutional because they were not based on sound science. On November 12, 2002, the Circuit Court ruled in favor of Wilkinson et al. The Court’s ruling eliminated speed zones in Estero Bay, Matlacha Pass, the southwest side of Pine Island, eastern San Carlos Bay, and north of the mouth of the Caloosahatchee River. The absence of zones and enforcement in these areas increases the potential for manatees to suffer injury and death from watercraft collisions. The Court’s ruling does not affect Federal speed zones in Lee County. The Service established Shell Island as a manatee refuge in November 2002 (67 FR 68450) and the Caloosahatchee River-San Carlos Bay as a manatee refuge in August 2003 (68 FR 46870).

The Court’s ruling affects speed zones in Estero Bay, Matlacha Pass, the southwest side of Pine Island, eastern San Carlos Bay, and the mouth of the Caloosahatchee River. FWC’s Law Enforcement Division has notified members of the Lee County Law Enforcement Task Force that FWC officers will not be enforcing any of the zones affected by the ruling.

These zones include:

Matlacha Pass - All Slow Speed areas [68C-22.005(2)(d)1 and (d)2].

York Island/Chino Island area of Pine Island Sound - All Slow Speed areas [68C-22.005(2)(g)4]. Note that the zones in this area are only in effect April 1-November 14 of each year and unregulated the rest of the year.

Mouth of Caloosahatchee River - Slow Speed areas downstream of marker 93 [68C-22.005(2)(d)4].

Punta Rassa/Shell Creek area - All Slow Speed areas [68C-22.005(2)(d)3].

Estero Bay area - All seasonal Slow Speed/25 mph areas in Estero Bay, Hell Peckney Bay, and Hendry Creek [68C-22.005(2)(f)2, (f)3 and (f)4].

On March 2, the 2nd District Court of Appeals in Lakeland, Florida denied the review of the commission’s case to overturn 20th Circuit Court’s ruling that five State manatee protection zones in Lee County are unconstitutional. The Commission is assessing its appeal options.

The Court's ruling does not affect Federal speed zones in Lee County. The Service established Shell Island as a manatee refuge in November 2002, and the Caloosahatchee River-San Carlos Bay as a manatee refuge in August 2003.

As a result of the court's decision and based on the best available data, the Service will exercise its authority under the Federal ESA and the MMPA, and use an emergency designation to establish the Pine Island-Estero Bay Manatee Refuge.

These Federal protection areas correspond exactly to the previous State designations in these areas. With this emergency designation, the Service is initiating the formal rule making process to make this designation permanent. This process will include an opportunity for public comment.

### Education

Aside from enforcement, another factor influencing boater compliance is education. Boater education is an integral component of Collier County's MPP. The purpose of an MPP is to present a summary of existing information about manatee use and watercraft use within the county and to develop strategies to balance manatee protection, resource protection, water resource uses, facility siting, speed zones, boating safety, and provide for public education.

In reviewing the baseline and to determine if speed zones or levels of enforcement were sufficient to minimize the likelihood of adverse effects to manatees, we looked at existing speed zones, levels of enforcement, manatee aggregation areas, warmwater refugia, freshwater sources, seagrass beds, and mortality data, as well as other biological factors. Based on this review, we focused on manatee mortality because this is the only form of take for which quantitative data are available. For Collier County, the result of all these factors (*i.e.*, zones in the right place with the appropriate signage for officers to enforce) is that between 1992 and 2004, 70 watercraft-related manatee deaths were recorded within Collier County, including 10 in 1999, 5 in 2000, 8 in 2001, 6 in 2002, 7 in 2003, and 5 in 2004.

We know that sublethal forms of take (such as injury and harassment) occur, but some of these forms are immeasurable. Sublethal injury to manatees due to boat interactions is a significant factor. On a continued basis, this type of injury could have an impact on maintaining a healthy and viable population. In that regard, most manatee carcasses examined bear scars from previous strikes with watercraft (Wright et al. 1995), and a significant number of living, but scarred, manatees exist. A photo-identification system and database of scarred manatees currently maintained by the Sirenia Project (Beck and Reid 1995) contain only individuals with distinct scars, the vast majority of which appear to have been inflicted by propeller blades or keels. This database now documents 1,184 living individuals scarred from collisions with boats. Most of these manatees (1,153, or 97 percent) have more than one scar pattern, indicating multiple strikes with boats. Carcasses examined at necropsy also bear healed scars of multiple past strikes by boats; one extreme case, recently noted by the FMRI, had evidence of more than 50 past boat collisions (O'Shea et al. 2001). The severity of these boat strikes, including completely severed tails, major tail mutilations, and multiple disfiguring dorsal lacerations, is

thought by some manatee researchers to impact population processes by reducing calf production (and survival) in wounded females, although there are no reliable data to establish this cause and effect relationship. Overall, the full effects of harm to manatee population dynamics resulting from boat strikes remain largely unknown.

In addition to direct injury due to boat strikes, harassment by boats and swimmers may drive animals away from preferred sites thus altering manatee behavior and movement patterns. Significant and/or long-term harassment may require manatees to travel greater distances to feed or to reach warmwater refugia. Furthermore, some researchers are concerned that manatee calves can be separated from their mothers and some individuals may be driven from preferred warmwater refuges due to harassment.

## Summary

Designated manatee critical habitat is present within the action area and important components of manatee critical habitat are also present. These components, although not identified as primary or secondary constituent elements of critical habitat, include seagrasses for foraging, shallow areas for resting and calving, channels for travel and migration, and refugia for cold weather events. Manatees forage in the extensive seagrass beds present throughout Collier County's waterways. Between 1999 and 2004, 43 watercraft-related manatee deaths were recorded in Collier County.

## EFFECTS OF THE ACTION

This section includes an analysis of the direct and indirect effects of the proposed action on the manatee and its interrelated and interdependent activities.

### Factors to be Considered

The proposed action is in areas that are occupied by the manatee and within designated critical habitat. The timing of construction for this project (when it will be constructed) as it relates to sensitive periods of the manatee's life cycle is unknown. Manatees may be found adjacent to the proposed construction footprint during any time of the year. However, due to cooler water temperatures generally present during mid-winter, there is a lower likelihood that manatees will be adjacent to the construction footprints during this time. There is a high probability that, during the cooler months, manatees will be present at warmwater sites in the Faka Union Canal and outside the action area. Each dock project will be constructed in a single, disruptive event, which depending on the design of the structure can take from 1-2 days to 4-5 days for single-family docks and several weeks for the multi-slip facilities. Once construction is completed, perpetual activities certain to follow include maintenance of the dock structure and watercraft entering and leaving the dock. According to the marine industry, the decking on docks (single-family and multi-slip) lasts from 10-15 years whereas the undercarriage of a dock (the pilings and framework) lasts 20-30 years.

## Analyses for Effects of the Action

The Corps has determined that the proposed dock project is located within Reach 30 as defined by the Corps' Reach Characterization. Manatees are found in the waters surrounding the project site. Designated manatee critical habitat is present within the action area and important components of manatee critical habitat are also present. These components, although not identified as primary or secondary constituent elements of critical habitat, include seagrasses for foraging, shallow areas for resting and calving, channels for travel and migration, warmwater refugia for cold weather events, and fresh water for drinking. Seagrasses are distributed throughout the action area.

Beneficial Effects - There are no known beneficial effects to manatees from the proposed action.

Direct Effects - Direct effects are those effects that are caused by implementation of the proposed action at the time of construction. The direct effects of watercraft access facilities on manatees and essential features of manatee habitat (such as seagrasses), include those arising from the location, design, and construction of watercraft access facilities, and associated dredging and filling for the construction of those facilities. In examining such effects, including those on seagrasses and other important features of manatee habitat, the Service analyzes the extent to which such effects are addressed by local MPPs, State review, and other protective conservation measures, such as standard precautions to protect manatees during construction. The *Standard Manatee Construction Conditions* have been used throughout the range of the manatee for more than a decade and have proven to reduce the direct effects to manatees and their habitat within the facility footprint. The direct effects that this project will have on the manatee and critical habitat within the action area include noise from barge operation and construction equipment; in-water movement of construction equipment and work watercraft; placing and securing dock support structures and mooring piles; and barge ingress and egress to the construction sites. The proposed project will not directly affect seagrasses.

To reduce potential construction-related effects to the manatee and critical habitat, the Corps has agreed to include as a condition of the permit, if approved, and the applicants have agreed to implement as part of their construction, the *Standard Manatee Construction Conditions*, which are as follows:

The permittee shall comply with the following manatee protection construction conditions:

- a. The permittee shall instruct all personnel associated with the project of the potential presence of manatees and the need to avoid collisions with manatees. All construction personnel are responsible for observing water-related activities for the presence of manatee(s).
- b. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the MMPA of 1972, the ESA of 1973, and the Florida Manatee Sanctuary Act.

- c. Siltation barriers shall be made of material in which manatees cannot become entangled, are properly secured, and are regularly monitored to avoid manatee entrapment. Barriers must not block manatee entry to or exit from essential habitat.
- 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 where the draft of the vessel provides less than a 4-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.
- e. If manatee(s) are seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure protection of the manatee. These precautions shall include the operation of all moving equipment no closer than 50 feet to a manatee. Operation of any equipment closer than 50 feet to a manatee shall necessitate immediate shutdown of that equipment. Activities will not resume until the manatee(s) has departed the project area of its own volition.
- f. Any collision with and/or injury to a manatee shall be reported immediately to the FWC Hotline at 1-888-404-FWCC. Collision and/or injury should also be reported to the U.S. Fish and Wildlife Service in Jacksonville (1-904-232-2580) for north Florida or Vero Beach (1-772-562-3909) in south Florida.
- g. Temporary signs concerning manatees shall be posted prior to and during all construction/dredging activities. All signs are to be removed by the permittee upon completion of the project. A sign measuring at least 3 feet by 4 feet which reads *Caution: Manatee Area* will be posted in a location prominently visible to water-related construction crews. A second sign should be posted if vessels are associated with the construction and should be placed visible to the vessel operator. The second sign should be at least 8-1/2" by 11" which reads *Caution: Manatee Habitat. Idle speed is required if operating a vessel in the construction area. All equipment must be shutdown if a manatee comes within 50 feet of operation. Any collision with and/or injury to a manatee shall be reported immediately to the FWC Hotline at 1-888-404-FWCC. The U.S. Fish and Wildlife Service should also be contacted in Jacksonville (1-904-232-2580) for north Florida or in Vero Beach (1-772-562-3909) for south Florida.*

With the incorporation of the above *Standard Manatee Construction Conditions* into the project permit, if approved by the Corps, the Service believes that the construction of the proposed multi-slip dock project will not directly affect the manatee.

Interrelated and Interdependent Actions - There are no interdependent or interrelated actions associated with the proposed activity that is expected to impact manatees.

Indirect Effects - Indirect effects are those long-term effects that are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. Authorizing a dock or marina or boat ramp in some manatee-inhabited areas indirectly affects manatees by increasing the likelihood of manatee mortality and injury resulting from collisions with new vessels

associated with the permitted facility. The placement of watercraft access points has the potential to concentrate boating activities to a particular vicinity. If this area is frequented by manatees, the likelihood of watercraft collisions with manatees is increased proportional to the number of watercraft using the area, given that the boats operate at a speed that could result in collisions with manatees. Also, take in the form of harassment from watercraft could increase in certain areas with the addition of more sublethal watercraft-manatee interactions. However, the likelihood of take is reduced if the adequate and appropriate regulatory measures (*i.e.*, designated manatee speed zones with the appropriate signage coupled with the necessary speed zone enforcement to prevent watercraft collisions with manatees from occurring as a result of the proposed project) are in place.

The Service assumes that the proposed multi-slip dock project will not increase the number of watercraft in the action area. Watercraft in the action area are typically used for fishing, sight-seeing, and recreation by local and seasonal residents. Critical habitat is present and manatee presence has been documented in the action area through aerial surveys, photo-identification studies, telemetry studies, and a carcass salvage program (FWC 2000). Per these studies, it is apparent the entire action area is used throughout the year by manatees.

As stated earlier, an MPP is one means of providing adequate planning to address effects of watercraft access projects on manatees and manatee habitat. Such plans provide a level of manatee protection commensurate with a certain level of boater access. Projects that are consistent with a county's MPP provides a level of boater access and activity that is within the capacity of the manatee protection measures provided. Projects that are not consistent with an MPP may exceed the capacity of the protective measures and, therefore, may result in incidental take of manatees.

Collier County has a State-approved MPP that includes a boating facility siting component. Specifically, the proposed multi-slip facility is consistent with the MPP because the facility reconfiguration will occur at an existing marina. Additionally, the proposed reconfiguration of an existing dock facility will not increase the number of boat slips in Collier County. Because of the reason described above, the Service believes the facility as proposed is consistent with the county's MPP.

#### Species Response to the Proposed Action

Watercraft traffic resulting from the proposed project will likely travel within the waters of the Little Hickory Bay, Wiggins Bay, Wiggins Pass, Water Turkey Bay, and the Cocohatchee River in Collier County, Florida. The most likely effects to manatees caused by increased watercraft traffic are deaths or injuries from collisions with watercraft and alteration of seagrass beds used as feeding or resting areas.

The Service believes that the disruption of behavioral patterns on the manatee population from the this multi-slip dock reconfiguration in no new slips will be insignificant because the waters in and around this dock facility are designated as "30 MPH in Channel/Slow Speed Outside of

Channel All Year”, no seagrasses are present in the project footprints, speed zones and signs are in place and enforcement is provided by a combination of State and local law enforcement personnel.

Although critical habitat is present in the action area, the Service believes that the reconfiguration multi-slip dock will not result in adverse modification of critical habitat because of the absence of and/or the minimization of risk to important components of manatee critical habitat, which are present in the action area. The Corps has agreed to include as a condition of the permit, if approved, and the applicants have agreed to implement as part of their construction, the *Standard Manatee Construction Conditions*.

## CUMULATIVE EFFECTS

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

In August 1999, the Service conducted a workshop to: (1) review what is known about the manatees’ winter use of natural and industrial warmwater sites, (2) discuss the status and future of these sites, and (3) discuss information and management needs necessary to ensure the availability of warm water for wintering manatees (Service 2000). Well over half of the manatee population relies on industrial warmwater discharges for warmth during the winter. While these discharges are reliable sources of warmth, they are ephemeral in nature, restricted by the life span of generating facilities, operational limitations, fluctuating demand for power, and pending deregulation of the power generation industry. This, in combination with the fact that some industrial discharges have attracted manatees outside of their traditional wintering habitat, has put this species at risk.

One of the presentations at the workshop reported the results of a study on the manatees’ response to the elimination of a warmwater refuge in north Florida. Of the 15 animals that were radio-tagged and tracked in this study, six manatees died and two were rescued between October 1997 and March 1998. A couple of the preliminary conclusions are that five of the six manatee deaths were due to prolonged exposure to colder temperatures and not all manatees migrate south to warmwater aggregation sites once their current source of warm water is eliminated. As discussed earlier in this biological opinion, manatees use the Faka Union Canal as a warmwater refuge during the winter months.

## CONCLUSION

After reviewing the current status of the manatee, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service’s biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the manatee and are not likely to adversely modify designated critical habitat. This conclusion is

based on the existing speed zones and associated signage, the level of enforcement provided by State and local law enforcement officers, and that these protective measures are currently in place as well as Collier County's State-approved MPP. These manatee-protective measures all have had a positive effect on manatee conservation and will have a continued positive effect on the species and its habitat. Therefore, each of these measures will contribute to a reduced likelihood of take and taken together the Service is not reasonably certain that take will occur as a result of the proposed docks in Reach 30. However, to confirm this conclusion, we will continue to closely monitor this Reach because of historic watercraft-related mortalities and the year-round utilization of the area by manatees. The proposed action represents no increase in the total number of registered watercraft in Collier County. If the current trend in manatee mortality changes, we will need to re-evaluate and implement an adaptive management approach to improving manatee protection in the future and reinitiate consultation with the Corps, when warranted. Furthermore, the existing speed zones and associated signage, the level of enforcement provided by State and local law enforcement officers, and that these protective measures are currently in place as well as Collier County's State-approved MPP, we believe that the proposed action may affect, but is not likely to adversely affect the manatee or its critical habitat in Reach 30. In addition, the *Standard Manatee Construction Conditions* will be implemented during the construction of this facility.

#### INCIDENTAL TAKE STATEMENT

The Service does not anticipate that the proposed action will result in the incidental take of manatees. Furthermore, the Service is not including an incidental take authorization for marine mammals at this time because the incidental take of marine mammals has not been authorized under section 101(a)(5) of the MMPA and/or its 1994 Amendments. Following issuance of such regulations or authorizations, the Service may amend this biological opinion to include an incidental take statement for marine mammals, as appropriate.

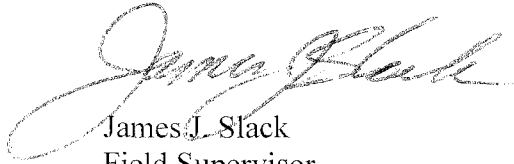
#### REINITIATION NOTICE

As provided in 50 CFR 402.15, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.



Thank you for your cooperation and effort in protecting fish and wildlife resources. If you have any questions regarding this project, please contact Chuck Kelso at 772-562-3909, extension 241.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "James J. Slack". The signature is fluid and cursive, with the first name "James" being more prominent.

James J. Slack  
Field Supervisor  
South Florida Ecological Services Office

cc:

Regional Solicitor, DOI, Atlanta, Georgia (Delores Young)  
Service, Atlanta, Georgia (Acting ARD-ES)  
Service, Jacksonville, Florida (Dave Hankla)  
Corps, Fort Myers, Florida (Skip Bergman and Carol Crane)  
NOAA Fisheries, St. Petersburg, Florida  
FWC (BPSM), Tallahassee, Florida (Carol Knox)  
FWC, Punta Gorda, Florida

## LITERATURE CITED

- Ackerman, B.B. 1995. Aerial surveys of manatee: A summary and progress report. Pages 13-33 in T.J. O'Shea, B.B. Ackerman, and H.F. Percival, (eds.). Population Biology of the Florida Manatee. National Biological Service, Information and Technology Report Number 1. Washington D.C.
- Ackerman, B.B., S.D. Wright, R.K. Bonde, D.K. Odell, and D.J. Banowetz. 1995. Trends and patterns in mortality of manatees in Florida, 1974-1992. Pages 13-33 in T.J. O'Shea, B.B. Ackerman, and H.F. Percival, (eds.). Population Biology of the Florida Manatee. National Biological Service, Information and Technology Report Number 1. Washington, D.C.
- Beck, C.A. and J.P. Reid. 1995. An automated photo-identification catalog for studies of the life history of the Florida manatee. Pages 120-134 in T.J. O'Shea, B.B. Ackerman, and H.F. Percival (eds.). Population Biology of the Florida Manatee. National Biological Service, Information and Technology Report Number 1. Washington, D.C.
- Beeler, I.E. and T.J. O'Shea. 1988. Distribution and mortality of the West Indian manatee (*Trichechus manatus*) in the southeastern United States: A compilation and review of recent information. Prepared by the U.S. Fish and Wildlife Service for the U.S. Army Corps of Engineers. Document Number PB 88-207 980/AS. National Technical Information Service. Springfield, Virginia.
- Bengston, J.L. 1981. Ecology of manatees (*Trichechus manatus*) in the St. Johns River, Florida. Ph.D. Thesis. University of Minnesota, Minneapolis, Minnesota.
- Bossart, G.D., D.G. Baden, R.Y. Ewing, B. Roberts, and S.D. Wright. 1998. Brevetoxicosis in manatees (*Trichechus manatus latirostris*) from the 1996 epizootic: gross, histologic, and immunohistochemical features. Toxicologic Pathology Volume 26(2):276-282.
- Buckingham, C.A., L.W. Lefebvre, J.M. Schaefer, and H.I. Kochman. 1999. Manatee response to boating activity in a thermal refuge. Wildlife Society Bulletin 27(2):514-522.
- Deutsch, C.J., R.K. Bonde, and J.P. Reid. 1998. Radio-tracking manatees from land and space: Tag design, implementation, and lessons learned from long-term study. Marine Technology Society Journal 32(1):18-29.
- Domning, D.P. and L-A.C. Hayek. 1986. Interspecific and intraspecific morphological variation in manatees (Sirenia: *Trichechus*). Marine Mammal Science 2(2):87-144.
- Florida Department of Highway Safety and Motor Vehicles. 2000. Vessel registrations by county, Fiscal Year 1998/99. Data Listing Unit, Tallahassee, Florida.

- Florida Department of Highway Safety and Motor Vehicles. 2001. Vessel registrations by county, Fiscal Year 2000/01. Data Listing Unit, Tallahassee, Florida.
- Florida Department of Highway Safety and Motor Vehicles. 2003. Vessel registrations by county, Fiscal Year 2002/03. Data Listing Unit, Tallahassee, Florida.
- Florida Fish and Wildlife Conservation Commission. 2000. Aerial Survey Database <[http://www.floridamarine.org/manatees/search\\_summary.asp](http://www.floridamarine.org/manatees/search_summary.asp)>. Tallahassee, Florida.
- Florida Fish and Wildlife Conservation Commission. 2003. Aerial Survey Database [http://www.floridamarine.org/features/category\\_sub.asp](http://www.floridamarine.org/features/category_sub.asp)>. Tallahassee, Florida
- Florida Office of Economic and Demographic Research, The Florida Legislature. Florida Population, Components and Change (1950-2000), (last modified March 27, 2001) <<http://www.state.fl.us/edr/index.html>>.
- Florida Marine Research Institute 2002. Final biological status review of the Florida manatee (*Trichechus manatus latirostris*) in Florida. Florida Marine Research Institute, Florida Fish and Wildlife Conservation Commission, St. Petersburg, Florida.
- Garrott, R.A., B.B. Ackerman, J.R. Cary, D.M. Heisey, J.E. Reynolds, III, P.M. Rose, and J.R. Wilcox. 1994. Trends in counts of Florida manatees at winter aggregation sites. *Journal of Wildlife Management* 58(4):642-654.
- Gerstein, E.R. 1995. The underwater audiogram of the West Indian manatee (*Trichechus manatus latirostris*). M.S. Thesis. Florida Atlantic University, Boca Raton, Florida.
- Gorzelany, J.F. 1996. Evaluation of boater compliance with speed regulations in Sarasota County, Florida. Final report submitted to the Florida Department of Environmental Protection. Tallahassee, Florida. 106 pages.
- Gorzelany, J.F. 1998. Evaluation of boat traffic patterns and boater compliance in Lee County, Florida. Final report submitted to the Florida Department of Environmental Protection. Tallahassee, Florida. 109 pages.
- Gorzelany, J.F. 2002. Evaluation of boater compliance in association with new boat speed regulations at two locations in Estero Bay. Final report submitted to the Florida Fish and Wildlife Conservation Commission. St. Petersburg, Florida. 36 pages.
- Gunter, G. 1941. Occurrence of the manatee in the United States, with records from Texas. *Journal of Mammalogy* 22(1):60-64.
- Hartman, D.S. 1979. Ecology and behavior of the manatee (*Trichechus manatus*) in Florida. American Society of Mammalogists Special Publication Number 5.

- Hernandez, P., J.E. Reynolds, III, H. Marsh, and M. Marmontel. 1995. Age and seasonality in spermatogenesis of Florida manatees. Pages 84-97 in T.J. O'Shea, B.B. Ackerman, and H.F. Percival (eds.). Population Biology of the Florida Manatee. National Biological Service, Information and Technology Report Number 1. Washington, D.C.
- Husar, S.L. 1977. The West Indian manatee (*Trichechus manatus*). U.S. Fish and Wildlife Service. Wildlife Resource Report Number 7:1-22.
- Kadel, J.J. and G.W. Patton. 1992. Aerial studies of the West Indian manatee (*Trichechus manatus*) on the west coast of Florida from 1985-1990: A comprehensive 6-year study. Mote Marine Laboratory Technical Report Number 246.
- Ketten, D.R., D.K. Odell, and D.P. Domning. 1992. Structure, function, and adaptation of the manatee ear. Pages 77-95 in J. Thomas, R. Kastelein, and A. Supin (eds.). Marine mammal sensory systems. Plenum Press, New York, New York.
- Kinnaird, M.F. 1983. Evaluation of potential management strategies for the reduction of boat-related mortality of manatees. Research Report Number 3, Florida Cooperative Fish and Wildlife Research Unit, U.S. Fish and Wildlife Service.
- Koelsch, J.K. 1997. The seasonal occurrence and ecology of Florida manatees (*Trichechus manatus latirostris*) in coastal waters near Sarasota, Florida. M.S. Thesis. University of South Florida, Tampa, Florida.
- Landsberg, J.H. and K.A. Steidinger. 1998. A historical review of *Gymnodinium breve* red tides implicated in mass mortalities of the manatee (*Trichechus manatus latirostris*) in Florida, USA. Pages 97-100 in Raguera, B., J. Blanco, M.L. Fernández, and T. Wyatt (eds.). Harmful Algae. Xunta de Galicia and Intergovernmental Oceanographic Commission of UNESCO 1998.
- Langtimm, C.A., C. Beck, H. Edward, B. Ackerman, K. Fick, and S. Barton. 2002. Survival estimates for Florida manatees from the photo-identification of marked individuals. Unpublished abstract for the Manatee Population Ecology and Management Workshop, April 2-4, 2002, Gainesville, Florida.
- Ledder, D.A. 1986. Food habits of the West Indian manatee (*Trichechus manatus latirostris*) in south Florida. M.S. Thesis, University of Miami, Coral Gables, Florida.
- Lefebvre, L.W. and R.K. Frohlich. 1986. Movements of radio-tagged manatees in southwest Florida, January 1985-March 1986. Unpublished report, U.S. Fish and Wildlife Service and Florida Department of Natural Resources, Gainesville, Florida.

- Lefebvre, L.W., T.J. O'Shea, G.B. Rathbun, and R.C. Best. 1989. Distribution, status, and biogeography of the West Indian manatee. Pages 567-609 in C.A. Woods (ed.). Biogeography of the West Indies: Past, Present, and Future. Sandhill Crane Press. Gainesville, Florida.
- Lefebvre, L.W., B.B. Ackerman, K.M. Portier, and K.H. Pollock. 1995. Aerial survey as a technique for estimating trends in manatee population size - problems and prospects. Pages 63-74 in T.J. O'Shea, B.B. Ackerman, and H.F. Percival (eds.). Population Biology of the Florida Manatee. National Biological Service, Information and Technology Report Number 1. Washington, D.C.
- Lefebvre, L.W., J.P. Reid, W.J. Kenworthy, and J.A. Powell. 2000. Characterizing manatee habitat use and seagrass grazing in Florida and Puerto Rico: Implications for conservation and management. *Pacific Conservation Biology* 5(4):289-298.
- Marine Mammal Commission. 1984. Marine Mammal Commission Annual Report to Congress 1983. Washington, D.C.
- Marine Mammal Commission. 1986. Habitat protection needs for the subpopulation of West Indian manatees in the Crystal River area of northwest Florida. Document Number PB86-200250, National Technical Information Service. Silver Spring, Maryland.
- Marine Mammal Commission. 1988. Preliminary assessment of habitat protection needs for West Indian manatees on the east coast of Florida and Georgia. Document Number PB89-162002, National Technical Information Service. Silver Spring, Maryland.
- Marine Mammal Commission. 1993. Marine Mammal Commission Annual Report to Congress 1992. Washington, D.C.
- Marmontel, M. 1995. Age and reproduction in female Florida manatees. Pages 98-119 in T.J. O'Shea, B.B. Ackerman, and H.F. Percival (eds.). Population Biology of the Florida Manatee. National Biological Service, Information and Technology Report Number 1. Washington, D.C.
- Marmontel, M., S.R. Humphrey, and T.J. O'Shea. 1997. Population Viability Analysis of the Florida Manatee (*Trichechus manatus latirostris*), 1976-1991. *Conservation Biology*. 11(2):467-481.
- Morris, J.G. 1994. An investigation of compliance to boat speed regulations in manatee protection zones in Brevard County, Florida. Final report submitted to the Florida Department of Environmental Protection. Tallahassee, Florida. 74 pages.

- Nill, E.K. 1998. Florida Manatee Entanglement Report. U.S. Fish and Wildlife Contract #40181-98-M146.
- Odell, D.K. 1981. Growth of a West Indian manatee, *Trichechus manatus*, born in captivity. Pages 131-140 in R. L. Brownell, Jr. and K. Ralls (eds). The West Indian manatee in Florida. Proceedings of a workshop held in Orlando, Florida, March 27-29, 1978. Florida Department of Natural Resources, Tallahassee, Florida.
- Odell, D.K. 1982. The West Indian manatee, *Trichechus manatus linnaeus*. Pages 828-837 in J.A. Chapman and G.A. Feldhammer (eds.). Wild Mammals of North America. Johns Hopkins University Press, Baltimore, Maryland.
- Odell, D.K. and J.E. Reynolds. 1979. Observations on manatee mortality in south Florida. *Journal of Wildlife Management* 43:572-577.
- Odell, D.K., G.D. Bossart, M.T. Lowe, and T.D. Hopkins. 1995. Reproduction of the West Indian manatee in captivity. Pages 192-193 in T.J. O'Shea, B.B. Ackerman, and H.F. Percival (eds.). Population Biology of the Florida Manatee. National Biological Service, Information and Technology Report Number 1. Washington, D.C.
- O'Shea, T.J. 1988. The past, present, and future of manatees in the southeastern United States: Realities, misunderstandings, and enigmas. Pages 184-204 in Odium, R.R., K.A. Riddleberger, and J.C. Ozier (eds.). Proceedings of the Third Southeastern Nongame and Endangered Wildlife Symposium. Georgia Department of Natural Resources. Social Circle, Georgia.
- O'Shea, T.J. and W.C. Hartley. 1995. Reproduction and early-age survival of manatees at Blue Spring, Upper St. Johns River, Florida. Pages 157-170 in T.J. O'Shea, B.B. Ackerman, and H.F. Percival (eds.). Population Biology of the Florida Manatee. National Biological Service, Information and Technology Report Number 1. Washington, D.C.
- O'Shea, T.J., C.A. Beck, R.K. Bonde, H.I. Kochman, and D.K. Odell. 1985. An analysis of manatee mortality patterns in Florida 1976-1981. *Journal of Wildlife Management* 49:1-11.
- O'Shea, T.J., G.B. Rathbun, R.K. Bonde, C.D. Buergelt, and D.K. Odell. 1991. An epizootic of Florida manatees associated with a dinoflagellate bloom. *Marine Mammal Science* 7(2):165-179.
- O'Shea, T.J., B.B. Ackerman, and H.F. Percival (eds.). 1992. Interim report of the technical workshop on manatee population biology. Manatee Population Research Report Number 10. Florida Cooperative Fish and Wildlife Research Unit, Gainesville, Florida.

- O'Shea, T.J., L.W. Lefebvre, and C.A. Beck. 2001. Florida Manatees: Perspectives on Populations, Pain, and Protection. Pages 31-43 in L.A. Dierauf and F.M.D. Gulland (eds.). CRC Handbook of Marine Mammal Medicine, 2nd edition. CRC Press, Boca Raton, Florida.
- Packard, J.M. and R. Mulholland. 1983. Analysis of manatee aerial surveys: a compilation and preliminary analysis of winter aerial surveys conducted in Florida between 1977 and 1982. Manatee Population Research Report Number 2. Florida Cooperative Fish and Wildlife Research Unit, Gainesville, Florida.
- Packard, J.M., R.C. Summers, and L.B. Barnes. 1985. Variation of visibility bias during aerial surveys of manatees. *Journal of Wildlife Management* 49(2):347-351.
- Powell, J.A. and G.B. Rathbun. 1984. Distribution and abundance of manatees along the northern coast of the Gulf of Mexico. *Northeast Gulf Science* 7(1):1-28.
- Provancha, J.A. and C.R. Hall. 1991. Observations of associations between seagrasses and manatees in East Central Florida. *Florida Scientist* 54(2):87-98.
- Rathbun, G.B. 1999. Sirenians. Pages 390-399 in Chapter 8: Behavior. J.E. Reynolds, III, and S.A. Rommel (eds.). *Biology of Marine Mammals*. Smithsonian Institution Press, Washington, D.C.
- Rathbun, G.B., J.P. Reid, and G. Carowan. 1990. Distribution and movement patterns of manatees (*Trichechus manatus*) in Northwestern peninsular Florida. Florida Marine Research Publication Number 48.
- Rathbun, G.B., J.P. Reid, R.K. Bonde, and J.A. Powell. 1995. Reproduction in free-ranging Florida manatees. Pages 135-156 in T.J. O'Shea, B.B. Ackerman, and H.F. Percival (eds.). *Population Biology of the Florida Manatee*. National Biological Service, Information and Technology Report Number 1. Washington, D.C.
- Reid, J.P. and G.B. Rathbun. 1984. Manatee identification catalogue, October 1984 update. Unpublished progress report prepared by the U.S. Fish and Wildlife Service, Sirenia Project, Gainesville, Florida, for the Florida Power and Light Company.
- Reid, J.P., G.B. Rathbun, and J.R. Wilcox. 1991. Distribution patterns of individually identifiable West Indian manatees (*Trichechus manatus*) in Florida. *Marine Mammal Science* 7(2):180-190.
- Reid, J.P., R.K. Bonde, and T.J. O'Shea. 1995. Reproduction and mortality of radio-tagged and recognizable manatees on the Atlantic Coast of Florida. Pages 171-191 in T.J. O'Shea, B.B. Ackerman, and H.F. Percival (eds.). *Population Biology of the Florida Manatee*. National Biological Service, Information and Technology Report Number 1. Washington, D.C.

- Reynolds, J.E. 1981. Behavior patterns in the West Indian manatee, with emphasis on feeding and diving. *Florida Scientist* 44(4):233-241.
- Runge, M.C., C.A. Langtimm, and W.L. Kendall. In review. A stage-based model of manatee population dynamics. *Marine Mammal Science*.
- Shapiro, S.L. 2001. Assessing boater compliance with manatee speed zones in Florida. Final report to the U.S. Fish and Wildlife Service. Jacksonville, Florida. 75 pages + appendices.
- Snow, R.W. 1991. The distribution and relative abundance of the Florida manatee in Everglades National Park, an annual report, October 1, 1991. South Florida Research Center, Everglades National Park, Homestead, Florida.
- Swett, R.A., D.A. Fann, G.A. Antonini, and L. Carlin-Alexander. 2000. Regional Waterway Management System for Lee County, Phase 1. Florida Sea Grant, University of Florida, Gainesville, Florida.
- Tyson, S. and L.R. Combs. 1999. Canaveral Barge Canal boater activity and compliance study Brevard County, Florida. Final report submitted to the Florida Department of Environmental Protection. Tallahassee, Florida. 86 pages.
- U.S. Army Corps of Engineers. 2001. The U.S. Army Corps of Engineers, Jacksonville District's Reach Characterization of Florida's Waters. (Last updated June 26, 2003) <[http://www.saj.usace.army.mil/permit/hot\\_topics/manatee/charaabstract.htm](http://www.saj.usace.army.mil/permit/hot_topics/manatee/charaabstract.htm)>
- U.S. Army Corps of Engineers and Florida Department of Environmental Protection. 2001. The U.S. Army Corps of Engineers, Jacksonville District, and the Department of Environmental Protection effect determination key for the manatee in Florida, January 2, 2001. U.S. Army Corps of Engineers, Jacksonville, Florida.
- U.S. Army Corps of Engineers and National Marine Fisheries Service. 2001. Dock Construction Guidelines in Florida for Docks and Other Minor Structures Constructed in or over Submerged Aquatic Vegetation, Marsh, or Mangrove Habitat.
- U.S. Fish and Wildlife Service. 1996. Florida Manatee Recovery Plan (*Trichechus manatus latirostris*), Second Revision. Atlanta, Georgia.
- U.S. Fish and Wildlife Service. 1999. South Florida multi-species recovery plan. Atlanta, Georgia.
- U.S. Fish and Wildlife Service. 2000. Florida manatees and warm water: Proceedings of the warmwater workshop. Jupiter, Florida, August 24-25, 1999. Jacksonville, Florida.



U.S. Fish and Wildlife Service. 2001. Florida Manatee Recovery Plan (*Trichechus manatus latirostris*), Third Revision. Atlanta, Georgia.

Wildlife Trust. 2001. 2001 Manatee Population Status Statement. March 2001.

Wright, S.D., B.B. Ackerman, R.K. Bonde, C.A. Beck, and D.J. Banowetz. 1995. Analysis of watercraft-related mortality of manatees in Florida, 1979-1991. Pages 259-268 in T.J. O'Shea, B.B. Ackerman, and H.F. Percival (eds.). Population Biology of the Florida Manatee. National Biological Service, Information and Technology Report Number 1. Washington D.C.