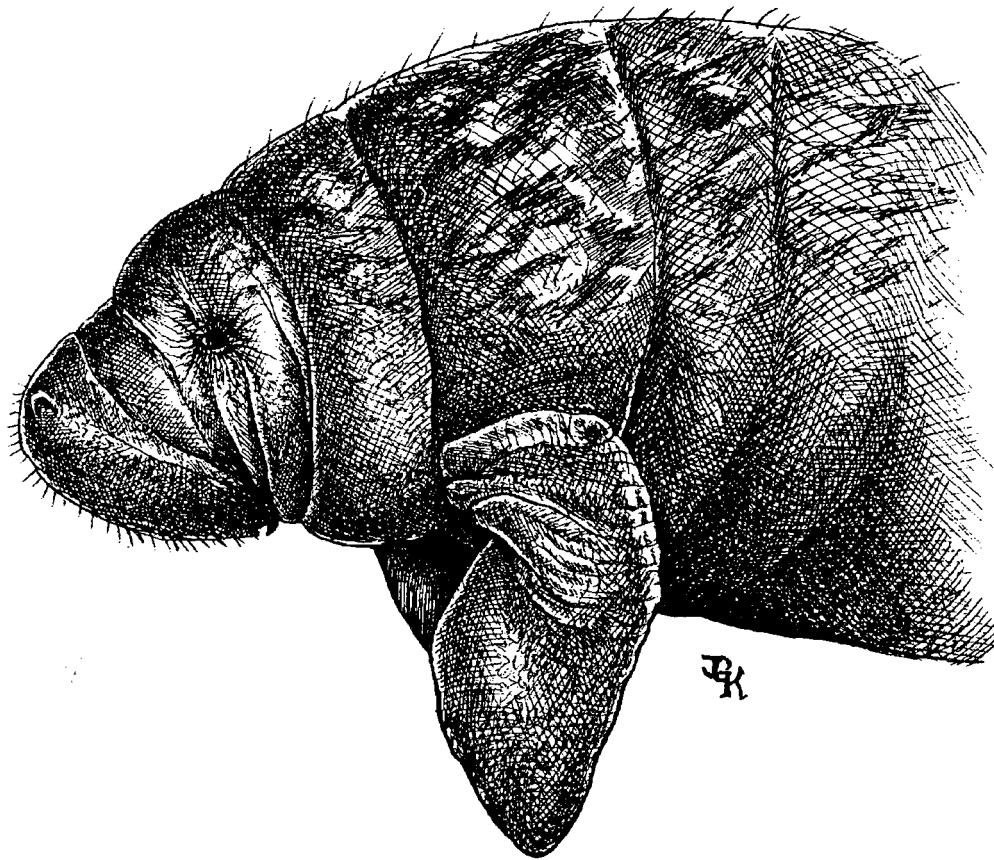


# *Florida Manatee Recovery Plan*



**January 29, 1996**



**U. S. Fish and Wildlife Service  
Southeast Region**



**FLORIDA MANATEE RECOVERY PLAN**

**(*Trichechus manatus latirostris*)**

**SECOND REVISION**

(Original Approval: April 15, 1980)  
(First revision approved: July 24, 1989)

Prepared by the  
Florida Manatee Recovery Team

for

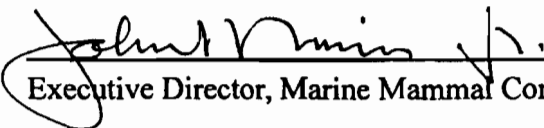
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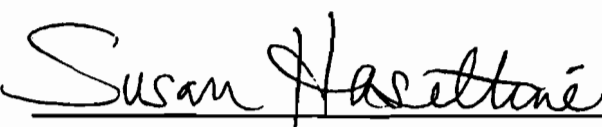
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*Rosen K. Clough*  
Regional Director, U. S. Fish and Wildlife Service

Date: \_\_\_\_\_

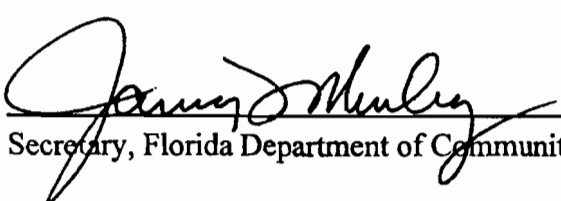
*January 29, 1996*

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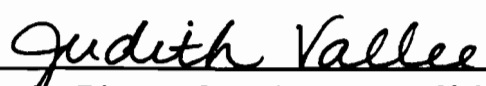
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Concur: W. Long 3/15/96  
President, Marine Industries Association of Florida

Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect listed species. Plans are published by the U.S. Fish and Wildlife Service, sometimes prepared with the assistance of recovery teams, contractors, state agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views nor the official policies of any individuals or agencies involved in the plan formulation, other than the U.S. Fish and Wildlife Service. They represent the official views of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director or Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Literature Citations should read as follows:

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## EXECUTIVE SUMMARY

**Current Status:** Endangered. The highest number of Florida manatees counted was 1,856 during a synoptic aerial survey conducted at warm-water refugia over a two day period during January 1992. Distribution was nearly equal between the east and west coasts of Florida.

**Habitat Requirements and Limiting Factors:** The Florida manatee lives in freshwater, brackish and marine habitats. Submerged, emergent, and floating vegetation are their preferred food. During the winter, cold temperatures keep the population concentrated in peninsular Florida. During the summer they expand their range and are seen as far north as Rhode Island on the east coast and as far west as Louisiana on the Gulf Coast. Mortality data collected since 1974 indicates a clear increase in manatee deaths over the last 15 years. Increasing numbers of manatees killed by boats and tremendous increases in boat traffic are the most important problem presently faced by manatees in Florida. Intensive coastal development is perhaps the greatest long-term threat to the Florida manatee. Their survival will depend on maintaining the integrity of ecosystems and habitat sufficient to support a sustainable manatee population.

**Recovery Objective:** Downlisting and ultimately delisting.

**Recovery Criteria:** Downlisting should be considered when the best available scientific data indicates that the population is growing or stable when mortality factors are controlled at acceptable levels or are stable or decreasing, and when critical habitats are secure and threats to them are controlled or decreasing.

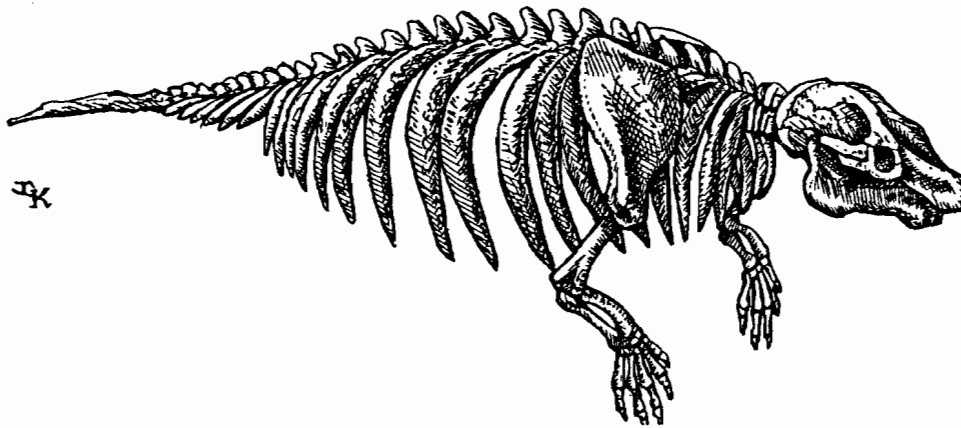
**Actions Needed:**

1. Identify and minimize causes of manatee disturbance, injury, and mortality.
2. Protect essential habitats.
3. Determine and monitor the status of manatee populations and essential habitat.
4. Coordinate recovery activities; monitor and evaluate progress and update/revise the Recovery Plan.

Costs (\$000's):

YEAR	NEED 1	NEED 2	NEED 3	NEED 4	TOTAL
Current	4311.5	410.0	1388.0	485.0	6594.5
FY 2	4166.0	449.0	1435.0	493.0	6543.0
FY 3	3654.5	592.0	1420.0	517.5	6184.0
FY 4	3654.5	592.0	1420.0	517.5	6184.0
FY 5	3771.5	542.0	1456.0	530.0	6299.5
Total Cost of Recovery	19558.0	2585.0	7119.0	2543.0	31805.0

Date of Recovery: Downlisting/delisting should be initiated in 2010, if recovery criteria have been met.



## **ACKNOWLEDGEMENTS**

This recovery plan revision closely follows the proposed recovery team draft submitted to the Service in 1993 by the Recovery Plan Drafting subcommittee of the Florida Manatee Recovery Team. The Subcommittee members were David Laist of the U.S. Marine Mammal Commission (Chair), Dr. Lynn Lefebvre of the National Biological Service's Sirenia Project, R. Kipp Frohlich of the Bureau of Protected Species Management, and Bradley L. Weigle of the Florida Marine Research Institute, both within the Florida Department of Environmental Protection, and Robert O. Turner, the Service's Manatee Recovery Coordinator. The plan revision accurately refines needed recovery program activities for the next 5 years and current program structure within involved agencies and incorporates the views of the entire Florida Manatee Recovery Team. The Recovery Team includes representatives of the agencies listed above plus the Florida Marine Patrol, Florida Game and Fresh Water Fish Commission, Georgia Department of Natural Resources, the U.S. Army Corps of Engineers, the Florida Department of Community Affairs, the Marine Industries Association of Florida, Florida Power & Light Co., Save the Manatee Club, and Sea World of Florida.

Claudia Myers, Vikki Barron, and Linda White assisted with the production of this document. Illustrations in the plan were provided by James G. Kraus.



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## PREFACE

The Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*), establishes policies and procedures for identifying and protecting species of wildlife endangered or threatened with extinction. The West Indian manatee, *Trichechus manatus*, is listed as endangered throughout its range (U. S. Fish and Wildlife Service 1967). The Secretary of the Interior is responsible for administering the Act's provisions as they apply to this species. Day-to-day management authority for endangered and threatened species under the Department's jurisdiction has been delegated to the U.S. Fish and Wildlife Service (Service), whereas, research is conducted by the National Biological Service.

To help identify and guide species recovery needs, section 4(f) of the Endangered Species Act directs the Secretary to develop and implement recovery plans for listed species or populations. Such plans are to include: (a) a description of site-specific management actions necessary to conserve the species or population; (b) objective measurable criteria which, when met, will allow the species or populations to be removed from the list; and (c) estimates of the time and funding required to achieve the plan's goals and intermediate steps.

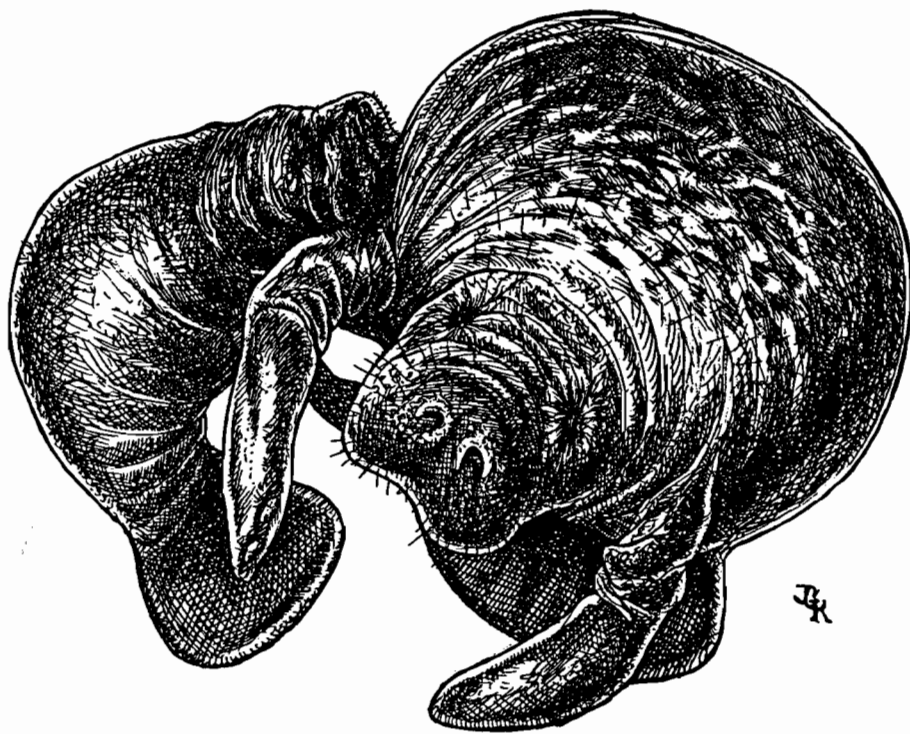
The Service developed an initial recovery plan for manatees in 1980. The 1980 plan focused primarily, but not exclusively, on manatees in Florida. In 1986, the Service adopted a separate recovery plan for manatees in Puerto Rico. To reflect new information and planning needs for manatees in Florida, the Service revised the original plan in 1989

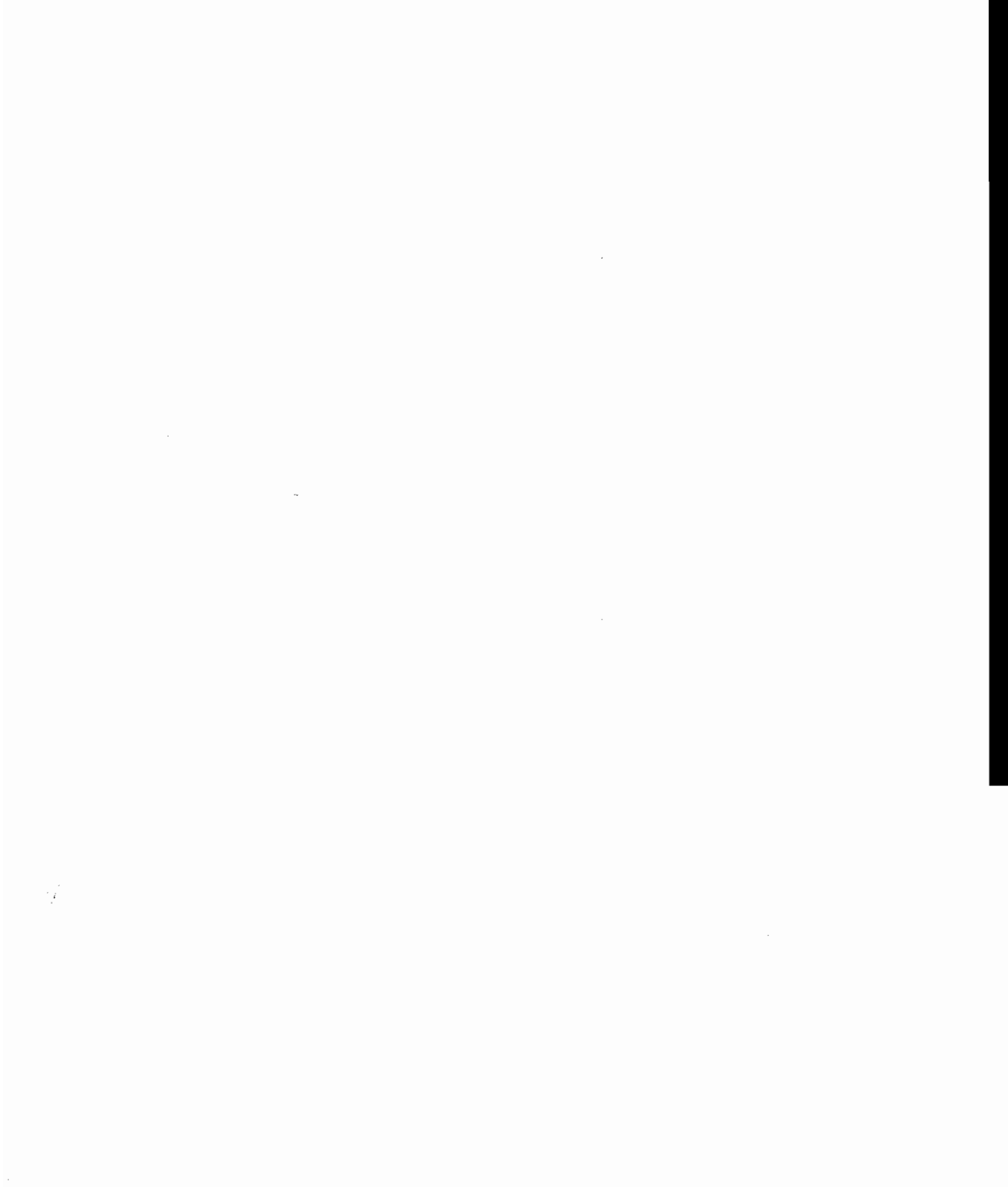
focusing exclusively on Florida's manatees. The first revision covered a five-year planning period ending in Fiscal Year 1994. To reflect progress since 1989 and planning needs beyond 1994, the Service revised the plan to meet these needs.

West Indian manatees also are protected under the Marine Mammal Protection Act of 1972, as amended (16 U.S.C. 1461 *et seq.*). This Act establishes as national policy maintenance of the health and stability of marine ecosystems, and whenever consistent with this primary objective, obtaining and maintaining optimum sustainable populations of marine mammals. It also establishes a moratorium, with certain exceptions, on harassing, hunting, capturing, killing, or attempting to harass, hunt, capture, or kill any marine mammal. Section 115(b) requires that conservation plans be developed for marine mammals, including West Indian manatees, considered "depleted" under the Act. The purpose of conservation plans is to identify actions needed to restore species or populations to optimum sustainable population levels as defined under the Act.

This plan addresses the planning requirements of both Acts through 1999. The plan is based on recommendations of the Florida Manatee Recovery Team.

## I. INTRODUCTION





## I. INTRODUCTION

The West Indian manatee (*Trichechus manatus*) is one of the most endangered marine mammals in coastal waters of the United States (U.S.). In the southeastern U.S., manatees are limited primarily to Florida and Georgia. This group constitutes a separate subspecies called the Florida manatee (*T. manatus latirostris*) that appears to be divided into at least two somewhat isolated subpopulations -- one along the Atlantic coast and the other on the Gulf of Mexico coast of Florida (Figure 1). Despite concerted research, it has not been possible to develop a reliable estimate of manatee abundance in Florida. The highest two-day count of manatees from comprehensive statewide aerial surveys and ground counts is 1,856 animals in January 1992 <sup>1</sup> (Ackerman 1995).

Historical accounts and archeological evidence of manatees prior to the first half of the 20th century are poor and often contradictory (Domning *et al.* 1982 and O'Shea 1988). The record indicates that manatees probably are as geographically widespread today as they were historically. They were hunted by pre-Columbian societies, but the extent to which they were taken is unclear. After Spanish occupation, Florida's human population increased and manatees probably were taken in greater numbers. Commercial and subsistence hunting, particularly in the 1800s, probably reduced the population significantly. Genetic studies, however, indicate that the reduction did not cause a "genetic bottleneck" (McClenaghan and O'Shea 1988). In 1893, the State of Florida passed legislation prohibiting the killing of manatees.

The long-term survival of manatees in Florida, however, is uncertain. Known mortality, which averaged over 170 animals per year between 1988 and 1994, is more than twice what it was in the late 1970s. Given what is known about the present population size

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<sup>1</sup>In February 1996, after this plan was finalized, a record 2,639 manatees were counted.

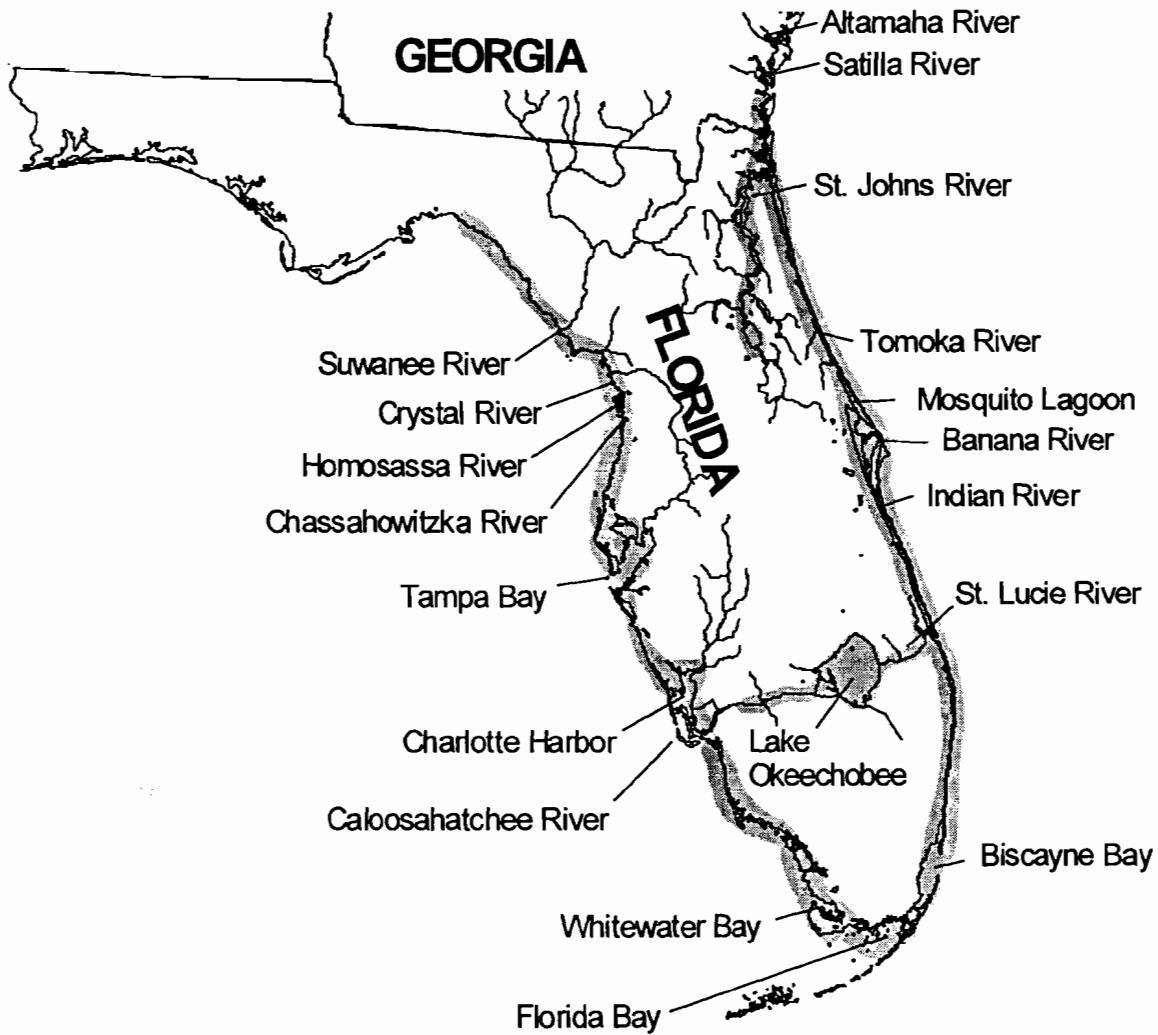


Fig. 1. General warm season distribution of the Florida manatee in the southeastern United States (cross hatching). Sightings in states north of Georgia and west of Florida are uncommon (see text).

and the species' ability to produce only a single calf every 2.5 to 5 years per mature female, mortality may be exceeding the populations' ability to produce new animals. The major threats to Florida manatees are collisions with watercraft, which account for about 25 percent of known manatee deaths in Florida annually, and destruction and degradation of habitat caused by widespread development throughout much of the species' Florida range.

Increases in direct human-caused mortality and habitat destruction are two of the consequences of the rapid growth in Florida's human population. Florida is presently one of the fastest growing states in the nation, increasing at a rate of nearly 1,000 people per day. As long as this trend continues, the long term survival of manatees in the U.S. is in serious jeopardy.

Based on the known minimum size of the southeastern U.S. manatee populations, Florida manatees constitute the largest known group of West Indian manatees anywhere in the species' range. Outside the U.S., manatees occur in the Greater Antilles, on the east coast of Mexico and Central America, along the north and northeastern coast of South America, and in Trinidad and Tobago (Lefebvre *et al.* 1989). In most of these areas, remaining populations are believed to be much smaller than the U.S. population and are subject to poaching for food, incidental take in gillnets, and habitat loss. Manatee protection programs in other countries are not well organized or supported and, in this context, protection of the Florida population takes on international significance.



### Taxonomy

The West Indian manatee, Trichechus manatus Linnaeus, 1758, is one of four living species of the mammalian Order Sirenia. The other three sirenians are the West African manatee (T. senegalensis), the Amazonian manatee (T. inunguis), and the dugong (Dugong dugon). All four species are aquatic herbivores listed as endangered or threatened throughout their ranges by the U.S. Department of the Interior (Federal Register, July 22, 1985. Vol. 50(140): 29900-29909). A fifth species, Steller's sea cow (Hydrodamalis gigas), existed in sub-Arctic waters of the Bering Sea. Hunted to extinction within 27 years of its discovery in 1741, Steller's sea cow was a toothless sirenian reaching lengths of up to 26 ft (8 m) that fed on kelp (Reynolds and Odell 1991).

Two subspecies of West Indian manatee are now recognized: the Florida manatee, T. manatus latirostris, which occurs in the southeastern U.S., and the Antillean manatee, T. manatus manatus found throughout the remainder of the species' range. The Florida manatee was first described by Harlan (1824) as a separate species, Manatus latirostris. Later, Hatt (1934) recognized Florida manatees as a subspecies of T. manatus Linnaeus. Although later researchers (Moore 1951 and Lowery 1974) questioned the validity of the subspecies status, Domning and Hayek (1986) carefully examined morphological characteristics and concluded that the distinction was warranted.

The historical ranges of the two subspecies may overlap on the coast of Texas where the origin of occasional strays (Florida or Mexico) is uncertain. Swift currents and open water in the Florida Strait appear to be effective barriers preventing the movement of manatees between the Greater Antilles and Florida (Domning and Hayek 1986).

### Species Description

West Indian manatees are massive fusiform-shaped animals 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 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 11.5 ft (3.5 m) in length and 2,200 lbs (1000 kg) in weight, but may reach lengths of up to 15 ft (4.6 m) (Gunter 1941) and weigh as much as 3,570 lbs (1,620 kg) (Rathbun *et al.* 1990). Newborns average 4 to 4.5 ft (1.2 to 1.4 m) in length and about 66 lbs (30 kg) (Odell 1981).

The nostrils, located on the upper snout, open and close by means of muscular valves as the animals surface and dive (Hartman 1979 and Husar 1977). 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. Externally, the ears are minute with no pinnae. Internally, the ear structure suggests that they can hear low frequency sound 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). This indirect "structured" evidence is not entirely concordant with actual electrophysiological measurements. Gerstein (1994) demonstrated that manatees have a greater low-frequency sensitivity than all other marine mammals tested.

## Population Biology

Recent information on manatee<sup>2</sup> population biology was reviewed during a technical workshop sponsored by the Service and the former Florida Department of Natural Resources<sup>3</sup> and held on 4-6 February 1992 (O'Shea *et al.* 1992). The objectives of the workshop were to synthesize existing information, evaluate the strengths and weaknesses of current data sets and research methods, and make recommendations for future research, particularly for constructing new population models.

There has been a tremendous increase in reproductive and mortality data since the last such workshop in 1978. Recent breakthroughs in age determination and survival rate estimation were reported at the workshop. The value of maintaining a long-term individual animal photo identification database was emphasized. This database not only provides information on manatee reproductive traits and movements, but also provides capture-recapture histories that can be used in a variety of statistical models to determine aspects of manatee population dynamics. It was concluded that sufficient data now exist to allow development of new population models. The Population Model Working Group emphasized that there will not be one final and conclusive model; rather modelling will be an ongoing process that evolves as databases and modeling tools are improved.

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<sup>2</sup> The unmodified word "manatee" hereafter refers to Florida manatees, Trichechus manatus latirostris.

<sup>3</sup> In July 1993 most offices and functions of Florida's Department of Natural Resources were combined with the offices and functions of the State's Department of Environmental Regulation to create the Florida Department of Environmental Protection. Sirenia Project's research functions were transferred from the Service to the National Biological Service in November 1993.

### Population Structure

Three principal lines of research have been particularly helpful in identifying the population structure of manatees in Florida. These are analyses of the manatee photo identification scar catalog, telemetry, and genetic studies. Information from these sources suggests that there is little routine intermixing of individual manatees living on the east and west coasts of Florida, but that, genetically, they constitute a single population.

As of the end of 1994, the manatee scar catalog maintained by the National Biological Service's Sirenia Project since 1981 includes over 1000 distinctively scarred manatees represented by nearly 15,000 sightings or resightings from throughout the southeastern U.S. (Beck and Reid 1995, and Sirenia Project data files). Within this extensive data set, no individuals have been documented as ranging on both the Atlantic and Gulf of Mexico coasts. (One animal has been documented occurring on the Atlantic coast and on the west side of Lake Okeechobee.) In addition, radio-tracking studies of over 100 manatees by the Sirenia Project and the former Florida Department of Natural Resources have found no movement of animals between Florida's east and west coasts. Notwithstanding these findings, there appears to be at least some genetic exchange around or across the peninsula based on genetic research. A study of tissues from 59 manatees collected from throughout Florida found little genetic variability among geographic regions (McClenaghan and O'Shea 1988). It seems likely, therefore, that there is occasional movement of some animals between the two coasts that has yet to be documented, that some interbreeding occurs at the southern tip of Florida or in Lake Okeechobee, or that these events occurred very recently.

Within both the east and west coast segments of the Florida manatee populations, documented movements suggest that at least some loosely formed subpopulations or groups exist which may constitute useful management units. These groups tend to return to the

same warm-water refuge(s) each winter and have similar non-winter distribution patterns. For example, on the east coast, a core group of more than 70 manatees use the Blue Spring warm-water refuge on the upper St. Johns River. Radio-tracking studies (Bengtson 1981) and other information (Beeler and O'Shea 1988 and Marine Mammal Commission 1988) suggest that most "Blue Spring manatees" tend to remain in the upper St. Johns River. On the west coast, (Rathbun *et al.* 1990) report that of 100 recognizable manatees identified at the Kings Bay and Homosassa River warm-water refuges in northwest Florida in the early 1980s, 92% of the females and 84% of the males returned to the same refuge each year. Radio-tracking results suggest that many animals wintering at Crystal River dispersed north in warm seasons to rivers along the Big Bend Coast, particularly the Suwannee River, and some move south to Tampa Bay and beyond (Rathbun *et al.* 1990).

The existence of more or less distinct subgroups in the southern half of Florida (*i.e.*, south of Cape Canaveral on the east coast and Tampa Bay on the west coast) is debatable. It is possible that manatees using warm-water refuges in Tampa Bay, the Caloosahatchee River, and Collier County may be somewhat discrete groups; however, given available data, possible sampling biases in studies to date, the proximity of these areas to one another, and the distribution of manatees throughout this stretch of coast, such distinctions are highly speculative at this time.

### Population Size

Despite considerable effort in the early 1980s, scientists have been unable to develop a useful means of estimating or monitoring trends in the size of the overall manatee populations in the southeastern United States (O'Shea 1988 and O'Shea *et al.* 1992). Even though many manatees aggregate at warm-water refuges in winter and most if not all such refuges are known, direct counting methods (*i.e.*, by aerial and ground surveys) have been unable to account for uncertainty in the number of animals that may be

away from these refuges at any given time, the number of animals which are not seen because of turbid water, and other factors. The use of mark-resighting techniques to estimate manatee population size based on known animals in the manatee photo identification database also has been impractical because of the difficulty in estimating the proportion of known animals in the population. Sampling protocols to estimate population size using these techniques would require major changes in the data collection methods and survey effort far beyond those possible based on available resources.

The only data on population size have been minimum point estimates based on maximum counts of animals at all winter refuges made within one or two days of each other. Based on such information in the late 1980s, the total number of manatees throughout Florida was known to be at least 1,200 animals (Reynolds and Wilcox 1987). Because aerial and ground counts at winter refuges are highly variable depending on the weather, water clarity, manatee behavior, and other factors (Packard *et al.* 1985) interpretation of analyses for temporal trends is difficult (Packard and Mulholland 1983 and Garrott *et al.* 1994). Aerial survey methods useful for monitoring trends in manatee abundance have yet to be developed.

Beginning in 1991, the former Florida Department of Natural Resources initiated a synoptic aerial survey program to count manatees in potential winter habitat during periods of severe cold weather (Ackerman 1995). During a survey in January 1991, 1,268 manatees were counted (679 east coast and 589 west coast). In February 1991, 1,465 manatees were counted (813 east coast, 652 west coast). In 1992, one survey was done in January yielding a count of 1,856 animals (907 east coast, 949 west coast). No synoptic surveys were done during the winters of 1992-93 or 1993-94 because of the lack of strong mid-winter cold fronts. It remains unknown what proportions of the manatee populations were counted in these surveys. The counts do not provide a basis for assessing population

trends. Based on the surveys, the sizes of the east and west coast populations appear to be approximately equal and the total number of Florida manatees is at least 1,856 animals.

On a more limited basis, it has been possible to estimate and monitor the number of manatees using the Blue Spring and Crystal River warm-water refuges. At Blue Spring, with its unique combination of clear water and confined spring area, it has been possible to count the number of resident animals by identifying individual manatees from scar patterns. The data indicate that this group of animals has increased steadily since the early 1970s when it was first studied. During the 1970s the number of manatees using the spring increased from 11 to 25 (Bengtson 1981). In the mid-1980s about 50 animals used the spring (Beeler and O'Shea 1988), and in the winter of 1993-1994, the number increased to 88 animals (Wayne Hartley, personal communication).

On the west coast of Florida, the clear, shallow waters of Kings Bay have made it possible to monitor the number of manatees using the warm-water refuge in Kings Bay at the head of the Crystal River. Large aggregations of manatees apparently did not exist there until recent times (Beeler and O'Shea 1988). The first careful counts were made in the late 1960s. Since then manatee numbers have increased significantly. In 1967-1968 Hartman (1979) counted 38 animals. By 1981-1982, the maximum winter count had increased to 114 animals (Powell and Rathbun 1984) and in December 1994, the maximum count was 303 animals (U.S. Fish and Wildlife Service, unpublished data). Both births and immigration of animals from other areas have contributed to the increases in manatee numbers at Crystal River and Blue Spring.

The trends at Blue Spring and Crystal River may not be reflective of manatee population trends elsewhere in Florida (O'Shea and Langtimm 1995). In part, this is because the observed increases at these sites are due to immigration of animals, because mortality differs in different parts of Florida, and because maximum aerial survey counts at

other winter refuges in Florida from 1977 and 1992 (Reynolds 1992) show no comparable increases. Based on preliminary analyses of survivorship, population growth at Blue Spring and Crystal River appears reasonable, while increases along the Atlantic coast do not seem likely (O'Shea and Langtimm 1995, Eberhardt and O'Shea 1995).

### Population Demographics

As noted above, the east and west coast populations are believed to be approximately equal in size. The sex ratio of adults and calves at Crystal River is 1:1 (Rathbun *et al.* 1995) and is considered reflective of the populations' overall sex ratio.

An evaluation of manatee reproduction based on carcasses recovered from both coasts of Florida between 1976 and 1992 found that manatees may mature as early as 3-4 years of age; 46% of the females were sexually mature; and 33% of the mature females were pregnant (Marmontel 1993). The annual pregnancy rate was estimated to be about 21% and the gross annual recruitment rate was estimated to be 7% (Marmontel 1995). These reproductive rates and survivorship data collected from ages-at-death indicate a stable or slightly increasing population with high probability of persistence over the long term provided present conditions remain constant. Sensitivity analyses show that high adult survival is critical for population maintenance, whereas calf mortality has a lesser effect on population growth rate and persistence probability (Marmontel 1995). Similar results were indicated by classical population modelling based primarily on data from observations on living animals (Eberhardt and O'Shea 1995).

Preliminary analyses of survival rates based on resighting data in the manatee scar catalog suggest that mean annual adult survival differ among study regions. Survival rates were higher at Crystal River and Blue Spring than on the Atlantic coast. Based on available population models (Eberhardt and O'Shea 1995), these rates may be high enough



to permit population growth at Crystal River and Blue Spring, but are too low for appreciable growth on the Atlantic coast given apparent rates of reproduction and mortality and survival rates in immature age classes. Further refinements to the database and analytic techniques are needed, however, to more accurately estimate and compare survival rates in these three areas (O'Shea and Langtimm 1995). Additionally, survival rate estimates of other important attributes have not been measured for large segments of the Florida population. This is particularly true for manatees in southwestern Florida where increased mortality and development have been documented over the past decade.

Some information on the proportion of calves in the population is available from counts of cow-calf pairs during aerial surveys. From winter surveys of major refuges at power plant outfalls between 1977 and 1992, annual percentages of calves observed range from 12.8 to 6.6%, with maximum one-day calf counts in those years ranging from 23 to 73 animals (Reynolds 1992). The overall percent and maximum number of calves sighted in this data set show a decline in recent years suggesting a decline in recruitment of calves into older age classes. While this trend, combined with information on increasing perinatal mortality (see Mortality below), is a cause for concern, some problems exist in interpreting aerial calf counts (Rathbun *et al.* 1990). Estimated calf percentages from recent state-wide surveys are 8.6% in January 1991, 8.8% in February 1991 survey, and 8.6% in January 1992 (Ackerman 1995, and Ackerman personal communication). The actual numbers of calves counted in the February 1991 and January 1992 surveys were 129 and 139 calves, respectively (Ackerman personal communication). The latter count, however, excludes calves in 13 percent of the count (248 of 1856 animals) where observers did not distinguish calves from adults due to sighting conditions.

### Distribution and Habitat Use Patterns

Due to telemetry, aerial surveys, photo identification sighting records, and other studies over the past 15 years, manatee distribution in the southeastern United States is now well known (Beeler and O'Shea 1988, O'Shea 1988, Marine Mammal Commission 1988, and Lefebvre *et al.* 1989). In general, the data show that manatees exhibit both opportunism and independence in their distribution and movement. They are able to undertake extensive north-south migrations with seasonal distribution determined by water temperature.

When ambient water temperatures drop below 68°F (20° C) in autumn and winter, manatees aggregate within the confines of natural or artificial warm-water refuges (Figure 2; Lefebvre *et al.* 1989) or move to the southern tip of Florida (Snow 1991). Most artificial refuges are created by warm-water outfalls from power plants or paper mills. The largest winter aggregations (50 or more animals) are at refuges in central and southern Florida (Table 1), although three or four smaller aggregations (about 15 or fewer animals) use warm-water outfalls in northern Florida and southern Georgia on the east coast (Marine Mammal Commission 1988). The northernmost refuge used regularly on the west coast is at Crystal River. Most manatees return to the same warm-water refuges each year; however, some use different refuges in different years and others use two or more refuges in the same winter (Reid and Rathbun 1984 and 1985, Rathbun *et al.* 1990, and Reid *et al.* 1991). There are also many lesser known, minor aggregation sites used as temporary thermal refuges. Most of these are canals or boat basins where warmer water temperatures persist as temperatures in adjacent bays and rivers decline.



Fig. 2. General winter distribution and warm-water manatee aggregation sites (see Table 1 for identification of numbered sites) in the southeastern United States.

Table 1. List of winter aggregation sites for Florida manatees (\* = major sites with 25 or more manatees in aggregations).

**EAST COAST:**

- 1) Georgia Pacific Corporation (Glynn County, Georgia)
- 2) Gilman Paper Company (Camden County, Georgia)
- 3) Container Corporation of America Incorporated (Nassau County, Florida)
- 4) Jefferson Smurfit Corporation (Duval County, Florida)
- 5) JEA Kennedy Generating Station (Duval County, Florida)
- 6) JEA Southside Generating Station (Duval County, Florida)
- 7) Blue Spring (Volusia County, Florida)\*
- 8) OUC Indian River Power Plant (Brevard County, Florida)\*
- 9) FPL Canaveral Power Plant (Brevard County, Florida)\*
- 10) Sebastian River (Brevard County, Florida)\*
- 11) Vero Beach Power Plant (Indian River County, Florida)
- 12) Henry D. King Electric Station (St. Lucie County, Florida)
- 13) FPL Riviera Beach Power Plant (Palm Beach County, Florida)\*
- 14) FPL Port Everglades Power Plant (Broward County, Florida)\*
- 15) FPL Fort Lauderdale Power Plant (Broward County, Florida)\*

**WEST COAST:**

- 16) FPC Crystal River Power Plant (Citrus County)
- 17) Crystal River (Citrus County)\*
- 18) Homosassa River (Citrus County)\*
- 19) TECO Port Sutton Power Plant (Hillsborough County)
- 20) TECO Big Bend Power Plant (Hillsborough County)\*
- 21) FPC Bartow Power Plant (Pinellas County)\*
- 22) Myakka River (Sarasota County)
- 23) FPL Fort Myers Power Plant (Lee County)\*
- 24) Port of the Islands (Collier County)\*

**Abbreviations:**

FPC Florida Power Corporation  
FPL Florida Power & Light Company  
JEA Jacksonville Electric Authority  
OUC Orlando Utilities Commission  
TECO Tampa Electric Company

During mild winter periods, manatees at coastal thermal refuges move to nearby grassbeds to feed. For example, manatees using the Riviera Power Plant feed in adjacent Lake Worth and in Jupiter and Hobe sounds 12 to 15 miles to the north (Packard 1981); animals using the Port Everglades power plant feed in grass beds in Biscayne Bay 15 to 20 miles to the south (Marine Mammal Commission 1988); animals in Kings Bay feed on submerged aquatic vegetation near the mouth of the Crystal River (Rathbun *et al.* 1990); animals at Blue Spring leave the spring run to feed on freshwater aquatic plants along the St. Johns River and associated waters near the Spring (Bengtson 1981); and animals using outfalls from a paper plant in southern Georgia and a container manufacturing plant on Amelia Island in northern Florida feed in creeks within one to two miles of those refuges (Zoodsma 1991).

As water temperatures rise in spring, manatees disperse from winter aggregation areas. While some remain near their winter refuges, others undertake extensive travels along the coast and far up rivers and canals. On the east coast, summer sightings drop off rapidly north of Georgia (Lefebvre *et al.* 1989) and are rare north of Cape Hatteras (Rathbun *et al.* 1982); the northernmost sighting is from Rhode Island. On the west coast, sightings drop off sharply west of the Suwannee River in Florida (Marine Mammal Commission 1986), although a small number of animals -- about 12 to 15 manatees -- are seen each summer in the Wakulla River at the base of the Florida Panhandle. Louisiana is considered the western limit of the Florida manatee's range (Powell and Rathbun 1984 and Lefebvre *et al.* 1989); manatees in Texas are believed to be migrants from Mexico though this has not been confirmed (Domning and Hayek, 1986). Rare sightings also have been made in the Dry Tortugas (Reynolds and Ferguson 1984) and the Bahamas (Odell *et al.* 1978).

In recent years, the most important spring habitat for the east coast population has been the northern Banana River in Brevard County; more than 300 manatees have been

counted in this area shortly before dispersing in late spring (Provancha and Provancha 1988). A comparable spring aggregation area does not appear to exist on the west coast, although Charlotte Harbor was visited in the spring by almost half of the 35 manatees radio-tagged at the Fort Myers power plant in Lee County (Lefebvre and Frohlich 1986). During summer, manatees may be found almost anywhere in Florida where water depths are greater than 3.3 to 6.6 ft (1-2 m)(O'Shea 1988). They usually occur alone or in pairs, although interacting groups of five to ten animals are not unusual.

Shallow grass beds with ready access to deep channels are preferred feeding areas in coastal and riverine habitats. Manatees often use secluded canals, creeks, embayments, and lagoons, particularly near the mouths of coastal rivers and sloughs, for feeding, resting, cavorting, mating, and calving (Marine Mammal Commission 1986 and 1988). In estuarine and brackish areas, natural and artificial fresh water sources are sought by manatees. As in winter, manatees often use the same summer habitats year after year (Reid *et al.* 1991).

### Trophic Relationships

Manatees are herbivores that feed opportunistically on a wide variety of submerged, floating, and emergent vegetation (see Table 2). Manatees also forage opportunistically on detritus as illustrated by their use of acorns in the upper St. Johns River (Bengtson 1981 and O'Shea 1986).

Feeding rates and food preferences depend, in part, on the season and available plant species. Bengtson (1981 and 1983) reported that time manatees spent feeding in the upper St. Johns River was greatest (6-7 hrs/day) before winter (August-November), least (3-4 hrs per day) in spring and summer (April-July), and intermediate (about 5 hrs/day) in winter (January-March). He estimated annual mean consumption rates at 33.2

Table 2. Plants species commonly eaten by manatees (Hartman 1979, Bengtson 1981, Packard 1981, Lefebvre and Powell 1990, Baugh et al. 1989, and Zoodsma 1991).

SUBMERGED SEAGRASSES -- ESTUARINE AND MARINE AREAS

Shoalgrass	<u>Halodule wrightii</u>
Manatee grass	<u>Syringodium filiforme</u>
Turtle grass	<u>Thalassia testudinum</u>
Widgeongrass	<u>Ruppia maritima</u>
Star grass	<u>Halophila spp.</u>

SUBMERGED PLANTS -- FRESH WATER AREAS

Hydrilla	<u>Hydrilla verticillata</u>
Wild celery/eelgrass	<u>Vallisneria americana</u>
Southern naiad	<u>Najas guadalupensis</u>
Coontail	<u>Ceratophyllum demersum</u>
Para grass	<u>Panicum purpurascens</u>
Parrot's feather	<u>Myriophyllum sp.</u>
Sago pondweed	<u>Potamogeton pectinatus</u>

BENTHIC MACROALGAE -- ESTUARINE AND MARINE AREAS

Sea lettuce	<u>Ulva sp.</u>
Red algae	<u>Gracilaria sp.</u>
Caulerpa	<u>Caulerpa spp.</u>

FLOATING PLANTS -- FRESH WATER AREAS

Water hyacinth	<u>Eichhornia crassipes</u>
Pickerelweed	<u>Pontederia lanceolata</u>
Water lettuce	<u>Pistia stratiotes</u>

EMERGENT VASCULAR PLANTS -- ESTUARINE AREAS

Smooth cordgrass	<u>Spartina alterniflora</u>
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EMERGENT VASCULAR PLANTS -- FRESH WATER AREAS

Alligatorweed	<u>Alternanthera philoxeroides</u>
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kg/day/manatee or about 4-9% of their body weight per day depending on season (Bengtson 1983). At Crystal River, Etheridge et al. (1985) reported cumulative daily winter feeding times from 0 to 6 hrs. 10 min. based on observations of three radio-tagged animals over seven 24 hour periods. The estimated daily consumption rates by adults, juveniles, and calves eating hydrilla (Hydrilla verticillata) were 7.1, 9.6, and 15.7% of body weight per day, respectively.

Packard (1984) noted two feeding methods in coastal seagrass beds: rooting, where virtually the entire plant is consumed, and grazing, where exposed grass blades are eaten without disturbing the roots or sediment. In the winter of 1980-1981 in Lake Worth and Jupiter Sound on Florida's east coast, Packard (1981) reported that rooting was the predominant feeding mode with feeding scars left in beds of manatee grass (Syringodium filiforme) having only 4-7% of the biomass found in adjacent undisturbed areas. She estimated 40% of the grass beds near the Riviera Beach Power Plant warm-water refuge were disturbed that winter and suggests that the creation of bare patches favors the growth of manatee grass and shoalgrass, which recolonize disturbed areas more rapidly than turtle grass (Thalassia testudinum) (Packard 1984). During the milder winter of 1988-89, Lefebvre and Powell (1990) found that manatees in Hobe Sound appeared to prefer shoalgrass (Halodule wrightii), that 46-67% of the root biomass was removed in feeding scars, and that the area disturbed by manatees was much less than during the winter of 1980-81.

In the upper Banana River, Provancha and Hall (1991) found spring concentrations of manatees grazing in grass beds dominated by manatee grass. They also reported an apparent preference for manatee grass and shoalgrass over the macroalga Caulerpa spp. Along the Florida-Georgia border, Baugh et al. (1989) found that manatees fed in salt marshes on smooth cordgrass (Spartina alterniflora) by timing feeding with periods of high tide.



## Reproduction

Breeding takes place when one or more males (groups of up to 17 have been reported) are attracted to an estrus female to form an ephemeral mating herd (Marmontel 1992). Such herds may remain together from a few hours to a few weeks. 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) but males as young as three years old are spermatogenic (Hernandez, *et al.* 1995). Estrus herds may remain together from a week to over a month (Hartman 1979). 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% of adult males recovered from March through November. Only 20% of adult males recovered from December through February showed similar production.

Females appear to reach sexual maturity by about age five but have given birth as early as four (Marmontel 1995, Odell *et al.* 1995, O'Shea and Hartley 1995, and 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 senescence is unclear (Marmontel *et al.* 1995, Rathbun *et al.* 1995); a captive animal named Juliet gave birth to a calf in 1990 at which time she was estimated to be 43 to 48 years of age (Bossart, personal communication). The length of the gestation period is uncertain but is thought to be between 12 and 14 months (Odell *et al.* 1995, Rathbun *et al.* 1995, and Reid *et al.* 1995). The normal litter size is one, with twins reported rarely (Odell *et al.* 1995, O'Shea and Hartley 1995, Marmontel 1995 and Rathbun *et al.* 1995).

Calf dependency usually lasts one to two years after birth (Hartman 1979, Rathbun *et al.* 1995, Reid *et al.* 1995, and O'Shea and Harley 1995). Calving intervals vary greatly among individuals. They are probably not often less than about 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, and Reid *et al.* 1995). Females that abort or lose a calf due to perinatal death may become pregnant again within a few months (Odell *et al.* 1995), or even weeks (Hartman 1979).

### Mortality

Data on manatee mortality in the southeastern U.S. have been collected since 1974 (Table 3). They indicate a clear increase in manatee deaths over the last 15 years (6.1% per year exponential regression between 1976 and 1991; Ackerman *et al.* 1995). Although both natural and human-related causes are significant components of manatee mortality, most of the increase in mortality can be attributed to increases in watercraft-related deaths and perinatal deaths (Marine Mammal Commission 1993).

A prominent cause of natural mortality in some years is cold stress. For example, following a severe winter cold spell at the end of 1989, 46 manatee carcasses whose death was attributed to cold stress were recovered. Exposure to cold also is believed to have caused many deaths in the winters of 1977, 1981, and 1984 (O'Shea *et al.* 1985). In 1982, a large number of manatees also died coincident with a red tide outbreak between February and March in Lee County, Florida (O'Shea *et al.* 1991). At least 37 manatees appear to have died due to incidental ingestion of filter-feeding tunicates which had accumulated the neurotoxin-producing dinoflagellates responsible for causing the red tide. Other natural causes of death are disease, parasitism, and non-human related injuries (O'Shea *et al.* 1985).

Table 3. Known Florida manatee mortality in the southeastern United States by year and cause of death (derived from Ackerman et al. 1992).

Year	Watercraft Related	Gate/ Lock	Other Human	Perinatal	Natural	Undetermined <sup>4</sup>	Total
1974	3	0	2	0	0	2(1) <sup>5</sup>	7(1)
1975	6	1	1	8	0	13	29
1976	10	4	0	15	1	32	62
1977	13	6	5(1)	9	1	80	114(1)
1978	21	9	1	10	3	40	84
1979	24	8	9	9	4	23(1)	77(1)
1980	16	8	2	14	4(2)	19	63(2)
1981	24	2	4	13	9	64(1)	116(1)
1982	20	3	1(1)	15	40	35(2)	114(3)
1983	15	7	5	18	6	30	81
1984	34	3	1	26(1)	23(1)	41	128(2)
1985	33(2)	3	3	23	19(1)	38(1)	119(4)
1986	33	3	1	27	13	45(2)	122(2)
1987	39	5	2(2)	31	15	22(1)	114(3)
1988	43	7	4	32	23	25(1)	133(1)
1989	50(1)	3	5	39(1)	31(1)	40(5)	168(8)
1990	47(2)	3	4	44(1)	67(4)	41(1)	206(8)
1991	53	9	6	53	14(1)	39	174(1)
1992	38	5	6	49	19(1)	46(2)	163(3)
1993	35(1)	5	6	39	24	36(1)	145(1)
1994	49	16	5	46	37	40	193(1)
1995	42(1)	8	5	56	35	55(1)	201(2)
TOTAL	648(7)	118	78(4)	576(3)	387(11)	806(20)	2613(45)

<sup>4</sup> Includes carcasses whose presence was verified but which were not collected.

<sup>5</sup> ( ) Indicates mortality which has occurred outside of Florida but within the range of the Florida manatee.

and Ackerman *et al.* 1995). The cause of many perinatal deaths is difficult to determine because these carcasses are generally in an advanced state of decomposition at the time they are retrieved. Some, and perhaps many, perinatal deaths are certainly due to natural causes; however, pollution, watercraft injuries or disturbance, or other human-related factors affecting pregnant and nursing mothers also may be responsible for a significant number of perinatal deaths.

The largest known human-related cause of manatee mortality is collisions with hulls and/or propellers of boats and ships. Between 1976 and 1991, watercraft-related deaths increased at an average of 10.3% per year, increasing from 21% of all deaths between 1976-1980 to 29% between 1986-1991 (Ackerman *et al.* 1995). In 1992, the number of watercraft-related deaths declined by the largest amount in over 10 years (from 53 in 1991 to 38 in 1992) although, given a decline in total deaths in 1992, it still represented 23% of the total 1992 mortality. After a decrease in boat caused mortality in 1992 and a leveling off in 1993, there was a dramatic increase in 1994 pointing out the need for caution in interpreting short-term changes. The next largest human-related cause of manatee mortality is entrapment in flood gates and navigation locks. These deaths were first recognized in the 1970s and efforts were then made to eliminate this source of mortality. In the 1980s the number of deaths declined. However, water control structure-related deaths increased in the early 1990s and in 1994, 16 deaths were recorded. Manatee mortality in floodgates is partially a function of the frequency of gate operation. The record manatee mortality caused by water control structures in 1994 is partly the result of record rain fall which resulted in more frequent opening and closing of the structure and high water velocities through the structures.

Other known causes of human-related manatee mortality include poaching and vandalism, entrapment in shrimp nets and other fishing gear, entrapment in water pipes, and ingestion of marine debris. Together, deaths attributable to these causes have remained constant and have been a low percentage of total known mortality, *i.e.*, about 5% between 1976-1980, 3% between 1981-1985, and 2% between 1986 and 1991. In recent

years, entrapment in shrimp nets has been the largest component of this catch-all category accounting for possibly 8 of 26 deaths between 1986 and 1991.

These data on mortality, and particularly the increasing number of watercraft-related deaths, should be viewed in the context of Florida's growing human population, which increased by almost 86% from 1970 to 1990. The rise in manatee mortality during this period is at least in part the result of the increasing numbers of people and boats sharing the manatees' habitat.

### Contaminants and Pollution Effects

The reliance of manatees on inshore habitats and their attraction to industrial and municipal outfalls has the potential to expose them to relatively high levels of contaminants. Despite this relationship, there have been few studies of contaminant levels and effects on manatees. What information is available suggests that direct effects are not significant at a population level. O'Shea *et al.* (1984) investigated levels of pesticides, polychlorinated biphenyls, mercury, lead, cadmium, copper, iron, and selenium in manatee tissues. Of these, only copper levels in the liver were found to be notably high. The highest copper levels (1,200 ppm dry weight) were found in animals from areas of high herbicidal copper usage and exceeded all previously reported concentrations in livers of wild mammals. Despite these findings, there were no field reports of copper poisoning and no evidence of deleterious effects to individual animals. Contaminants, siltation and modified deliveries of fresh water to the estuary can indirectly impact manatees by causing a decline in submerged aquatic vegetation on which manatees depend.

Manatees ingest various debris incidental to feeding. Beck and Barros (1991) found monofilament fishing line, plastic bags, string, rope, fish hooks, wire, rubber bands, and other debris in the stomachs of 14.4% of 439 manatees recovered between 1978 and 1986. Monofilament line was the most common item found. In most cases, ingested items do not appear to affect animals. However, ingested monofilament line has resulted in death due

to blockage of the digestive system (Buergelt *et al.* 1984). A few deaths have been caused by ingesting wire, which perforated the stomach lining, and plastic sheeting, which blocked the digestive tract (J. aist 1987). Discarded monofilament line and rope have been found wrapped around flippers, sometimes leading to serious injury or death (Beck and Barros 1991).

### Accomplishments

Under the guidance of previous Manatee Recovery Plans, Federal agencies, State agencies, and private organizations have initiated cooperative actions to address important conservation needs upon which this plan builds. Some of the major initiatives are reviewed below.

Reduction of Watercraft Injuries and Deaths The largest source of human-related manatee mortality is collisions with watercraft. Many, if not most, living manatees also bear scars or wounds from vessel strikes. A recent analysis of injuries to 406 manatees killed by watercraft and recovered between 1979 and 1991 found that 39% were killed by propeller cuts, 55% were killed by impact, and 4% had both types of injuries, either of which could have been fatal (Wright *et al.* 1995). Analyses of wounds suggest that most lethal propeller wounds were caused by medium-sized or larger vessels, but that impact injuries appear to be caused by fast-moving small- to medium-sized boats (Wright *et al.* 1995). Most propeller wounds are on the backs and sides rather than the heads of animals, suggesting that they were diving to avoid collision when hit. Because watercraft operators cannot reliably detect and avoid hitting manatees, Federal and state managers have sought to limit watercraft speed in areas where manatees are most likely to occur to afford manatees time to avoid oncoming boats.

In 1989, the Florida Governor and Cabinet approved a series of recommendations by the former Florida Department of Natural Resources to improve protection of manatees

in 13 key manatee counties<sup>6</sup>. Initial work has been devoted to developing waterway speed and access (i.e., no entry) rules in these counties. At this time, the Florida Governor and Cabinet have approved county rules for twelve key counties. Efforts are underway to finalize rules for Lee County. Speed and access rules for boats also have been developed by the Service to protect manatees within the boundaries of Merritt Island National Wildlife Refuge and are being proposed for Lake Woodruff National Wildlife Refuge.

As initial work in the 13 key counties is completed, attention is shifting to development and approval of county manatee protection plans, and similar protection of important manatee habitat in counties not listed among the 13 key counties will need to be considered. Ongoing needs include boater education, maintenance of signs and buoys, enforcement, compliance assessment, and periodic reevaluation of the effectiveness of the rules. Such work requires close cooperation between the Bureau of Protected Species Management in the new Florida Department of Environmental Protection, county officials, the Florida Marine Patrol, the Florida Game and Fresh Water Fish Commission, the Florida Governor and Cabinet, the Service, and, of course, boaters.

Reduction of Flood Gate and Navigation Lock Deaths Entrapment in flood gates and navigation locks is the second largest cause of human-related manatee deaths. In some cases, manatees appear to have been crushed in closing doors; in others, they may have been drowned after being pinned against narrow door openings by water currents rushing through openings. Most flood gates implicated in manatee deaths are in Dade and Broward counties and are operated by the South Florida Water Management District. Most navigation locks implicated in manatee deaths have been along waterway access routes to Lake Okeechobee and are operated by the U.S. Army Corps of Engineers(Corps of

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<sup>6</sup> The thirteen key manatee counties include Duval, Volusia, Brevard, Indian River, St. Lucie, Martin, Palm Beach, Broward, and Dade counties on east coast and Collier, Lee, Sarasota and Citrus on the west coast.

Engineers). In the late 1970s, one quarter of all manatee deaths in Dade County were attributed to flood control structures.

In the early 1980s, steps were taken to modify gate opening procedures to ensure openings were wide enough to allow a manatee to pass through unharmed. Steps were also initiated to fence off openings and cavities in gate structures in which manatees might become trapped. Manatee deaths subsequently declined and remained low for much of the 1980s (see Table 3). However, a recent increase in deaths at modified gates suggests that the measure may only partially address the problem. A task force with representatives of the South Florida Water Management District, the Corps of Engineers, the Florida Department of Environmental Protection, the Dade County Environmental Resource Management office, and the Service has been formed to examine further actions. Options being considered include automatic reversal mechanisms similar to those on elevator doors, further modifications to gate opening and closing sequences, and sonar devices to detect the presence of manatees near structure doors. The South Florida Water Management District and the Corps of Engineers are testing automatic reversal mechanisms. If the tests prove to be successful, the Corps of Engineers, through Section 1135 of the Water Resources Development Act of 1986, as amended, and other sources, will retrofit structures implicated in manatee deaths.

Habitat Protection Intensive coastal development throughout Florida, driven by increases in the human population, is degrading important manatee habitat and poses perhaps the greatest long-term threat to the Florida manatee. Three major approaches have been initiated to address this problem. First, the Service and the former Florida Department of Natural Resources initiated extensive efforts to review and comment on applications for Federal and State permits for construction projects in manatee habitat areas. For example, pursuant to Section 7 of the Endangered Species Act, the Service now annually reviews hundreds of permit applications to the Corps of Engineers for construction projects in waters and wetlands that include or are adjacent to important manatee habitat.



The Florida Department of Environmental Protection has a similar program for reviewing Environmental Resource Permits and applications for leasing state-owned submerged lands. In 1989, the Florida Governor and Cabinet also established an interim boating facility siting policy for the 13 counties that limits construction of new or expanded multi-slip docking facilities to one power boat slip per 100 feet of shoreline owned or controlled by a permit applicant.

A second major approach is developing county manatee protection plans for the 13 key manatee counties. The provisions of these plans are anticipated to be implemented as amendments to local growth management plans prepared pursuant to the State's Local Government Comprehensive Planning and Land Development Regulation Act of 1985. In addition to boat speed rules, manatee protection plans are to include marina siting policies and other measures to protect manatees and their habitat. To date, one county has completed its manatee protection plan and plans for the other 12 counties are in varying stages of development.

A third approach to habitat protection is land acquisition. Both the Service and the State of Florida have taken steps to acquire and add new areas containing important manatee habitat to Federal and State protected area systems. At the state level, several programs, most notably the Conservation and Recreational Lands (CARL) Program, have acquired important areas. At the direction of the Florida Governor and Cabinet, special attention is given by the CARL Program to manatee habitat. Five percent of the CARL program budget is currently devoted to manatee-related purchases. Approximately \$500 million has been spent to acquire 250,000 acres whose importance included, but was by no means limited to, protection of manatee habitat. Particularly important purchases have been made along and near the Crystal River, at Rookery Bay, the Sebastian River, and near Blue Spring.

The Service also has acquired thousands of acres of land important to manatees for inclusion in the National Wildlife Refuge System. Particularly important acquisitions over

the past 10 years have been for National Wildlife Refuges along the Crystal River, the Homosassa River, and the Suwannee River. Both the State and the Service are continuing cooperative efforts with a view towards establishing a network of core manatee habitats throughout Florida.

In 1993, the Service added three new Sanctuaries and expanded one of the three existing Sanctuaries in Kings Bay within or near the Crystal River National Wildlife Refuge under authority of the Endangered Species Act (U.S. Fish and Wildlife Service 1994). In addition, a 15 square mile motorboat-prohibited area was established in the Banana River within the Merritt Island National Wildlife Refuge and the Kennedy Space Center.

Research Findings The foundation of the manatee recovery program is detailed information on manatee ecology and life history. These data have been gathered cooperatively by the Service (and currently the National Biological Service), the former Florida Department of Natural Resources, Georgia Department of Natural Resources, academic institutions, and marine zoological parks. Key elements of the manatee research program are: the carcass recovery and necropsy program to monitor manatee mortality and obtain tissue samples for basic research; radio-tagging and tracking studies using VHF and satellite-linked telemetry to define manatee movements and habitat use patterns; a scar catalog to photographically identify individual animals and thereby determine basic life history parameters such as calving intervals, age of first reproduction, and survivorship; age determination studies to develop age-specific population parameters; studies of manatee food preferences and feeding ecology; aerial surveys to identify distribution and relative abundance; and a geographic information system to store, integrate, and retrieve site-specific information for the myriad of research and management tasks.

Many of the above elements were pioneered by staff from the Sirenia Project. The Florida Marine Research Institute, now in the Florida Department of Environmental Protection, developed the geographic information system for manatee data, and has

assumed responsibility for the carcass recovery and necropsy program, in addition to becoming involved in many of the above activities. The Federal and State agencies work closely with one another as well as with cooperating researchers at various institutions in sharing data, information and efforts. The Florida Department of Environmental Protection now has the modern, well-equipped Marine Mammal Pathobiology Laboratory in St. Petersburg, Florida that was partially funded by the Service through Section 6 grant-in-aid funds. To provide managers with basic, up-to-date information for making informed management decisions, continued work in all of the above areas is essential.

Captive manatees residing at oceanaria for rehabilitation have provided an important opportunity for collaborative research on basic behavior, physiology and biomedical aspects of manatee biology.

Manatee Rescue, Rehabilitation and Release Over the past 5 years, distressed manatees have been rescued at a rate of about 25 to 40 animals per year in the southeastern United States. Most rescues involve animals seriously injured by collisions with boats, animals entangled in rope or line, orphaned calves judged unlikely to survive on their own, or animals trapped in water conduits, such as power plant intake canals or drainage-pipes. Voluntary support by marine zoological parks and other groups is a cornerstone of the manatee rescue and rehabilitation network and involves close cooperation among those groups and Federal agencies, State agencies, and law enforcement officials.

To guide rescue/rehabilitation work, the Service recently shifted responsibility for this aspect of the recovery program from its former research arm to its management staff. Initially, rescue work was authorized under a Service research permit. However, as methods for capturing, transporting, treating, and maintaining animals were refined and the potential to successfully treat and release animals has increased, this work has become more of a management function.

The Service also established an Interagency/Oceanaria working group to coordinate captive manatee management and rehabilitation, and obtained an enhancement permit under the Marine Mammal Protection Act to authorize related activities. The Service also developed a system authorizing three levels of involvement by cooperating organizations: verification teams to corroborate reports of distressed animals and to remain with animals pending arrival of further help; rescue/transport teams to undertake hands-on rescue operations and to transport live animals; and approved rehabilitation facilities to maintain and treat animals.

In addition, space and resources for maintaining and treating injured manatees have become a concern because some animals judged unreleasable have necessitated costly, long-term care and maintenance. Animals judged unreleasable have included those whose injuries make survival in the wild unlikely and calves born in captivity or brought in as orphans which have not learned necessary survival skills. A soft-release facility was developed at Merritt Island National Wildlife Refuge in 1994 to provide a staged release alternative for long-term captives and orphans. As of 1994, nearly 50 manatees were in captivity at five captive maintenance facilities in Florida.

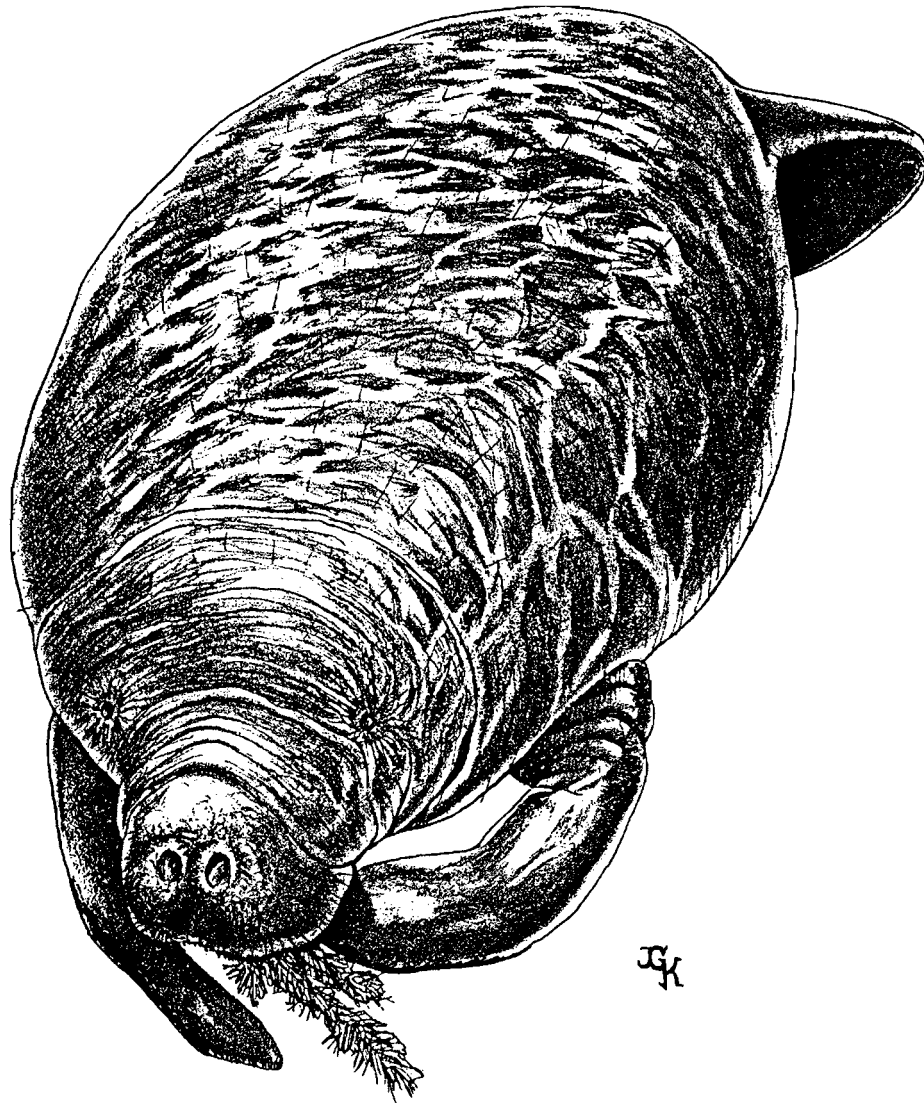
The Florida Department of Environmental Protection, through the carcass recovery and necropsy program staff at its Florida Marine Research Institute, has agreed to coordinate rescue responses by receiving initial reports of distressed animals and arranging for the appropriate authorized participants to respond. To assist in the operation of the rescue/rehabilitation network, the Service has issued letters of authorization under its enhancement permit outlining responsibilities of cooperating groups at each of these three levels of involvement. The Service also has developed criteria to guide and schedule release of rehabilitated animals and convened meetings of the Interagency/Oceanaria working group to review and coordinate network activities.

Public Education, Awareness, and Support The manatee recovery program's success depends on public education, awareness and support. Responsible agencies,

industries and environmental groups have been outstanding in their involvement and contribution to these efforts. Efforts initiated in the 1970s and early 1980s by the former Florida Department of Natural Resources, the Service, Florida Power & Light Company, the Florida Audubon Society, marine zoological parks and aquaria, and The Nature Conservancy have since been joined by the Save the Manatee Club, Georgia Department of Natural Resources, boating organizations, and many others.

By means of pamphlets, brochures, posters, films, public service announcements, viewing opportunities, and presentations to schools and other groups, the public has been made aware of new information on the biology and status of manatees, urgent conservation issues, and the regulations and measures required to assure their protection. Such efforts are essential for obtaining public compliance with conservation measures to protect manatees and their habitats. They also have encouraged informed public participation in regulatory and other management decision-making processes, and provided constructive avenues for public funding of state manatee recovery programs, research, and land acquisition efforts. The latter have resulted in substantial savings in Federal and State tax revenues that otherwise would be needed and have permitted important work to proceed that likely would not have been possible in their absence. Public interest in manatee conservation has also grown internationally. The First International Manatee and Dugong Conference was held in Gainesville, Florida in March 1994. This conference promoted exchanges of ideas and scientific findings concerning all aspects of sirenian biology, conservation and education and was attended by over 115 professionals from 15 nations.

II. RECOVERY ACTIONS





## II. RECOVERY ACTIONS

### A. Goals and Objectives

The immediate goal of this plan is to restore Florida manatee populations to levels that will permit down-listing them from endangered to threatened under provisions of the Endangered Species Act of 1973, as amended. As an ultimate goal, this plan seeks to promote the recovery of manatees in Florida to a point where they can be delisted under that Act. The Act defines an "endangered species" as "any species which is in danger of extinction throughout all or a significant portion of its range." A "threatened species" is defined as "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range."

The Plan's long-range goal is restoring Florida manatees to optimum sustainable population levels under provisions of the Marine Mammal Protection Act of 1972, and maintaining them at those levels. The Service and the National Marine Fisheries Service define optimum sustainable population size for a given species or stock as a level that is within a range between the largest number supportable by the ecosystem (i.e., carrying capacity) and the population size that results in maximum net productivity. Maximum net productivity is the greatest net annual increment in population numbers or biomass resulting from additions to the population by reproduction and/or growth, less losses due to natural mortality (50 CFR 216.3).

Decisions to down-list and delist manatees require assessments of population size and trends. As direct and unambiguous measures of the sizes and trends of Florida manatee populations are not now available, this Plan addresses this need through tasks to develop the methodology and data needed to estimate key population parameters. Population modeling based on resulting data will also be employed as a tool to assist in



decision making. When data and models are available to assess population size and trends, downlisting should be considered when analyses indicate that the population is growing or stable, when mortality factors are controlled at acceptable levels or are decreasing, and when critical habitats are secure and threats to them are controlled or decreasing. Growth in the human population and coastal development in Florida remain major obstacles in accomplishing these goals. Actions to stabilize the size of the human population are outside the scope of this plan. It must be emphasized, however, that while the following actions are considered necessary, they cannot by themselves accomplish this plans' goals.

This plan establishes four objectives to achieve these goals:

1. to identify and minimize causes of manatee disturbance, injury and mortality;
2. to protect essential manatee habitat;
3. to determine and monitor the status of manatee populations and essential habitat;
4. to coordinate recovery activities, monitor and evaluate progress, and update and/or revise the Recovery Plan.

Tasks identified to carry out these objectives are listed in the following step-down outline and described in the narrative below.

#### B. Step Down Outline

1. Identify and Minimize Causes of Manatee Injury and Mortality.

*126 known*

11. Maintain and improve the salvage and necropsy program.
  111. Ensure prompt and complete reporting of manatee carcasses.
    1111. Provide training for law enforcement officials on carcass reporting procedures.
    1112. Encourage public reporting of carcasses.
  112. Maintain salvage and necropsy field stations and staff.
    1121. Provide support for salvage and necropsy program staff and equipment.
    1122. Develop and coordinate out-of-state salvage efforts.
  113. Undertake special studies and analyses to improve understanding of mortality causes and trends.
    1131. Assess manatee carcass reporting rates.
    1132. Undertake a workshop and/or studies to identify the proximal cause(s) of perinatal mortality.
    1133. Undertake routine and periodic tissue analyses.
    1134. Investigate and respond to potential unusual mortality events.
12. Minimize collisions between manatees and watercraft.
  121. Develop and refine state waterway speed and access rules.

122. Develop and refine Federal waterway speed and access rules.
  123. Post and maintain regulatory signs.
  124. Enforce and encourage manatee protection regulations.
    1241. Focus and increase officer time dedicated to enforcing manatee protection rules.
    1242. Develop and implement a strategic plan to strengthen cooperative interagency enforcement.
    1243. Conduct surveys to assess compliance with rules.
    1244. Encourage and cooperate with efforts to develop unified state-wide boating safety measures.
  125. Establish policies for authorizing boat races and other water sport events.
  126. Indicate speed and access zones on nautical charts.
  127. Assess and reduce mortality caused by large vessels.
  128. Evaluate the feasibility of propeller guards or alternative propulsion technology for small watercraft.
  129. Continue Section 7 and state reviews of boating facilities and water sport events.
13. Minimize manatee deaths in water control structures.

131. Develop, test, and implement new alternative measures.
132. Promptly investigate structure-related deaths.
14. Assess and minimize manatee injuries and deaths caused by fisheries.
  141. Minimize manatee drownings in shrimp nets.
  142. Minimize injuries and deaths in crab pot lines and other fishing gear.
  143. Identify locations where fishing gear impact manatees and implement measures to mitigate these impacts.
15. Investigate and prosecute all incidents of poaching and malicious vandalism.
16. Rescue, rehabilitate, and release distressed manatees.
  161. Authorize cooperative participation in the manatee rescue/rehabilitation network.
  162. Coordinate and oversee day-to-day rescue operations.
  163. Ensure adequate rehabilitation facilities.
  164. Convene periodic meetings of the Interagency/Oceanaria working group and the Captive Manatee Planning Committee.
  165. Facilitate and evaluate animal releases.
    1651. Construct and maintain acclimation pens as needed.

1652. Develop protocols and criteria to govern releases and evaluate readaptive success.
  1653. Radio-tag and track released manatees.
  166. Develop a response plan for large-scale morbidity or mortality events.
2. Protect Essential Manatee Habitat.
21. Establish regional protected area networks containing essential manatee habitat.
    211. Acquire and incorporate essential manatee habitats to the National Wildlife Refuge System.
    212. Acquire and incorporate essential manatee habitats to State Reserve, Preserve, and Park systems.
    213. Review and provide advice on priority habitat acquisitions relative to manatees.
    214. Identify and propose new land acquisition projects.
    215. Encourage and coordinate Federal, State, and private land acquisition efforts.
  22. Establish effective manatee management programs at established Federal and State protected areas.
    221. Develop and maintain public education programs at selected protected areas.

- 2211. Develop a visitor interpretive center for the Crystal River National Wildlife Refuge.
- 2212. Develop a new manatee display at Homosassa Springs State Park.
- 2213. Maintain public awareness/education programs at Blue Spring State Park.
- 2214. Develop public awareness/education programs at other parks and refuges.
- 222. Incorporate manatee protection measures into management systems for protected areas and state-owned submerged lands.
  - 2221. Include manatee protection and monitoring measures in management plans for Federal and State protected areas.
  - 2222. Develop policies and provisions to guide decisions on leasing State-owned submerged lands.
- 23. Designate and maintain Federal Manatee Sanctuaries and Refuges.
- 24. Develop, implement, and update county manatee protection plans.
  - 241. Assist counties to develop manatee protection plans.
  - 242. Assist in implementing manatee protection plans.
  - 243. Periodically assess, review, and modify manatee protection plan provisions.
- 25. Maintain safe, reliable artificial warm-water refuges.

- 251. Minimize interruptions to thermal discharges.
- 26. Protect and promote regeneration of grassbeds.
  - 261. Assess threats to seagrass habitats and develop protection strategies.
  - 262. Develop and implement alternative measures to mitigate threats and promote regeneration of seagrasses.
- 27. Review aquatic plant control programs.
- 28. Minimize disturbance and harassment.
  - 281. Prepare and adopt guidelines for the development of manatee viewing areas.
  - 282. Prepare and adopt guidelines or regulations on feeding and watering manatees.
  - 283. Develop and keep under review guidelines governing close approaches to manatees.
- 29. Support public education and outreach programs.
  - 291. Develop curricula and materials for schools.
  - 292. Develop and update materials for target user groups.
  - 293. Maintain avenues to encourage and direct voluntary contributions in support of needed recovery work.

3. Determine and monitor the status of manatee populations and essential manatee habitat.
  31. Maintain a manatee telemetry program.
    311. Maintain adequate telemetry capabilities (in addition to animals tagged in Task 1653).
    312. Routinely enter telemetry locations into the manatee Geographic Information System (GIS) database.
    313. Prepare and distribute monthly updates, annual progress reports, and final summaries of telemetry results.
    314. Develop regional atlases of telemetry location data.
    315. Develop a long-term strategy for telemetry studies.
  32. Continue and improve aerial surveys.
    321. Continue flying synoptic state-wide aerial surveys.
    322. Undertake regional or local aerial surveys.
    323. Continue aerial surveys of aggregation sites after cold fronts.
    324. Support a dedicated aerial survey specialist and convene an Aerial Survey Working Group.
    325. Analyze available aerial survey data.



33. Better define aspects of physiology, life history, and ecology.
  331. Maintain and analyze manatee "scar catalog" data.
    3311. Continue to collect photographs of individually identifiable manatees in the field.
    3312. Maintain staff support to collect, enter, check, retrieve and analyze scar catalog data.
    3313. Upgrade and maintain computer/video equipment for the scar catalog.
    3314. Analyze scar catalog data to determine annual survival rates and other population parameters.
  332. Continue and expand long-term studies of individual animals.
  333. Analyze data on calf production.
  334. Continue aerial photogrammetry analyses.
  335. Continue opportunistic deployment of Passive Integrated Transponder (PIT) tags.
  336. Conduct additional physiological studies of thermal tolerances.
  337. Conduct additional studies to assess hearing capabilities.
  338. Complete and conduct additional studies of manatee food habits.

- 339. Conduct additional genetic analyses from manatee tissue samples.
- 3310. Conduct additional studies to identify requirements for fresh water.
- 34. Continue studies to develop methodology, data and models to assess population size and trends by convening a population status working group.
- 35. Develop and implement a manatee habitat monitoring program.
  - 351. Develop methodology and expertise to monitor the condition of essential manatee habitats.
  - 352. Coordinate and implement a long-term habitat monitoring program.
- 36. Maintain and improve the Geographic Information Systems(GIS) for data on manatees and manatee habitat.
  - 361. Maintain the hardware, software, and expertise to operate the GIS.
  - 362. Convene regular meetings of the GIS Coordinating Team.
  - 363. Convene regular meetings of the GIS Working Group.
- 4. Coordinate recovery activities, monitor and evaluate progress, and update/revise the Recovery Plan.
  - 41. Maintain State and Federal Manatee Coordinator staff positions.
  - 42. Convene periodic meetings of the Florida Manatee Recovery Team and Manatee Technical Advisory Council.

43. Develop an annual progress report.
44. Update the Florida Manatee Recovery Plan.
45. Convene a panel or workshop to evaluate the effectiveness of the manatee recovery program.
46. Share experience and expertise developed through the manatee recovery program.
  461. Develop cooperative agreements with other states and countries.
  462. Participate in and assist manatee-related work under the Caribbean Environment Program.
  463. Participate in national and international manatee conservation and research activities.

### **C. Narrative**

#### **1. Identify and Minimize Causes of Manatee Injury and Mortality.**

Manatees are killed and injured as a result of interactions with boats, flood gates, navigation locks, marine debris, and fishing gear. In rare cases, manatees are killed by vandals and poachers. Additional mortalities, from natural causes such as severe cold weather or red tide, may also significantly affect the status of the manatee population. To permit growth of the manatee population and attainment of

an optimum sustainable population level, such causes of mortality must be reduced to, and maintained at, low levels. This section of the recovery plan identifies activities needed to monitor and reduce such sources of mortality.

**11. Maintain and improve the salvage and necropsy program.**

The manatee salvage/necropsy program is fundamental to identifying causes of manatee mortality and injury. The program is responsible for collecting and examining virtually all manatee carcasses reported in the southeastern United States, determining the causes of death, monitoring mortality trends and disseminating mortality information. Program data help identify, direct, and support essential management actions (e.g., promulgating watercraft speed rules and reviewing permits for construction in manatee habitat). The program was begun by the Sirenia Project and the University of Miami in 1974. Procedures and protocols to standardize necropsies were developed in the early 1980s (Bonde *et al.* 1983). The program was transferred to the former Florida Department of Natural Resources in 1985 and, early in the 1990s, the program was expanded significantly. Now part of the Florida Marine Research Institute in the new Florida Department of Environmental Protection, the major program components are: receiving manatee carcass reports from the field; collecting and examining dead animals; maintaining accurate mortality records; and carrying out special studies to improve understanding of mortality causes, rates, and trends. Program staff also coordinate rescues of injured or distressed manatees (see Task 16).

**111. Ensure prompt and complete reporting of manatee carcasses.**

To obtain manatee carcasses for necropsy, the carcass recovery and necropsy program relies on reports of carcasses from members of the public. These reports are usually provided through the Florida Marine Patrol, officers in the Florida Game and Fresh Water Fish Commission, or local officials. To provide the best possible understanding of manatee mortality causes and trends, it is important not only to obtain as many reports as possible, but also to assure that reports are received promptly so that carcasses are as fresh as possible when necropsied. To facilitate reporting from the field, the following tasks are needed.

**1111. Provide training for law enforcement officials on carcass reporting procedures.**

Most manatee carcasses are found by the public and reported to the Florida Marine Patrol or local law enforcement officials. To ensure that program staff are notified of all reported carcasses, officials likely to receive such reports need to be advised and reminded of the data needs and procedures for reporting carcasses to the salvage and necropsy program staff and the importance of doing so promptly. For example, periodic presentations by program staff and/or mailings should be made to the Florida Marine Patrol Academy, to Florida Marine Patrol officers in the field, and to other law enforcement groups, such as the Florida Game and Fresh Water Fish Commission, the U.S.

Coast Guard, local police departments, and county sheriffs. To maintain interest and involvement, efforts to provide feedback to law enforcement officials on the results of necropsies and program findings should be undertaken routinely.

**1112. Encourage public reporting of carcasses.**

Most manatee carcasses are found by boaters, shoreline residents, and other members of the public frequenting waterways and shorelines. To increase public reporting, information on procedures for reporting carcasses and the importance of doing so promptly should be included in posters and appropriate public education materials. Periodic mailings and/or presentations and public service announcements targeting appropriate groups such as home owners associations, boating, diving, and fishing groups, and others should be prepared and sent.

**112. Maintain salvage and necropsy field stations and staff.**

The salvage and necropsy program includes a central necropsy facility operated by the Florida Department of Environmental Protection at Eckerd College in St. Petersburg, three field stations on the east coast located at Jacksonville, Melbourne, and Tequesta, and one field station on the west coast at Port Charlotte. To collect, examine, and dispose of carcasses and to record, analyze, and

distribute mortality data, support must be provided to maintain an adequate program staff and provide the necessary equipment.

**1121. Provide support for salvage and necropsy program staff and equipment.**

Salvage and necropsy program staff are part of the Florida Marine Research Institute in the Florida Department of Environmental Protection. Field station personnel are responsible for promptly collecting dead animals and related data in the field and transporting the carcasses to the central necropsy facility. The central facility's staff is responsible for: conducting all necropsies; collecting, examining, and archiving tissue samples; distributing tissue samples to other researchers; photo-documenting wounds and scars on all salvaged carcasses; recording and analyzing data; performing special studies; preparing monthly and annual mortality summary reports; and administering and coordinating all salvage and necropsy program work. Staffing must be continued to properly conduct this program. In addition, annual funding is needed to repair, replace, upgrade, and otherwise maintain such equipment and supplies necessary to carry out necropsy work.

**1122. Develop and coordinate out-of-state salvage efforts.**

During summer, some Florida manatees migrate north into Georgia, South Carolina, North Carolina, and Virginia or

west into Alabama and Louisiana. To maintain accurate mortality data, arrangements are needed to collect carcasses and data from animals that die in these areas. This requires a) alerting State and local officials in these areas of the importance of reporting dead manatees, and b) supporting travel and other expenses associated with collecting carcasses and mortality data. To meet these needs, the Service and the salvage and necropsy program staff should cooperate in contacting appropriate officials outside of Florida to alert them as to reporting needs and procedures for manatee carcasses found in their respective areas, and ensuring funds are available for collecting manatee carcasses and mortality data promptly.

**113. Undertake special studies and analyses to improve understanding of mortality causes and trends.**

To clarify certain poorly understood mortality trends and causes, special studies are needed to better define and explain various factors, phenomena, or events influencing mortality trends.

**1131. Assess manatee carcass reporting rates.**

While it is believed that most dead manatees are found and reported to the program, an unknown proportion go unreported. Annual manatee mortality totals, therefore, under-represent actual mortality. To assess the number of



manatee carcasses that go unreported, studies of carcass detection and reporting rates should be done.

**1132. Undertake a workshop and/or studies to identify the proximal cause(s) of perinatal mortality.**

In recent years, perinatal mortality has increased at a rate greater than any other mortality category and now constitutes approximately 25% of the total annual mortality. The causes of increased perinatal mortality are uncertain. It may be related to pollution, injuries and stress from increased vessel traffic and other human activities, changes in the age structure of mature breeding females, habitat changes, or some combination of these and other possible causes. It also may be due to a greater number of births. To assess possible causes, research needs, and mitigation measures, a workshop should be held to investigate available information on perinatal mortality, possible contributing factors, and any regional differences.

**1133. Undertake routine and periodic tissue analyses.**

To obtain maximum information from carcasses and wild and rescued manatees, it is necessary to examine and analyze tissues for information on contaminant levels, reproductive status, age at death, *etc.* In addition, to improve understanding of disease and immunotoxicological processes, salvaged tissues, organs, and organ systems should be

studied. In addition, serum from wild and rescued manatees should be screened to assess the incidence of exposure to various viral, bacterial, parasitic and other pathogenic organisms. Establishment of a centralized serum bank to help analyze disease processes and occurrence should be a high priority.

**1134. Investigate and respond to potential unusual mortality events.**

From time to time there are unusual mortality events in which large numbers of manatees die or become moribund. For example, over 45 animals died in association with a severe cold front in late December 1989 and at least 37 animals died in association with a red tide event in the Caloosahatchee River in southwest Florida in 1982. A plan for responding to such an event is now being prepared by the Service as required by the Marine Mammal Stranding Act of 1992. If a large scale mortality event occurs, the Service and the salvage and necropsy program will need to coordinate response efforts using contingency plans and funding as have been previously arranged and set aside for such events.

**12. Minimize collisions between manatees and watercraft.**

The largest source of human-related manatee mortality is collisions between manatees and watercraft. Known watercraft deaths now constitute at least 20-22% of the total known annual mortality. Watercraft may cause

additional cryptic deaths or reduced population growth due to indirect effects of injuries and stress on the reproductive success of mature females (Marine Mammal Commission 1993). To minimize watercraft-related injuries and deaths, further work is needed to develop appropriate waterway speed and access rules, to make vessel operators aware of those rules and to enforce them, to plan special events such as boat races and fishing tournaments so they do not pose a threat to manatees, and to manage the proliferation of boating facilities in vital manatee habitat so as to avoid waterway traffic patterns likely to cause manatee injuries or deaths. Steps also are needed to better assess mortality caused by large vessels and to continue reviewing technological developments, such as new propeller guard designs, that might help reduce manatee injury and deaths. Actions to address these needs are discussed below.

**121. Develop and refine State waterway speed and access rules.**

The State of Florida has begun promulgating waterway speed and access rules to reduce the number of collisions between manatees and watercraft. The rules seek to create a system of speed and access zones tailored to local manatee habitat use patterns and boating needs. Rulemaking is an intensive process that requires: compiling and reviewing voluminous site-specific environmental data, particularly on manatee habitat use patterns and boating activity; extensive coordination between county and Florida Department of Environmental Protection officials to develop rule provisions; public hearings and review; and approval by the Secretary of the Department of Environmental Protection. As directed by the Florida Governor and Cabinet in 1989, priority attention in this regard has

been focused toward 13 key manatee counties. Rules for 12 of the 13 key counties are complete. Over the next five years, the need for manatee protection measures in the remaining key counties and some 20 other counties with important manatee habitat should be considered. Also, rule refinements likely will be needed to increase rule and sign uniformity and to reflect new information on manatee habitat use patterns and boating activity.

**122. Develop and refine Federal waterway speed and access rules.**

For certain Florida waterways, particularly those in or adjacent to National Wildlife Refuges, the Service has promulgated Federal rules to regulate vessel speed and access. These rules, which complement state rules, are issued under authority of the Endangered Species Act, the Marine Mammal Protection Act, and/or the National Wildlife Refuge System Administration Act. Federal rules issued by the Corps of Engineers to control vessel speeds adjacent to navigation locks also may enhance manatee protection. Although the principal purpose of the latter rules is vessel safety around navigation locks, they also reduce the risk of manatee-vessel collisions and should be encouraged for both reasons at locks used by manatees along the Okeechobee Waterway, Cross Florida Barge Canal, and elsewhere. As necessary and appropriate, such Federal rules should be modified and new rules should be promulgated in cooperation with the State of Florida and other concerned parties.

**123. Post and maintain regulatory signs.**

To advise watercraft operators of speed and access restrictions, regulatory signs are posted strategically along waterways. As proper posting is a prerequisite for enforcing and prosecuting violations, signage is as important as the rules themselves. The extensive new rules necessitate posting thousands of new signs along thousands of miles of waterway. On the east coast, the Florida Inland Navigation District is responsible for sign posting and maintenance. Elsewhere the task is shared by the Florida Department of Environmental Protection, the West Coast Inland Navigation District, and the counties. Once county rules are adopted, the Department's Bureau of Protected Species Management develops or reviews signage plans, the Florida Marine Patrol issues permits for sign placement, and the entity responsible for printing and posting then proceeds with actual posting. As rules are completed or modified, signs should be posted promptly by the responsible agency. Once posted, they should be inspected periodically and repaired or replaced as needed. Signage changes may be warranted based on enforcement or navigation needs or efforts to make sign messages clearer and more uniform.

**124. Enforce and encourage manatee protection regulations.**

The Florida Marine Patrol is the principal agency in Florida responsible for enforcing speed and access rules as well as other manatee protection rules. Federal and state officers assigned to selected parks, refuges, and reserves, the Florida Game and Fresh Water Fish Commission, and the U.S. Coast Guard also assist with

enforcement. Effective enforcement requires officer training to ensure they are aware of the purposes and provisions of the rules and how to enforce them. It also requires cooperation among various Federal and State enforcement officials, and a cooperative judiciary. Specific steps to address enforcement needs include the following tasks.

**1241. Focus and increase officer time dedicated to enforcing manatee protection rules.**

Manatee protection rules are but a few of the myriad rules which law enforcement officers must enforce. To maximize the effectiveness of enforcing rules concerning manatees, steps should be taken to: (1) concentrate effort at times and areas where boat and manatee densities are greatest; (2) increase the amount of time dedicated to manatee protection rules; and (3) provide speed guns and training in their use to appropriate field officers. Regarding the first point, the Florida Marine Patrol, the Game and Fresh Water Fish Commission, the Bureau of Protected Species Management, and the Service should periodically consult to review needs and strategies for concentrated enforcement effort. Regarding the second point, the Florida Marine Patrol should be provided funding for overtime pay that would be used by officers exclusively for enforcing manatee protection rules.

**1242. Develop and implement a strategic plan to strengthen cooperative interagency enforcement.**

Enforcement of manatee protection rules involves field officers in various Federal, State, and local agencies as well as judicial, legislative, and regulatory support. Although waterway speed and access rules demand the greatest time and effort to administer, rules for poaching, incidental take in fisheries, harassment, *etc.*, also require attention. To develop an effective enforcement system, a strategic enforcement plan should be developed and implemented to establish a cooperative interagency field enforcement network that is backed by a supportive judiciary and legislature. The strategic plan should address steps to: develop, review, and modify interagency agreements as may be needed for cross-deputizing and coordinating Federal, State, and local field officers; develop and update officer training programs and explanatory materials on manatee protection rules and enforcement needs; conduct periodic training and refresher courses for enforcement units at all levels; coordinate interagency enforcement exercises; make regulations as clear and as uniform as possible; educate the judiciary and otherwise facilitate prosecutions of manatee-related rule violations; and work with the legislature to ensure fines, penalties, and other statutory provisions are clear and as effective as possible.

**1243. Conduct surveys to assess compliance with rules.**

To help evaluate the effectiveness of waterway speed and access rules in reducing manatee mortality and to identify enforcement needs, field surveys should be done to monitor the extent to which watercraft comply with regulatory measures. Periodic surveys on selected waterways in each county should be undertaken.

**1244. Encourage and cooperate with efforts to develop unified state-wide boating safety measures.**

Proposals for state-wide speed limits, boat operator licenses, and mandatory boater education have been considered in the past. Such measures would complement and enhance efforts to reduce watercraft-related manatee deaths by offering opportunities to educate boaters about rules to protect manatees and to reduce boat speeds in other areas where manatees may occur. Although such boating safety measures have been rejected to date, similar measures may be proposed and adopted in the future. To the extent possible, new proposals to establish state-wide boating safety measures should be encouraged. Particular efforts should be made to integrate manatee protection concerns into any new boater education programs.



**125. Establish policies for authorizing boat races and other water sport events.**

Certain organized water sports events, such as boat races, water ski contests, and fishing tournaments, involve boats traveling at high speed. In certain areas and times, these activities pose threats to manatees. Permits for such events typically are required from the U.S. Coast Guard. The U.S. Coast Guard considers advice from the Service and the State on whether a permit should be granted, denied, or granted conditionally given possible effects on manatees. To help planning for boat races, representatives from the Department, the Service, and boat racing organizations developed guidelines on when, where, and under what conditions such events could be held consistent with manatee protection objectives. The guidelines are used by the Service and the State to review permit requests and by event organizers to plan events. The Service and the Department should keep such guidelines under review and modify and expand them as needed to address other types of water sport events. The Service, the State, and the U.S. Coast Guard should continue to consult on the issuance of permits for sporting events that involve high speed boats in manatee habitat (see Task 129).

**126. Indicate speed and access zones on nautical charts.**

The National Oceanic and Atmospheric Administration (NOAA) publishes nautical charts and a Coast Pilot to help vessel operators navigate in coastal waters. Among other things, the charts and Coast Pilot provide information and advice on navigation rules and

hazards. Private organizations also publish navigation charts that are distributed widely. As new speed and access rules are adopted, NOAA and other organizations publishing navigation charts should be asked to add information on the new rules to forthcoming editions of area nautical charts and the regional Coast Pilot.

**127. Assess and reduce mortality caused by large vessels.**

Large slow-moving ships (e.g., tugs and cargo vessels) are known to kill manatees. Some animals appear to be pulled into propeller blades by the sheer power of generated water currents and others are crushed between the bottom and the hull of deep draft ships. When moored, large vessels also can crush manatees between their hulls and adjacent wharves or ships. To prevent the latter problem, some ports (e.g., the Mayport Naval Base) have begun using fenders to maintain minimum stand-off distances between moored vessels and wharves. To address the threat of propellers on large tugs operating at the Kings Bay Submarine Base, the Navy recently designed and installed propeller shrouds on its C-tractor tugs. These approaches may be useful in other areas.

To consider applying such measures more widely, a study should be undertaken to: review mortality data for evidence of deaths attributable to large vessels; examine barge, tug, and other large vessel traffic patterns relative to manatee distribution; assess the feasibility and cost of installing propeller guards or shrouds on large vessels or tugs routinely plying waterways used by manatees; consider rules to require fenders when mooring large vessels in

manatee habitat; evaluate ways to educate harbor pilots about threats large vessels pose for manatees; and identify other possible mitigation measures. Actions to implement appropriate measures should be taken based on study findings.

**128. Evaluate the feasibility of propeller guards or alternative propulsion technology for small watercraft.**

In the past, propeller guards have been examined as a possible solution to recreational watercraft-related manatee mortality. They also have been considered for improving human safety and protecting seagrass beds. While new designs are developed periodically, their effect on vessel speed and steering have discouraged general use. Broad use of propeller guards should reduce propeller manatee injuries; however, it may only marginally reduce overall injuries and deaths if the impact of a propeller guard on a fast moving boat is as injurious to manatees as the wounds from propellers. Nevertheless, as new designs are developed, they should be tested and evaluated as a means of mitigating manatee injuries and deaths. Once efficient and effective guards are available, incentive based programs should be explored to encourage greater use of propeller guards.

**129. Continue Section 7 and State reviews of boating facilities and water sport events.**

Marinas, boat ramps and other boating facilities increase local boat traffic. They can therefore influence the frequency of watercraft collisions with manatees in areas where manatees are common. Facility construction and

resulting traffic also can degrade habitat features, such as grassbeds, which are important to manatees. Such facilities require permits from the Corps of Engineers, environmental resource permits from the Florida Department of Environmental Protection, and, in many cases, submerged land leases from Florida's Board of Trustees. As noted above, water sport events also may affect manatees and require permits from the U.S. Coast Guard. Under Section 7 of the Endangered Species Act and other Federal laws, the Fish and Wildlife Service reviews and comments on permit applications whenever they may affect endangered species such as manatees. This formal review process is a fundamental part of the manatee recovery program and must be continued. In addition, the Florida Department of Environmental Protection should establish rules to implement policies addressing cumulative impacts of coastal marine facilities. Since 1989, the Department has implemented a policy approved by the Governor and Cabinet to limit new powerboat slips (wet or dry) to one for every 100 feet of shoreline owned or controlled by the applicant in the 13 key manatee counties. The Service has incorporated this standard into its Section 7 biological opinions and such a policy should be adopted by the State by rule.

**13. Minimize manatee deaths in water control structures.**

Late in the 1970s, eight to nine manatees per year were killed in flood gates and navigation locks. To reduce this mortality, steps were taken early in the 1980s to modify gate opening procedures. Annual mortality initially decreased in the early 1980s. However, the number of deaths subsequently increased and in 1994, 16 deaths were recorded. An ad hoc interagency task force was established with representatives from the South Florida Water Management District, the Corps of Engineers, the Service, and the Florida

Department of Environmental Protection to examine other steps to prevent such deaths. Further steps needed in this regard are identified below.

**131. Develop, test, and implement new alternative measures.**

The interagency task force has identified several possible alternatives to reduce flood gate and navigation lock deaths. They include adjusting gate opening sequences, installing slotted gates or gates with new top-flow designed structures, adding detection devices to alert gate operators when manatees are present, and/or installing automatic door reversing mechanisms similar to safeguards on elevator doors. A pressure sensitive unit has been designed and tested on two water control structures by the South Florida Water Management District with inconclusive results. The Jacksonville District of the Corps of Engineers is preparing a Section 1135 Project Modification Report on Manatee Protection at Select Navigation and Water Control Structures. The local sponsor, the South Florida Water Management District, coordinated and conducted the research and development of sensor devices and other protection devices with the Jacksonville District. The devices and techniques that resulted from this study should be installed, tested for effectiveness, and implemented in a timely manner.

**132. Promptly investigate structure-related deaths.**

Gate and lock-related manatee mortality should be kept under continual review by the Service, the Florida Department of Environmental Protection, and the agencies directly responsible for

the structures. Structures at which multiple deaths occur should be investigated immediately to identify and, as possible, correct contributing factors.

**14. Assess and minimize manatee injuries and deaths caused by fisheries.**

In some years, as many as six manatees have been killed in commercial fishing gear. Most are caught and drowned in nets of inshore shrimp boats in northeast Florida; others are entangled in float lines for crab traps. Commercial fisheries in coastal Florida are managed cooperatively by the Florida Marine Fisheries Commission and the Florida Department of Environmental Protection. To minimize adverse interactions between fisheries and manatees, the following steps are needed.

**141. Minimize manatee drownings in shrimp nets.**

The Florida Marine Fisheries Commission has completed portions of a statewide shrimp fishery management plan. The Commission, the Florida Department of Environmental Protection, and the Service should review and, as necessary, update measures to prevent manatees from being caught and drowned in shrimp nets. As an initial step, the Department has printed and distributed brochures to advise shrimp fishermen of the problem and the steps they can take to minimize drownings (e.g., reducing tow times and immediately retrieving nets when heavy objects are encountered). If such education efforts do not resolve the problem, other measures (e.g., gear, season, and/or area closures) should be considered, incorporated into the plan, and implemented as warranted.

**142. Minimize injuries and deaths in crab pot lines and other fishing gear.**

Occasionally, manatees become entangled in crab pot float lines, various types of fishing nets, and monofilament line used by recreational fishermen. Information on interactions with such fishing gear should be kept under review by the Florida Department of Environmental Protection and the Service. As necessary and possible, steps should be taken to improve reporting of animals caught in fishing gear, particularly those that are released or escape alive. If warranted, steps to identify and implement measures to reduce or avoid such interactions should be taken.

**143. Identify locations where fishing gear impacts manatees and implement measures to mitigate impacts.**

In certain areas where commercial and recreational fishing is particularly heavy and/or where manatees tend to aggregate, interactions with fishing gear may be particularly common. For example, at some east coast aggregation sites, manatees are often snagged by lines, lures, and treble hooks of recreational fishermen. Sites where interactions with recreational and/or commercial fishing gear appear particularly common should be identified and, as warranted, steps should be taken to assess and implement actions to prevent potentially threatening interactions with fishing gear.

**15. Investigate and prosecute all incidents of poaching and malicious vandalism.**

Poaching, shooting, butchering, and other malicious vandalism against manatees are rare occurrences. All reports and evidence regarding such incidents should be turned over to the Service's law enforcement agents for investigation and prosecution to the fullest extent of the law. As appropriate, a reward system should be established to help investigate and prosecute violations.

**16. Rescue, rehabilitate, and release distressed manatees.**

Reports of injured or distressed manatees are frequently received by officials in the manatee recovery program. While many prove false, some form of rescue action is deemed necessary in about 15 to 25 cases per year. In some cases, animals are treated and released immediately. In others, rehabilitation in captivity is needed and marine zoological parks make facilities, resources, and expertise available to transport and care for animals prior to their release back into the wild. Such actions help reduce manatee mortality but require extensive cooperation among Federal and State agencies, zoological parks, and other institutions and organizations. The Service, with the assistance of an Interagency/Oceanaria working group, maintains oversight of work to rescue, rehabilitate, and release animals. The Florida Marine Research Institute's manatee salvage and necropsy program has agreed to coordinate rescue response work on a day-to-day basis. The Service's Jacksonville Field Office coordinates captive program activities and manatee releases. In addition, under state law, the Florida Department of Environmental Protection has been authorized and directed to



provide partial reimbursement to cooperating parks and organizations to help defray rescue and rehabilitation costs. Steps needed to rescue, rehabilitate, and release distressed manatees include the following.

**161. Authorize cooperative participation in the manatee rescue/rehabilitation network.**

The Service has overall responsibility for work to rescue, rehabilitate, and release injured or otherwise distressed manatees. To meet this obligation, the Service's Office of Management Authority issued an endangered species/marine mammal enhancement permit to authorize related work by cooperating facilities and organizations. Letters of authorization under this permit are issued by the Service to qualified groups interested in participating in the rescue/rehabilitation network. The letters set forth the scope of their respective involvement in (1) verifying, (2) rescuing and transporting, and/or (3) treating and maintaining distressed animals. Activities under letters of authorization need to be reviewed continually. Every effort should be made to provide training opportunities to members of authorized groups to ensure continuous improvement in local rescue assessment and logistic capabilities. As necessary or desirable, the Service should update or modify the terms of existing letters as personnel changes occur and experience grows and/or issue new authorization letters to additional qualified facilities or organizations as such needs are identified.

**162. Coordinate and oversee day-to-day rescue operations.**

To assure prompt, effective responses to distressed manatees, a rescue coordinator has been designated to receive initial reports of such animals and to mobilize and coordinate rescue network teams. Given existing organization, geographic allocation of personnel and contacts with local law enforcement officials and others likely to receive reports of distressed animals, coordination of routine rescue work should rest with the staff of the manatee salvage and necropsy program. The Florida Marine Research Institute, now in the Florida Department of Environmental Protection, has assumed primary responsibility for that aspect of the program. The Director of the Institute's manatee salvage and necropsy program currently serves as the rescue coordinator. Reports of distressed animals are directed to the rescue coordinator who in turn contacts authorized rescue network teams to organize a response for verification, rescue, and transport to available treatment facilities as necessary, and notifies the Service of ongoing rescue operations, and unusual or significant incidents as necessary.

**163. Ensure adequate rehabilitation facilities.**

Over the past several years, the number of captive manatees has ranged from about 40 to 50 animals. Three "Pre-Act" animals (animals brought into captivity prior to enactment of the Endangered Species Act) have been in captivity for several decades. Some captives have been judged unreleasable due to the nature of their injuries or concern about their ability to readapt to the wild (e.g.,

long-term captive animals that were born in captivity), and the remainder are animals in varying stages of rehabilitation.

Captive Florida manatees are held at six marine facilities and zoological parks:

1. Sea World of Florida\* - Orlando, Florida
2. Miami Seaquarium\* - Miami, Florida
3. Lowry Park Zoo\* - Tampa, Florida
4. Homosassa Springs State Wildlife Park - Homosassa Springs, Florida
5. Epcot's Living Seas - Lake Buena Vista, Florida
6. South Florida Museum - Bradenton, Florida

(\* = Critical Care Treatment Facility)

Space for captive animals is limited and maintenance costs to feed and care for manatees are relatively high (at least \$ 25-40,000 per animal per year). To assure space is available to maintain animals rescued in the future, steps are being taken to return rehabilitated animals to the wild as quickly as possible (see Task 164). To provide additional options for management, captive maintenance facilities at the Homosassa Springs State Wildlife Park and elsewhere should be expanded and improved as needed. In addition, to meet statutory obligations for defraying costs incurred by authorized groups in rehabilitating distressed animals, the Florida Department of

Environmental Protection also must develop and implement a process for responding to reimbursement requests.

**164. Convene periodic meetings of the Interagency/Oceanaria working group and the Captive Manatee Planning Committee.**

The Service has constituted and convenes periodic meetings of an Interagency/Oceanaria working group to help coordinate rescue, rehabilitation, and release work and to manage captive maintenance activities in ways that will best meet manatee recovery objectives. Among other things, the working group: reviews the status of manatee rescue and rehabilitation work; maintains records of captive manatees; charts the progress of animals towards their release; assists the Service in developing and reviewing protocols and criteria for the rescue, transport, rehabilitation, maintenance, and release of animals; and exchanges information and expertise with respect to rescue, rehabilitation, maintenance, and release procedures.

Captive manatees also provide unique opportunities to study physiological processes and other matters that could shed light on habitat requirements and recovery needs. Such work, however, should not impede rehabilitation and release of captive animals. To help evaluate and direct research on captive animals consistent with this need, the Service has established a Captive Manatee Planning Committee. In part, the Committee is responsible for reviewing all research proposals and management options involving captive manatees and making recommendations to the Service's manatee

coordinator. At least two meetings per year of both the full working group and its planning committee should be held.

**165. Facilitate and evaluate animal releases.**

As soon as animals taken into captivity for rehabilitation or care are judged suitable for release back into the wild, steps should be taken to do so. Decisions on releases should be made by the Service in coordination with the facility maintaining the animal and the Interagency/ Oceanaria working group following established criteria (see Task 164). The following steps are needed to facilitate and evaluate releases.

**1651. Construct and maintain acclimation pens as needed.**

To help rehabilitated manatees readjust to wild conditions, acclimation pens should be constructed and tested in coastal waters. Such pens may be useful for temporarily maintaining and observing animals in natural settings and helping ensure that they adjust properly to wild conditions at the location of their release. They may be particularly helpful in releasing long-term captive animals, orphans, captive born animals, and others that may have greater difficulty in readapting to the wild. A fenced enclosure has been constructed at Merritt Island National Wildlife Refuge in Brevard County to assess a soft-release approach for returning selected manatees to the wild. At least one pen should be maintained on both the east and west coasts of Florida. The pens should allow free water

circulation and should have sufficient wild local vegetation to support reintroduced manatees for several weeks at a time. Funding to construct, maintain, and operate needed pens should be provided.

**1652. Develop protocols and criteria to govern releases and evaluate the manatee's readaptive success.**

To assure in so far as possible that released animals will readjust to the wild, criteria and protocols need to be developed and kept under review for assessing the physical health of animals in release pens and their fitness to be released. The guidance in these criteria and protocols should be modified as necessary based on the success or failure of animals with different histories and medical records to readapt to wild conditions. Veterinarians in the Interagency/Oceanaria working group, in consultation with the Service (see Task 164), should develop and keep such protocols and criteria under review. Similar guidance also should be developed to help with decisions on whether and when to recapture animals not satisfactorily readapting to the wild.

**1653. Radio-tag and track released manatees.**

To help assess readjustment and survival of rehabilitated manatees returned to the wild, certain released animals should be followed by telemetry upon release and all released

animals should be tagged with Passive Integrated Transponders (PIT) tags. This will aid in assessments of whether animals adopt normal habitat use patterns, interact with other manatees, and readapt successfully to the wild. If problems arise, it also may help in locating and recapturing animals. Over the next five years, 5 to 10 animals are expected to be released annually. Telemetry tags, staff, and other support needed to track about 5 to 7 released animals annually will be required.

**166. Develop a response plan for large-scale morbidity or mortality events. (see Task 1134)**

Unusual natural or human-related events (e.g., disease outbreaks, red-tides, severe winter cold fronts, and large oil spills) may produce large numbers of distressed, dying, or dead animals. Such events could exceed normal rescue and salvage program response capabilities and necessitate emergency arrangements for transporting, holding, and treating animals. To help prepare for such an event, an emergency response plan, as required under the Marine Mammal Stranding Act of 1992, needs to be developed to identify, to the extent possible, arrangements and resources that might be brought to bear to retrieve, isolate and handle large numbers of dead or dying animals, and to collect data necessary to thoroughly identify and assess the cause of event. Such a plan and arrangements to implement it need to be developed and periodically reviewed by those that would be involved in the response.

## **2. Protect Essential Manatee Habitat.**

In addition to controlling direct sources of manatee injury and mortality, manatee population recovery and growth depends on maintaining the availability of habitat suitable to support a larger manatee population. Manatee habitat requirements include: adequate sources of aquatic vegetation for food; sources of fresh water; secluded areas in which to mate, to bear and nurse their young, and to rest; warm-water refuges during cold winter periods; and safe travel corridors connecting such areas. Availability of these habitat features may be affected by coastal development and human activity patterns along waterways used by manatees. The challenge for managers, therefore, is to provide for human needs while, at the same time, protecting the availability and quality of a network of essential habitats. These essential habitats reflect seasonal manatee movement patterns and maintain a full complement of habitat needs throughout the principal range of both the east and west coast manatee populations. This section of the recovery plan identifies the tasks needed to protect essential manatee habitat. Aerial surveys, telemetry, and salvage will all be useful in identifying habitats for acquisition and protection.

In addition, ongoing dredge and fill and water quality permit review programs involving the Service, the Corps of Engineers, the National Marine Fisheries Service, and the Environmental Protection Agency at the Federal level (Section 10 of the Rivers and Harbors Act, Section 404 of the Clean Water Act, and Section 7 of the Endangered Species Act), Florida's Department of Environmental Protection and water management districts and Georgia's Department of Natural Resources at the state level, and local environmental permitting agencies, should continue to review and comment on permit applications that have the potential to adversely impact manatees and/or their habitat.



**21. Establish regional protected area networks containing essential manatee habitat.**

Federal and state systems of refuges, reserves, preserves and parks in Florida contain important manatee habitat. Management of those areas offers assurance that habitat will be maintained so as to protect the features (e.g., grassbeds, quiet secluded waterways, warm-water springs, etc.) important to manatees. In the last 10 years, considerable cooperative effort has been devoted to acquiring essential manatee habitat and adding it to Federal and State protected area systems. These efforts are beginning to form regional protected area networks that contain many important regional habitat features essential for the long-term survival of manatee populations. These efforts need to continue as well as efforts to manage key protected areas in ways that enhance achievement of manatee recovery objectives.

**211. Acquire and incorporate essential manatee habitats to the National Wildlife Refuge System.**

Several National Wildlife Refuges managed by the Fish and Wildlife Service contain essential manatee habitat and are adjacent to other essential manatee habitat that is not similarly protected. Expanding these refuges to add such areas would significantly improve protection not only for manatees, but also for many other species. Particularly important areas in this regard are along the Crystal River near the Crystal River National Wildlife Refuge; along the Homosassa River near the Chassahowitzka National Wildlife Refuge; and along the St. Johns River and associated waterways in and

adjacent to the Lake Woodruff National Wildlife Refuge. As possible, the Service should pursue acquisitions, in cooperation with the State of Florida, to expand these and other refuges to incorporate essential manatee habitat.

**212. Acquire and incorporate essential manatee habitats to State Reserve, Preserve, and Park systems.**

Florida's Conservation and Recreation Lands (CARL) Program and the Save Our Rivers Programs administered by the five regional Water Management Districts have acquired many areas that will further manatee habitat protection. They also have many important acquisition projects in varying stages of development. Among the pending CARL projects having particular importance to manatees are those near Kings Bay (i.e., the Crystal River, St. Martins River, and Homosassa Reserve projects), Blue Spring (i.e., the Wekiva-Ocala connector and St. Johns River projects), and along certain creeks on the east coast (i.e., the Sebastian Creek, Spruce Creek, and Goldy/Bellemead projects). As possible, administrators of the two State programs, in cooperation with the Service, should place special emphasis on completing these projects.

**213. Review and provide advice on priority habitat acquisitions relative to manatees.**

The CARL Trust Fund provides a significant source of funding for manatee habitat acquisition projects. In allocating these acquisition funds, the Bureau of Protected Species Management in the Florida

Department of Environmental Protection provides comments and advice to the Division of State Lands and the Program's Land Acquisition Advisory Council on listed acquisition projects of particular importance to manatees. The Bureau and the Service should continue to provide such advice to this program and the Save Our Rivers program as a routine function. Particular efforts should be made to solicit acquisition advice from manatee biologists with the Department's Florida Marine Research Institute. Input from field research biologists with the National Biological Service's Sirenia Project should also be solicited.

**214. Identify and propose new land acquisition projects.**

As new information on manatee habitat use patterns and essential habitats become available, new areas for acquisition may be identified. To develop regional protected area systems containing key essential manatee habitat, periodic efforts should be undertaken to review and summarize data on manatee distribution and movement patterns in relation to evolving regional protected area systems to identify and propose new land acquisition projects. A task force to undertake this work should be created and convened as necessary.

**215. Encourage and coordinate Federal, State, and private land acquisition efforts.**

Manatee-related land acquisitions that help create regional networks of essential manatee habitat are particularly important. In this regard, identification of priority areas must consider regional

manatee habitat requirements and relationships among essential manatee habitats. To promote and guide complementary projects, the Service and the Florida Department of Environmental Protection should designate an individual to convene meetings, act as a clearinghouse on the status of manatee acquisition projects, and otherwise help coordinate relevant land acquisition by Federal and State agencies, The Nature Conservancy, and others.

**22. Establish effective manatee management programs at established Federal and State protected areas.**

After essential manatee habitats are acquired and added to Federal and State refuge, reserve, preserve and park systems, the agencies responsible for administering those areas should incorporate manatee protection and public awareness measures into unit administration programs.

**221. Develop and maintain public education programs at selected protected areas.**

Because Federal and State protected areas attract thousands of visitors each year, those containing essential manatee habitat offer valuable opportunities for interpretive programs on manatee conservation. Also, visitors to refuges, preserves, and parks with essential manatee habitat must be made aware of special measures to protect manatees within these areas. Actions needed in this regard are discussed below.

**2211. Develop a visitor interpretive center for the Crystal River National Wildlife Refuge.**

The Crystal River National Wildlife Refuge in Kings Bay includes the largest natural warm-water refuge for manatees in Florida. It also offers divers a rare opportunity to see manatees under water. This opportunity and the Bay's clear warm-water attract thousands of visitors annually. This, in turn, has created the need for special protection measures. To advise visitors of manatee conservation issues and special protection measures in the Bay, a visitor interpretive center with exhibits and programs on manatees is urgently needed.

**2212. Develop a new manatee display at Homosassa Springs State Park.**

The recently acquired Homosassa Springs State Wildlife Park features a warm-water spring with several captive manatees on view to the public. One of five authorized manatee rehabilitation facilities, the park offers an outstanding opportunity to attract and inform individuals and groups about manatee conservation. Its proximity to Crystal River, where the public may see wild animals in a natural setting, also offers a unique opportunity to develop a complementary education and awareness program. The Service and the State should cooperate to develop and maintain a manatee display and public awareness program at the Park that will

complement needs and programs at the nearby Crystal River National Wildlife Refuge.

**2213. Maintain public awareness/education programs at Blue Spring State Park.**

Blue Spring State Park includes a natural clear warm-water spring used by a large group of manatees. Park personnel (in cooperation with the Sirenia Project) monitor the history of individual animals using the spring and offer interpretive programs on manatees to visitors and groups. Manatees at Blue Spring are featured by Save the Manatee Club in an Adopt-a-Manatee Program that attracts visitors from throughout the State and the nation. This outstanding education program should be continued.

**2214. Develop public awareness/education programs at other parks and refuges.**

As possible, the Service and the State should develop and maintain displays and education programs explaining manatee conservation issues at other refuges, reserves, preserves and parks that include essential manatee habitat. This should also be a priority at manatee aggregation sites where managed public viewing and education opportunities exist.

**222. Incorporate manatee protection measures into management systems for protected areas and state-owned submerged lands.**

Depending on local conditions and human activity patterns, management measures may be needed to ensure that activities and development projects within protected area boundaries or affecting state-owned submerged lands do not adversely affect manatees or their essential habitat.

**2221. Include manatee protection and monitoring measures in management plans for Federal and State protected areas.**

As appropriate and possible, managers of Federal and state refuges, reserves, parks, etc. should adopt measures to: develop and enforce waterway speed and access rules to avoid vessel traffic patterns that threaten manatees; manage aquatic plant control programs to avoid impacts to manatees or their food supplies; protect and monitor the quality and quantity of water flowing from natural warm-water springs used by manatees; and identify and avoid uses incompatible with protection of manatees and manatee habitat. They also should carry out programs to monitor and record manatee habitat use patterns in and around unit boundaries. Such measures should be developed and reviewed periodically in consultation with the Service's manatee coordinator and the State's Bureau of Protected Species Management, and needed measures should be incorporated into unit management plans.

**2222. Develop policies and provisions to guide decisions on leasing State-owned submerged lands.**

Most essential manatee habitat in Florida overlies publicly owned sovereignty submerged lands. Private use of these lands to construct marinas, docks or other facilities potentially affecting manatees requires a lease from the Florida Board of Trustees. To ensure that the use of such areas is consistent with manatee recovery objectives, there is a need to develop policies, guidelines, and/or other provisions to help review lease requests involving activities or projects that may directly or indirectly affect manatees and manatee habitat.

**23. Designate and maintain Manatee Sanctuaries and Refuges.**

Under authority of the Marine Mammal Protection Act and the Endangered Species Act (50 CFR Part 17), the Service may designate certain waters as Manatee Sanctuaries (areas in which all waterborne activities are prohibited) or Manatee Refuges (areas in which certain waterborne activities may be regulated). Six seasonal Manatee Sanctuaries have been designated by the Service in Kings Bay located in Citrus County within and/or near the Crystal River National Wildlife Refuge. These areas range from 1.7 to 18 acres in size. No Manatee Refuges have been designated, although one is proposed for waters within the perimeter of Lake Woodruff National Wildlife Refuge. A 15 square mile motorboat prohibited area has been established by the Service under its refuge authority in the upper Banana River south of the NASA Causeway. Established areas must be posted and



enforced. As necessary, the Service should modify existing rules and designate other Sanctuaries or Refuges.

**24. Develop, implement, and update county manatee protection plans.**

To develop effective, fair manatee protection schemes, site-specific conditions and information should be reviewed and protection measures should be integrated into the fabric of local policies, and ordinances. Comprehensive, multi-faceted county manatee protection plans are considered appropriate and vital. It is anticipated that such plans would be implemented as amendments to local government comprehensive plans required by the State's Comprehensive Growth Management Act of 1985 and reviewed for consistency by the Florida Department of Community Affairs. Steps to encourage manatee protection plans already have been taken for the 13 key counties where manatee mortality has been greatest and manatees occur most frequently. Two of the most important components of these plans are county waterway speed zones (see Task 121) and measures to balance plans for new boating facilities with manatee protection needs. Regarding the latter point, the Governor and Cabinet have directed that limits be placed on the construction and expansion of boating facilities pending the implementation of more comprehensive plans. Eventually, such plans should be prepared for all counties with important manatee habitat. Steps to develop and implement such plans are noted below.

**241. Assist counties to develop manatee protection plans.**

To develop and approve manatee protection plans, county planners and the Florida Department of Community Affairs need reliable

information on local manatee habitats and habitat use patterns. To varying degrees, counties also may need help to identify and evaluate appropriate planning provisions. Such information and assistance should be provided by the State's Bureau of Protected Species Management and the Service's Jacksonville Field Office and the National Biological Service's Sirenia Project. The staff of these agencies should cooperatively synthesize and provide accurate, up-to-date data on manatee distribution and habitats within county borders to county officials and work closely with them to develop appropriate planning measures. When draft plans are completed and submitted to the Florida Department of Community Affairs for review, pertinent Federal and state agencies should be asked to review them and comment to the Department on the adequacy of protection measures. The Bureau, the Service, and the National Biological Service must allocate the staff and resources needed to provide such assistance.

**242. Assist in implementing manatee protection plans.**

Approved manatee protection plans should be provided to Federal and state agencies whose decisions with regard to permitting, leasing submerged lands, project review, or other activities should consider the adopted planning measures. Of particular importance in this regard are the Florida Department of Environmental Protection, the Corps of Engineers, and the Service.

**243. Periodically assess, review, and modify manatee protection plan provisions.**

As new information becomes available on manatees and the effectiveness of measures to protect manatees and manatee habitat, there may be a need to modify manatee protection plans. One of the most critical needs in this regard is data on boating activity patterns. While efforts are underway to gather these data in the 13 key manatee counties, it should be collected state wide. Accordingly, the Office of Waterway Management and the Bureau of Protected Species Management in the Florida Department of Environmental Protection should cooperate in developing a state-wide database that includes data on: (1) boat traffic patterns; (2) areas of concern for boating safety; (3) the location of existing marine facilities; and (4) proposed sites of future marine facilities. Based on this and other relevant data, county officials and staff of the Florida Department of Community Affairs, the Bureau of Protected Species Management, and the Service should periodically review county manatee protection plans and, as needed, modify and update their provisions.

Modification of county plans may be called for in the future, based on changes in available information. Plans would need to be strengthened as needed should human caused mortality increase. Similarly, modifications to accommodate boaters may be warranted where manatee use of speed zone areas is demonstrated to be significantly less than previously documented.

**25. Maintain safe, reliable artificial warm-water refuges.**

Many Florida manatees have come to rely on warm-water outfalls from certain power plants and other industrial facilities to avoid thermal stress during periods of extreme winter cold. If warm-water discharges used regularly by manatees are disrupted or otherwise fail to provide needed warmth during the winter, animals which have learned to use them may be exposed to cold stress and perhaps die before they can find or reach alternative heat sources. In addition, water intake canals, pipe openings, etc. could trap manatees attracted to these facilities. Management agencies should conduct a review of these artificial warm-water discharges and develop recommendations based on the importance of each outfall to the long term survival of the manatee. For those discharges that are determined to be essential for the survival of the manatee, written agreements should be established between the Service and relevant industries on appropriate courses of action.

**251. Minimize interruptions to thermal discharges.**

To minimize discharge interruptions and other threats to artificial refugia, National Pollution Discharge Elimination System permits issued by the U.S. Environmental Protection Agency or the Florida Department of Environmental Protection should be reviewed by the Service pursuant to its authority under the Endangered Species Act and the Clean Water Act. Manatee site protection plans should be developed by permittees as requirements of issued permits and should address such issues as: (a) disruptions to warm-water outflows during winter; (b) inadequate discharge temperatures to

sustain manatees during extreme cold events; (c) precautions to minimize hazards to manatees at intake and outfall areas; and (d) timely communication to manatee recovery program personnel of any long-term changes in the availability of warm-water discharges and/or unanticipated problems that may affect manatees in plan outfall areas.

**26. Protect and promote regeneration of grassbeds.**

In many areas, manatees depend on submerged seagrasses for food. Water pollution and dredging have drastically reduced the extent of grassbeds. Steps to protect remaining areas and promote regeneration of lost beds are urgently needed. As possible, the Service, the Florida Department of Environmental Protection, and other participants in the manatee recovery program should actively support efforts to establish water quality standards for water transparency and other measures that will protect and promote regeneration of grassbeds.

**261. Assess threats to seagrass habitats and develop protection strategies.**

While the loss of seagrass beds historically has been well documented, an assessment of the relative severity of present threats is needed. For this purpose, an assessment of losses from various sources such as dredge-and-fill projects, new docks, prop scarring, changes in fresh water flow, and particularly increases in turbidity should be made. Based on the results, existing measures affording protection to seagrasses should be evaluated and a strategy to

enhance protection against acute and long-term threats should be developed. Emphasis should be placed on essential seagrass beds such as those in Biscayne Bay, Hobe Sound, the Indian River, and the Banana River on the east coast and the Crystal River area, Pine Island Sound, and Estero Bay on the west coast.

**262. Develop and implement alternative measures to mitigate threats and promote regeneration of seagrasses.**

Based on the results of Task 261, new measures needed to protect and recover seagrasses should be implemented. Particular attention should be given to establishing monitoring procedures and standards for water clarity in areas of existing or historic seagrass beds. In addition, guidelines should be established to assist in the review of applications for state environmental resource permits issued by the Florida Department of Environmental Protection (see Task 129) and requests for state submerged lands leases issued by the Florida Board of Trustees (see Task 2222) that may affect the quality of seagrass beds important as manatee feeding areas.

**27. Review aquatic plant control programs.**

Essential freshwater food supplies for manatees outside of protected areas may be damaged by dispersal of herbicides to control exotic aquatic plants. The Service and the Bureau of Protected Species Management should routinely review treatment plans developed by aquatic plant control programs to ensure that neither manatees nor their essential food sources are adversely affected by applications of aquatic herbicides. Mechanical or

biological plant control alternatives should be considered as possible. Such alternatives, however may not always be appropriate. For example, mechanical plant removal may be inadvisable in some areas when manatees are present in large numbers (e.g., Kings Bay and Crystal River in the winter).

**28. Minimize disturbance and harassment.**

Disturbance and harassment by boaters, divers, fishermen, and others can alter manatee behavior and reduce the suitability of some areas as manatee habitat. Waterway speed and access restrictions (see Tasks 121, 122, and 213) partially address causes of disturbance and harassment. However, general guidance and advice for certain user groups and the general public also are needed on ways to minimize or avoid interactions that alter natural behavior and movement of manatees. The following steps should be taken to develop regulations, guidelines, and/or practical principles that define proper conduct by divers, boaters, and others with respect to feeding, watering, approaching, viewing, or otherwise interacting with manatees.

**281. Prepare and adopt guidelines for the development of manatee viewing areas.**

Interest in developing facilities to allow members of the public to view wild manatees is increasing. While such facilities offer public education and awareness opportunities, they also increase the potential for harassment of animals and perhaps even malicious injuries. Proposals for such facilities need to be examined carefully. To respond to future proposals to create manatee viewing facilities,

guidelines should be prepared for determining when such facilities would be consistent with manatee recovery objectives and what design features or other conditions should be required.

**282. Prepare and adopt guidelines or regulations on feeding and watering manatees.**

Even when well-intentioned, public feeding or watering of wild manatees may alter natural behavior in ways that ultimately change manatee distribution patterns or place individual animals at risk. For example, it may condition animals to approach boats or areas that are hazardous or encourage them to remain in areas during seasons that could expose them to thermal stress. The development of guidelines and public education programs and, if necessary, regulations to discourage such activities should be evaluated and implemented as deemed appropriate. Enforcement policies must be adopted by responsible agencies. Special attention is needed at areas where feeding or watering by the public is done routinely.

**283. Develop and keep under review guidelines governing close approaches to manatees.**

At times, manatees and people, particularly divers, come in close and even direct physical contact with one another. While manatees occasionally invite such contact, people often chase after manatees that are trying to avoid them. This constitutes harassment which is a violation of Federal law and may cause animals to leave preferred habitats. The latter is an issue of particular concern at the Crystal



River National Wildlife Refuge. The Service has prepared a brochure advising divers at Crystal River on proper conduct when encountering wild manatees. Current policies and provisions governing close encounters between manatees and people in the wild should be kept under continuing review with a view toward modifying their form and content if they are found to afford inadequate protection for manatees.

**29. Support public education and outreach programs.**

Compliance with regulatory and planning measures and broad public support for manatee recovery depends on an informed public that understands manatee conservation issues and the rationale for initiated actions. Public education and outreach programs carried out both by government and non-governmental agencies and organizations are achieving a level of awareness and support that has made the public a true participant and partner in recovery work. Such efforts must be continued and updated as the manatee recovery program evolves. Areas on which public education and outreach efforts should focus include the following.

**291. Develop curricula and materials for schools.**

Most manatee protection and conservation measures need to remain in place indefinitely. To provide a sound base of understanding and support for conservation measures by future generations of Floridians and Georgians, materials and curricula on manatees and manatee conservation should be updated periodically and made

available for use at various academic levels from elementary to high school.

**292. Develop and update materials for target user groups.**

Information important to achieve manatee conservation objectives differs for different user groups (e.g., boaters, divers, fishermen, commercial ship operators, shoreline owners, etc.) and different areas (e.g., people using a particular protected area, residents of coastal areas in Florida, people living outside of Florida). By the same token, appropriate media (e.g., films, posters, brochures, public service announcements, personal presentations, etc.) also differ according to user groups and areas. Agencies and organizations carrying out public education and outreach programs should cooperate in assuring that pertinent information in appropriate formats is made available to relevant sectors of the public.

**293. Maintain avenues to encourage and direct voluntary contributions in support of needed recovery work.**

A significant amount of the funding to support the State of Florida's manatee recovery work is obtained from voluntary contributions in the form of a special state license plate and an optional contribution on boat registration applications as authorized by the Florida Legislature. Some equipment and funding also are provided from donations to the Save the Manatee Club and other environmental organizations. These voluntary contributions form a significant part of the funding base for the recovery program and permit much work

to be done that would not otherwise be possible. Innovative approaches to obtain and direct voluntary support to needed program work should be tested and, where successful, maintained.

3. **Determine and monitor the status of manatee populations and essential manatee habitat.**

The success of efforts to develop and implement measures to minimize manatee injury and mortality and to protect manatee habitat will depend on the accuracy and completeness of data on manatee life history and ecology, population status, and habitat condition. Good data in these areas are needed to identify and define problems, make informed judgements on appropriate management alternatives, establish an information base to justify selected actions, and provide a basis for determining whether or not the actions taken are achieving their desired end. The tasks to develop basic supporting information for recovery work are described in this section.

31. **Maintain a manatee telemetry program.**

Telemetry programs are currently the only reliable means by which to generate detailed information on manatee movement and habitat use patterns. Manatees are netted, belted, and tagged with transmitters for remote and visual monitoring. These monitoring programs provide information used to identify key use areas and travel corridors, and to tabulate reproductive histories, monitor use of power plant effluents, and trace the progress of re-introduced captive manatees. This information is used to develop specific recommendations for manatee protection and to support habitat management initiatives.

**311. Maintain adequate telemetry capabilities (in addition to animals tagged in Task 1653).**

Telemetry studies require personnel, tags, tag attachments, receivers, boats, vehicles, airplanes and other equipment to capture and tag animals and to retrieve or replace transmitting units. They also require computer hardware and software and personnel to process the data and funding for the cost of satellite data retrieval. Presently the Sirenia Project and the Florida Marine Research Institute can track up to 20 and 15 animals, respectively. This level of capability should be maintained exclusive of telemetry needs for tracking released rehabilitated animals (see Task 1653), for work in Puerto Rico (see the Puerto Rican manatee recovery plan), or for cooperative studies in other countries.

**312. Routinely enter telemetry locations into the manatee Geographic Information System (GIS) database.**

Accurate information on manatee habitat use patterns provide a sound scientific basis for identifying and supporting management decisions on waterway speed and access rules, permits for facility construction in manatee habitat, *etc.* To assure access to new data by managers, telemetry data should be processed by researchers for entry into the Florida Marine Research Institute's GIS (see section 36). A standardized methodology to interpret and display telemetry data should be developed with the results distributed to the appropriate management agencies and cooperating groups annually through the manatee GIS Coordinating Team (see Task 362).

**313. Prepare and distribute monthly updates, annual progress reports, and final summaries of telemetry results.**

To keep managers and researchers involved in the recovery program abreast of progress and new findings from manatee tagging and tracking studies, monthly updates on the status of tagged manatees should be compiled and distributed. Summary progress reports should be circulated annually and final research findings and conclusions should be made available as soon as possible following the completion of regional study elements.

**314. Develop regional atlases of telemetry location data.**

Telemetry research has proceeded as a series of regional studies with tracking work concentrated in different areas over spans of several years. To date, studies have been conducted or are underway in the upper St. Johns River, along the east coast of Florida and southeastern Georgia, in the Crystal River area, in Lee County, in the Tampa Bay area, and along the southwest Florida coast. Upon the completion of a regional study, an atlas of telemetry results should be compiled to summarize habitat use patterns of different age and sex classes by season.

**315. Develop a long-term strategy for telemetry studies.**

Presently, telemetry studies are being done on the east coast by the Sirenia Project and along the west-central Florida coast by the Florida Marine Research Institute. The National Biological Service

expects to complete its ongoing field work in 1995 and the Institute expects to complete its study in 1996. In the future, telemetry work may be needed in areas of the State not well studied (i.e., the Everglades, Okeechobee Waterway and Lake Okeechobee) as well as in areas that have been previously studied. The latter is important to identify possible shifts in habitat use patterns over time. To ensure telemetry capabilities address recovery program data needs as effectively as possible, a set of goals with long-term strategy (over 5-10 years) for telemetry work in Florida should be developed. The goals and strategy should be kept under review by the Service, the Sirenia Project, and the Institute and updated as needed. A working group composed of the Service, the National Biological Service and Florida Marine Research Institute should be formed to develop long term strategies for telemetry studies.

**32. Continue and improve aerial surveys.**

Aerial survey sighting data have provided and continue to provide useful data on manatee distribution and, in some situations, relative abundance. When combined with telemetry data, certain types of aerial sightings provide a sound basis for determining habitat use patterns. Aerial sightings also provide useful information on the proportion of calves. Because of uncertainty in the number of animals not seen in turbid water, uncertainty as to the proportion of the population within a survey area, and other problems, however, aerial sighting data generally do not permit scientists to estimate or detect trends in population size. Work needed to continue aerial surveys and improve resulting data is described in this section.

**321. Continue flying synoptic state-wide aerial surveys.**

In 1991, the Florida Marine Research Institute began flying coordinated state-wide aerial surveys of all known winter manatee habitat. The surveys are flown following cold fronts when manatees aggregate at warm-water refuges in greatest numbers. They involve large numbers of observers flying simultaneously over different segments of known winter manatee habitat. Although above noted problems limit the use of this sighting data to measure population size or trends, the surveys have provided high counts that improve the lower bound of the range of the estimated number of animals. If correction factors for uncertainties noted above can be developed, the resulting data also may be used in the future to determine population trends. As appropriate, such surveys should be continued.

**322. Undertake regional or local aerial surveys.**

In some areas, aerial surveys are needed to improve information on local habitat use patterns. Such has been an important basis for developing and analyzing new speed zones and other management measures. In addition, in Crystal River where clear water minimizes uncertainty in the completeness of aerial survey counts, regular winter surveys provide a means of monitoring trends in the relative abundance of manatees using the Kings Bay warm-water refuge. With improvements in aerial survey methodology (see Task 324), it may be possible to use aerial survey data to detect regional population trends even when water clarity is poor. As appropriate and possible, local aerial surveys should be undertaken or continued

in Tampa Bay, Crystal River, the Indian and Banana Rivers, Sarasota Bay, and other areas to improve information on local habitat use patterns and trends in relative abundance.

**323. Continue aerial surveys of aggregation sites after cold fronts.**

Florida Power & Light Company has supported aerial surveys of manatees at warm-water power plant outfalls each winter since 1977. In addition to data on the numbers of animals sighted at these warm-water refuges, this long-term data set includes calf counts that provide valuable information on reproduction. If correction factors can be developed to account for sighting uncertainties, the data may be useful in the future for assessing past population trends. This aerial survey program should be continued.

**324. Support a dedicated aerial survey specialist and convene an Aerial Survey Working Group.**

During a 1992 workshop on manatee population biology (O'Shea *et al.* 1992), participants reviewed aerial survey methodology and identified steps that might be taken to improve information generated by aerial surveys. For example, by stratifying survey effort by habitat type, refining information on diving behavior in different habitats, defining acceptable sighting conditions, and testing strip transect methodology, participants concluded that it should be possible to strengthen data interpretation capabilities and detect regional (though perhaps not state-wide) trends in abundance. To monitor progress on aerial survey research, to improve survey



methodology and, if possible, to develop correction factors for sighting uncertainties, a dedicated aerial survey specialist should be supported to help develop and test methodological improvements and sighting correction factors. In addition, an Aerial Survey Working Group chaired by the specialist should be convened at least annually to provide further advice and assistance. As possible, the results should be tested and used in surveys undertaken in Tasks 321, 322, and 323.

**325. Analyze available aerial survey data.**

Based on the results of Task 324, it may be useful to re-evaluate results of past aerial surveys to improve estimates of selected parameters and population trends. To identify areas that need to be resurveyed, aerial survey data sets should be evaluated regionally to determine whether they are sufficiently complete and up-to-date. In addition, new methodologies and analytic techniques might be applied to ongoing aerial surveys (e.g., from Tasks 321, 322, and 323). As possible, such analyses should be undertaken.

**33. Better define aspects of physiology, life history, and ecology.**

Studies of physiology, life history, and ecology are needed to develop estimates of vital population parameters critical for understanding population status and trends, and to help assess what habitats are most important to manatees and why. Important research in this regard is discussed below.

**331. Maintain and analyze manatee "scar catalog" data.**

Many, if not most, manatees have scars from boat strikes or other sources. When carefully photographed, they provide a means of identifying individual animals. Photographs of distinctively marked animals collected by researchers in the field are compiled in a manatee scar catalog begun in 1981 by the Sirenia Project with support from the Florida Power & Light Company. The catalog has been expanded and improved and is now a photo, compact-disc based computerized system, the Manatee Individual Photo-identification System. The Florida Marine Research Institute now assists in maintaining portions of the catalog. The data provide valuable information on movements, site-fidelity, age at first reproduction, calving intervals, and other vital parameters. Recent analyses indicate resighting data can be used to derive survival rates. This database should continue to be maintained and analyzed. Needed tasks in this regard are discussed in this section.

**3311. Continue to collect photographs of individually identifiable manatees in the field.**

Photographs of individually identifiable manatees should be routinely collected from the field. In particular, photographs should be obtained at winter aggregation sites. The routine collection of photographs from the field and their incorporation into the catalog will ensure that information on movement patterns, site-fidelity, reproductive histories, survival rates, and related databases remain current.

It is essential to maintain adequate staff to photograph manatees at the major aggregation sites throughout Florida. Staff must be trained in the appropriate use of standardized codes describing various traits noted during photography. Vital life history and feature information is collected concurrently with the photographs. Loss of these details over more than one season could result in an inability to photographically "track" individuals and may compromise the value of the system.

**3312. Maintain staff support to collect, enter, check, retrieve, and analyze scar catalog data.**

Some 6,000 new photographs are submitted annually by field researchers for inclusion in the catalog. Comparison of photographs with previously identified animals, proper entry of new data, and retrieval of data for analyses require a dedicated staff member who is proficient and familiar with both the classification system and the identified individuals. Continued support, including a dedicated scar catalog archivist, to maintain and upgrade the scar catalog for both the east and west coasts should be provided. Standardized protocols for describing and coding data collected by photographers have been distributed for use by all cooperators submitting photographs to the catalog. Distribution of photographs taken by FDEP/FMRI of carcasses must continue so that dead manatees can be removed from the active catalog files.

**3313. Upgrade and maintain computer/camera equipment for the scar catalog.**

The scar catalog is presently maintained as a computer-based system that uses a CD-ROM player and a color monitor. The catalog now includes over 1,000 animals and nearly 15,000 sighting and resighting records (Beck and Reid 1995).

Computer and camera equipment to store, sort, and retrieve photographs and sighting data must be purchased, maintained, and upgraded to facilitate and enhance use of the catalog's data.

Photographs of carcasses taken by the Florida Marine Research Institute should be shared with the Sirenia Project so that dead animals can be removed from the active scar catalog. It will also provide information on minimum ages of manatees in the system, permitting analysis of age-specific reproduction and survival (as noted in Task 332). Finally, carcass recovery data can be combined with resighting data in some recently developed survival models to further enhance the accuracy and precision of survival estimates.

**3314. Analyze scar catalog data to determine annual survival rates and other population parameters.**

One of the most important parameters for estimating trends in population status is age-specific survival. Scar catalog data on animals at Crystal River, at Blue Spring, and along

Florida's east coast are now sufficiently extensive to estimate survival rates in those areas (O'Shea and Langtimm 1995).

Analyses of survival rates, as well as calving intervals, age of first reproduction, and other parameters should be undertaken and/or refined as new records are entered.

**332. Continue and expand long-term studies of individual animals.**

Long-term studies of the reproductive traits, behavior, and life history of individual females provide data on age-specific birth rates and success in calf rearing. Such data, in turn, are important for assessing potential population growth rates. Although long-term records on individual females are best from Crystal River and Blue Spring, useful data also have been collected at some other locations. Relevant data are included in the scar catalog (see Task 3311), in long-term telemetry results for individual females (see Task 31) through routine monitoring programs at major warm-water refuges (see Task 222), by long-term telemetry studies on selected manatees (see section 31), and through reports from various researchers. Efforts to gather and analyze data on the reproductive history and behavior of known females should be continued and expanded to other study areas. Research should address the behavioral/environmental causes of perinatal mortality by focusing on cow-calf behavior and their interaction with conspecifics, especially during the perinatal period.

**333. Analyze data on calf production.**

The total number of calves produced is uncertain and may vary regionally. Calf counts from research at Crystal River and Blue Spring and from aerial surveys (i.e., from Tasks 222, and 321-323) and data on the reproductive status of females recovered in the salvage necropsy program (see Task 1121) should be analyzed to estimate and identify possible regional differences in reproductive rates.

**334. Continue aerial photogrammetry analyses.**

Aerial photographic techniques to estimate the size, and hence age class, of individual animals are being investigated as a way to determine the age-structure of manatee populations. If the results suggest that further work is needed, studies should be designed, and equipment and support should be provided to collect and analyze aerial photogrammetric data.

**335. Continue opportunistic deployment of Passive Integrated Transponder (PIT) tags.**

PIT tags are small tags inserted under the skin of animals to identify them if they are recaptured or recovered in the salvage and necropsy program. By comparing data on an animal's size, reproductive status, and general condition between time of tagging and recovery one can increase the amount of information obtained on life history parameters from rehandled animals. PIT tags are applied

opportunistically by the Florida Marine Research Institute, the Sirenia Project, or an authorized veterinarian whenever animals are caught for radio tagging or rehabilitation or released from captivity. PIT tags should continue to be applied as opportunities arise and PIT tag readers should be purchased and made available to individuals and groups likely to handle live or dead manatees.

**336. Conduct additional physiological studies of thermal tolerances.**

Although it is known that manatees are sensitive to cold stress, precise information on thermal tolerances and the effects of cold on physiological processes of different manatee age/sex classes is not known. Such information may be useful for assessing the percentage of the manatee population likely to aggregate at warm-water refuges at different ambient water temperatures, when different age/sex groups are likely to arrive at and depart from refuges, when emergency situations are likely to arise from unexpected changes in thermal discharges, *etc.* (see Task 251). Studies to assess thermal tolerances and physiological effects of cold stress should be designed and undertaken as possible.

**337. Conduct additional studies to assess hearing capabilities.**

Manatees, particularly mothers and calves, communicate vocally. Noise from boats or other sources may interfere with such communications or provide a source of stress. Hearing capabilities, however, have been poorly known. Preliminary studies of hearing capabilities indicate that manatees may have a wider range of hearing

than previous studies suggested (Gerstein 1994). There is a need for further research on hearing capabilities and the effects of noise on manatees.

**338. Complete and conduct additional studies of manatee food habits.**

Nutritional characteristics of manatee food plants and the importance of different food sources for different manatee age and sex classes in various regions are poorly understood. Such information is needed to help assure that adequate food resources are protected in different portions of the population's range (see Tasks 26 and 27). Ongoing studies should be completed to identify manatee food habits and feeding patterns, the nutritional value of different aquatic plants important to manatees, and, based on that information, the regional food resources most in need of protection and management.

**339. Continue genetic analyses from manatee tissue samples.**

New molecular techniques to examine genetic material provide an opportunity to improve information on the genetic sub-structure of manatee populations, male mating success and paternal contributions, frequencies with which social groups include kin of various degrees of relatedness, tendencies towards regional homozygosity and possible effects due to localized matrilineages, stock and individual identity for forensic purposes, *etc.* Such information could improve understanding of the structure and social interactions of populations and thereby influence management objectives for different groups of manatees. Research to examine a number of these points has already



been initiated. In addition, a number of researchers are interested in conducting other analyses. For some questions, however, the genetic data alone will not yield insights into manatee biology without a simultaneous field effort to collect the appropriate behavioral data. For example, to determine the role of kinship in social interactions it will be necessary to collect data on association patterns and interactions among known individuals (i.e., on individuals that are in the scar catalog and for which we have tissue samples for genetic analysis). Likewise, assessment of paternity for a large number of males will provide data on variance in male reproductive success but will not shed light on factors affecting male success. Associated data on male physical characteristics (e.g., size, body condition, age) and behavioral traits (e.g., movement patterns, "dominance" in a mating herd), and extended observations of mating herds will be important for understanding reproductive activity among males. As appropriate, steps should be taken under Task 164 to facilitate and coordinate research related to manatee genetics.

**3310. Conduct additional studies to identify requirements for fresh water.**

In estuarine and marine areas manatees are attracted to and drink from fresh water sources. While this attraction is well known, the physiological need for fresh water is not clear. To clarify the importance of fresh water as a basic habitat requirement, studies have been initiated to examine processes by which manatees regulate internal salt levels and the physiological role of drinking fresh water.

The results of these studies should be reviewed and, if warranted, further research should be undertaken.

**34. Continue studies to develop methodology, data and models to assess population size and trends by convening a population status working group.**

Information on trends in the size of Florida manatee populations is essential for assessing the effectiveness of manatee recovery actions. It also is needed to develop objective, measurable criteria required by the Endangered Species Act for determining when manatee populations may be reclassified as threatened or removed from the endangered species list. Given the present difficulty in measuring population size and trends directly, assessments of these parameters in the foreseeable future will benefit from information derived from population models that use estimates of mortality, reproduction, survivorship, age/sex structure, *etc.* that stem from various other research tasks enumerated in the recovery plan. Steps to develop, evaluate, and improve such models should be undertaken. Where estimates of model parameters need to be developed or improved, other relevant tasks should be modified or strengthened.

As more information on manatee life history parameters is obtained, population models will tend to become highly complex. It is important for those developing manatee population models to coordinate their activities, and to interact directly with biologists who have collected manatee life history data or who are very familiar with manatee ecology. Biologists will better understand how models were derived, and the modelers will obtain feed back on the reasonableness of their assumptions and interpretation of

their results. The working group should be convened at least once every two years chaired by the staff of the National Biological Service's Sirenia Project.

**35. Develop and implement a manatee habitat monitoring program.**

In addition to efforts to monitor the status of manatee populations, work should be undertaken to monitor the condition and status of manatee habitats. Information from such a program could provide an early warning of future threats to manatee populations and help explain observed manatee population trends. Presently, there is no systematic approach to monitoring the condition of key manatee habitats. Steps needed to develop and implement a useful program are discussed in this section.

**351. Develop methodology and expertise to monitor the condition of essential manatee habitats.**

While basic manatee habitat requirements have been identified and many, if not most, of the essential areas providing those requirements are known, there is no systematic approach for monitoring the condition of those habitat features. For example, the condition of essential grassbed feeding areas and the discharge rates and water quality at natural warm-water refuges are not routinely monitored. To provide a means of detecting potential problems in the capacity of such areas to support manatee populations, methodologies and expertise to monitor the condition of essential manatee habitat features should be identified and tested.

Ongoing research on manatee-seagrass grazing interactions should be continued and completed. Investigations of manatee grazing effects and seagrass recovery, using both exclosures and enclosures, have been conducted in the Banana River in Brevard County. Results from these studies should provide information useful in design of monitoring studies, estimation of manatee carrying capacity of seagrass beds in key areas, and better understanding of the manatee's role in maintaining healthy, diverse seagrass communities.

**352. Coordinate and implement a long-term habitat monitoring program.**

Based on the results of Task 351, a long-term program should be initiated to monitor key parameters, such as the species composition and extent of aquatic plant species at vital feeding areas and the discharge rates and water quality at warm-water refuges. To the extent possible, such efforts should rely on habitat monitoring programs and research already undertaken by Federal and state agencies or academic institutions.

**36. Maintain and improve the Geographic Information System (GIS) for data on manatees and manatee habitat.**

The Florida Marine Research Institute has developed a GIS to store, synthesize, and retrieve large volumes of data on manatees and manatee habitat. This computer-based data management system can store, manipulate, analyze, and display site-specific data on manatee carcass recovery sites; manatee sighting data from aerial surveys, ground research;

telemetry studies; water depths; vegetation coverage; waterway speed and access zones; shoreline characteristics and development patterns; etc. The hardware, software, and database are used by Federal, state, and local officials for scientific analyses, permit reviews, developing waterway speed and access rules, and preparing county manatee protection plans. Tasks to maintain and improve this system are identified below.

**361. Maintain the hardware, software, and expertise to operate the GIS.**

Hardware, software, personnel, and training to access the GIS should be provided and maintained by involved agencies. GIS work stations already exist at the Florida Department of Environmental Protection's Florida Marine Research Institute and Bureau of Protected Species Management, and the Service's Jacksonville Field Office and the National Biological Service's Sirenia Project. Other work stations should be established and maintained at appropriate agency offices (e.g., the Corps of Engineers District Office and other divisions of the Florida Department of Environmental Protection). These agencies should assign trained staff to serve as GIS operators and analysts responsible for providing maps and data summaries needed by staff planners, managers, and scientists. To meet information needs of cooperating agencies and organizations which lack the hardware, software, or expertise necessary to use the database (e.g., some county planners) the Department and/or the Service should provide sufficient staff support to respond to requests for needed information.

**362. Convene regular meetings of the GIS Coordinating Team.**

To improve the usefulness of the GIS, there is a need to establish standards and procedures for entering and accessing the database, reviewing new technology and software, and generally developing and updating an operational plan for the database and field network of work stations. A Manatee GIS Coordinating Team has been developed by the Florida Marine Research Institute to address these needs and help facilitate the involvement of agencies and organizations wishing to use or contribute to the GIS database. The team is composed of experts familiar with the basic data sets, GIS technology, and the ethics of data use and ownership. Funding to convene this group on a regular basis should be provided.

**363. Convene regular meetings of the GIS Working Group.**

Optimum use of the GIS database requires that the staff of agencies, offices, laboratories, and organizations responsible for key research and management tasks have access to GIS databases pertinent to their analytic needs. To promote interactions between system users and system curators, a GIS Working Group composed of representatives from governmental agencies and interest groups wanting to use Manatee GIS data should be convened on a regular basis by the GIS Coordinating Team. The Working Group should meet with members of the Coordinating Team to: review data processing needs, access procedures, and available data; encourage and organize cooperative efforts to acquire ancillary data sets that would contribute to the Manatee GIS; and provide opportunities to instruct users in the use

of available data and new technologies. Working Group members should be responsible for overseeing their agency's participation in Manatee GIS-related work and serve as the operational link between the GIS Coordinating Team responsible for maintaining the system (see Task 362) and the end users. Funding to convene this group should be provided as needed.

**4. Coordinate recovery activities, monitor and evaluate progress, and update/revise the Recovery Plan.**

The actions necessary to support and implement this recovery plan are beyond the abilities or scope of any one agency. They require the participation and cooperation of many Federal, State, and local agencies, as well as public, private, and industry organizations. To ensure that the work of involved agencies and groups is carried out in a timely, cost-effective manner that addresses priority recovery needs, the following administrative and coordination tasks should be carried out to provide proper oversight and leadership.

**41. Maintain Federal and State Manatee Coordinator staff positions.**

Given the central role of the Service and the Florida Department of Environmental Protection, each agency needs to designate a full-time manatee coordinator and provide basic support staff. The level of support must be adequate to carry out administrative functions for which each is responsible and to work directly with involved agency and organization officials on a day-to-day basis to assist and coordinate their activities.

The primary responsibility of the Service's manatee coordinator and support staff is to provide Federal oversight, guidance, and support for the overall

manatee recovery effort as outlined on the recovery plan. Additional responsibilities include: preparing rules for Federal Manatee Sanctuaries; reviewing and providing guidance on development permits and Section 7 consultations (see Task 129); assisting and monitoring recovery-related work by participating agencies and organizations (e.g., Tasks 125, 131, 132, 26, and 27); developing a die-off response plan (see Task 166); overseeing efforts to rescue, rehabilitate, and release distressed manatees (see Task 16); assisting and coordinating manatee land acquisitions (see Task 21); helping develop state waterway speed and access regulations and county manatee protection plans (see Tasks 22 and 24); assisting in the development of manatee-related provisions, programs and facilities at National Wildlife Refuges (see Task 22); updating the manatee recovery plan and preparing annual status reports (see Tasks 42 and 43); and chairing and convening meetings of the manatee recovery team (see Task 44).

Primary tasks for the state manatee coordinator and support staff include the following: developing state waterway speed and access rules and overseeing efforts to post and enforce established zones (see Tasks 121, 123, and 124); reviewing environmental resource permits and state submerged land leases (see Task 129); providing advice and assistance to responsible agencies on resolving mortality caused by flood gates and fishing gear (see Tasks 13 and 14); assisting and coordinating manatee-related land acquisition (see Task 21); assisting in the development of manatee-related provisions, programs, and facilities at State Parks, Reserves, and Aquatic Preserves, *etc.* (see Task 22); assisting counties in developing county manatee protection plans (see Task 24); serving as staff for the Manatee Technical Advisory Committee (see Task 44); and carrying out relevant public education and awareness work.



**42. Convene periodic meetings of the Florida Manatee Recovery Team and Manatee Technical Advisory Council.**

The Service has constituted and periodically convenes meetings of a Manatee Recovery Team composed of the principal involved agencies and groups. Chaired by the Service's manatee coordinator, the team: reviews progress on the recovery program tasks; develops advice on program priorities and needs; and helps coordinate work and support on recovery tasks among involved agencies and groups. In addition, the Florida Department of Environmental Protection has established a Manatee Technical Advisory Council. The Council provides advice to the Secretary of the Department on progress and priority needs with respect to Departmental involvement in the manatee recovery program. Both groups complement each other. They meet at times when advice and assistance is most timely and have become an important means of reviewing, guiding, and coordinating ongoing activities. The Service's Manatee Coordinator provides staff support for the Recovery Team and the Department's Manatee Coordinator serves as staff for the Advisory Council. Support to convene periodic meetings of both groups should be provided.

**43. Develop an annual progress report.**

As a means of documenting and monitoring progress on recovery tasks, the Service, with the assistance of involved agencies and groups, prepares annual progress reports reviewing activities on all identified tasks. The annual reports provide a means of tracking ongoing work, identifying areas

in need of further attention, and projecting priorities for the coming year. The preparation of annual status reports should continue.

**44. Update the Florida Manatee Recovery Plan.**

The Florida Manatee Recovery Plan identifies and interrelates fundamental recovery tasks. It also identifies task priorities, agency involvement, and funding needs for a five-year period. Agency involvement and funding projections are included as guides rather than commitments and are provided solely for planning purposes. In this regard, it is used by the Service and other agencies as a principal reference to develop annual budget requests for manatee related-work. Given progress on listed tasks, new information on manatees, environmental changes, changes in agency administration, and other factors that are difficult or impossible to predict accurately more than a few years in advance, the plan is limited to a five-year period and should be updated at least once every five years. Responsibility for doing so rests with the Service, with assistance from the Florida Manatee Recovery Team.

**45. Convene a panel or workshop to evaluate the effectiveness of the Manatee Recovery Program.**

This revised recovery plan, assumes that more extensive boat speed regulations will minimize the major source of human related mortality, and that local manatee protection plans, land acquisition, and development permit reviews will achieve adequate manatee habitat protection. While these assumptions seem reasonable and appropriate, it remains to be demonstrated that they will in fact be successful. A workshop or panel should be convened prior to the next revision of the recovery plan to

identify and evaluate such fundamental things in the Florida Manatee Recovery Program should present strategies and assumptions prove ineffective. To obtain a fresh, independent assessment of options, the panel or workshop should be heavily weighted toward expert scientists and wildlife managers not directly involved in the manatee recovery program.

**46. Share experience and expertise developed through the Manatee Recovery Program.**

The Florida Manatee Recovery Program is a model for potential or evolving manatee recovery programs in other countries. The experience and expertise that has been gained in Florida should be applied to other southern states and U.S. territories with sirenian populations to encourage conservation efforts. Tasks to help meet this obligation are noted below.

**461. Develop cooperative agreements with other states and countries.**

Manatees also occur in Georgia, occasionally in other southeastern states, and Puerto Rico. Research and management techniques developed to protect manatees in Florida could be applied to protect manatees in those areas as well. Therefore, steps should be taken to establish working relationships with appropriate officials in other states or territories to transfer expertise and experience.

Similarly, other countries developing manatee conservation programs should be encouraged to enter into agreements with the Service and the National Biological Service's Sirenia Project to facilitate the transfer of information, experience, and expertise related to manatee

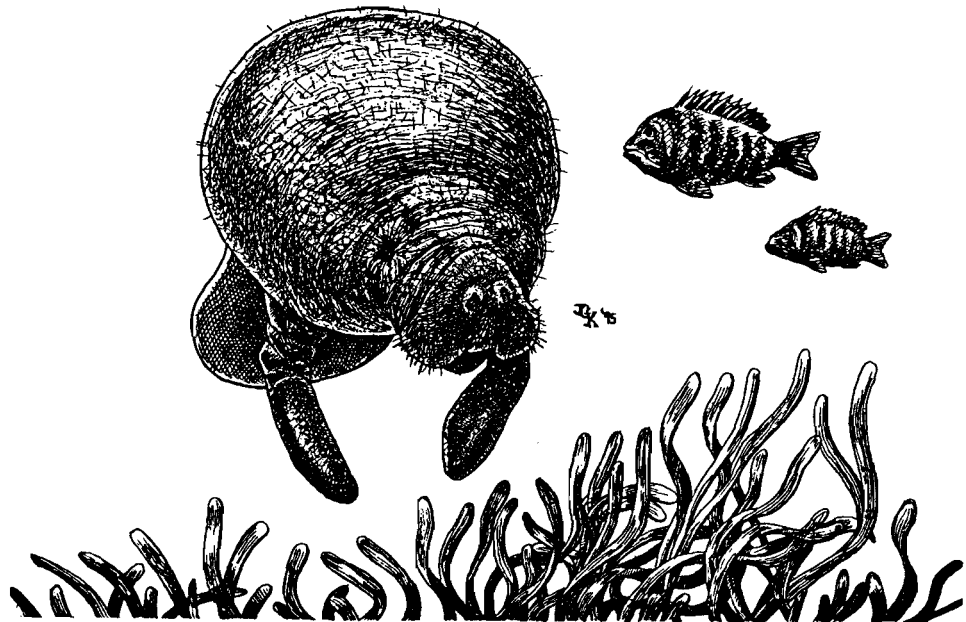
research and management. Such agreements might involve the exchange of personnel for training purposes or cooperation in carrying out specific projects. Where opportunities arise to establish such agreements, they should be pursued and supported.

**462. Participate in and assist manatee-related work under the Caribbean Environment Program.**

Under a regional SEAS program sponsored by the United Nations Environment Program, nations in the wider Caribbean region, including the United States, cooperate in the Caribbean Environment Program. The program is designed to coordinate work on regional environmental and development issues. The program is guided by provisions set forth in an action plan and the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean (i.e., the Cartagena Convention). In 1991, parties to the Convention signed a Protocol on Specially Protected Areas and Wildlife. To address provisions of the protocol for manatees, there is interest in encouraging and supporting development of national or regional recovery plans for manatees. Plans are being made for holding a regional manatee workshop to identify actions needed to develop and implement these plans. As appropriate, participants in the Florida manatee recovery program should assist and participate in efforts to develop recovery programs envisioned under this protocol and the Caribbean Environment Program.

**463. Participate in national and international manatee conservation and research activities.**

Results from the manatee recovery program are of interest not only to scientists and managers involved in manatee conservation, but also to scientists and resource managers working on general aspects of wildlife biology and conservation. Conversely, the experience of other wildlife scientists and managers may provide insights that may help resolve problems confronting the manatee recovery program. Therefore, as possible, agencies should encourage and support the participation of individuals involved in aspects of the recovery program to present papers or otherwise participate in national and international activities involved in wildlife research and management, including conferences, training, and technical assistance.



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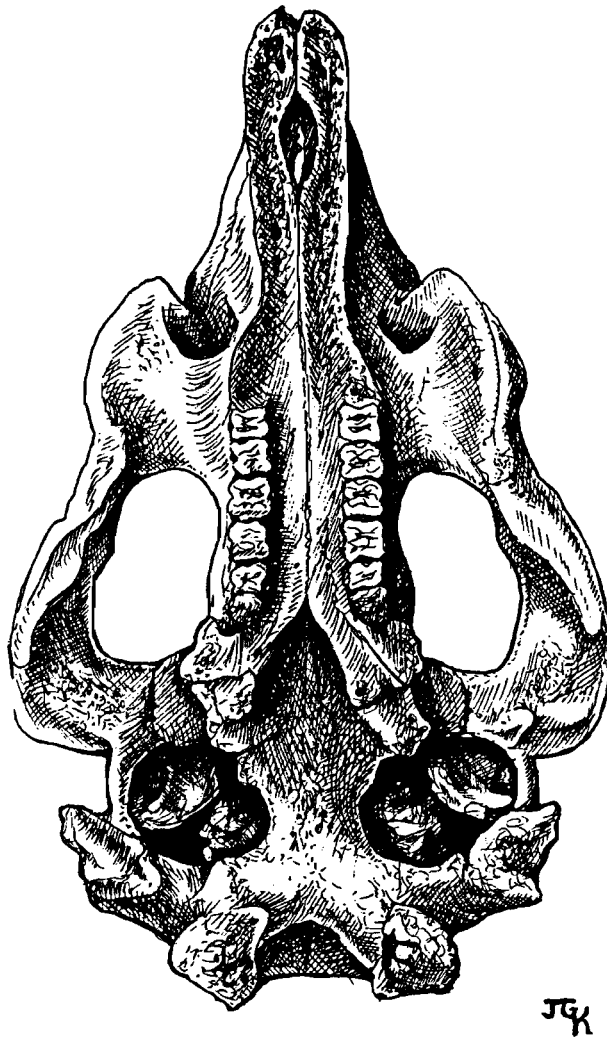
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### III. IMPLEMENTATION SCHEDULE





## IMPLEMENTATION SCHEDULE RECOVERY PRIORITIES

Priorities in the Implementation Schedule are assigned as follows:

- Priority 1 -** An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
- Priority 2 -** An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant impact short of extinction.
- Priority 3 -** All other actions necessary to provide for full recovery of the species.

**NOTE:** Each task in the Implementation Schedule is assigned a priority number. While the number reflects the importance of the activity, it **does not** relate to the order in which tasks will be accomplished.

GENERAL CATEGORIES FOR IMPLEMENTATION SCHEDULES\*

- |  |   |
|--|---|
| <p>Information<br/>Gathering (I)<br/>or Research (R)</p> | <ol style="list-style-type: none"> <li>1. Population status</li> <li>2. Habitat status</li> <li>3. Habitat requirements</li> <li>4. Management techniques</li> <li>5. Taxonomic studies</li> <li>6. Demographic studies</li> <li>7. Propagation</li> <li>8. Migration</li> <li>9. Predation</li> <li>10. Competition</li> <li>11. Disease</li> <li>12. Environmental contaminants</li> <li>13. Reintroduction</li> <li>14. Other information</li> </ol> |
| <p>Management (M)</p>                                    | <ol style="list-style-type: none"> <li>1. Propagation</li> <li>2. Reintroduction</li> <li>3. Habitat maintenance and manipulation</li> <li>4. Predator and competition control</li> <li>5. Depredation control</li> <li>6. Disease control</li> <li>7. Other management</li> </ol>  |
| <p>Acquisition (A)</p>                                   | <ol style="list-style-type: none"> <li>1. Lease</li> <li>2. Easement</li> <li>3. Management agreement</li> <li>4. Exchange</li> <li>5. Withdrawal</li> <li>6. Fee title</li> <li>7. Other</li> </ol>  |
| <p>Other (O)</p>   | <ol style="list-style-type: none"> <li>1. Information and education</li> <li>2. Law enforcement</li> <li>3. Regulations</li> <li>4. Administration</li> </ol>   |

\* Column 1 of Implementation Schedule. Primarily for the use of the U.S. Fish and Wildlife Service.

**LIST OF ABBREVIATIONS**

**1. Plan task**

GIS	Geographic Information System
NWR	National Wildlife Refuge
PIT	Passive Integrated Transponders

**2. Agency/Division**

COE	U.S. Army Corps of Engineers
DCA	Department of Community Affairs
FWS	U.S. Fish and Wildlife Service
FDEP	Florida Department of Environmental Protection
FDEP/FMRI	Florida Department of Environmental Protection's Florida Marine Research Institute
FDEP/BPSM	Florida Department of Environmental Protection's Bureau of Protected Species Management
FIND	Florida Inland Navigation District
FMP	Florida Marine Patrol
FPL	Florida Power and Light Company
GFC	Florida Game and Fresh Water Fish Commission
GDNR	Georgia Department of Natural Resources
LE	Law Enforcement
MIA	Marine Industries Association
MMC	Marine Mammal Commission
NASA	National Aeronautics and Space Administration
NBS	U.S. National Biological Service
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
STMC	Save the Manatee Club
USCG	U.S. Coast Guard
USN	U.S. Navy
WMD'S	Water Management Districts

**3. Comments/Notes**

CARL	Conservation and Recreation Lands
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**IMPLEMENTATION SCHEDULE**

**Florida Manatee Recovery Plan**

**U.S. Fish and Wildlife Service**

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency/ Division	Estimated Fiscal Year Costs \$000					Comments/ Notes
						Current	FY 2	FY 3	FY 4	FY 5	
R-1,R-11, R-14,M-7, O-1,O-2	Identify & minimize causes of manatee injury & mortality.	1	1	Continuing	*FDEP/FMRI/ BPSM,FIND,MMC, FWS,GFC,FMP, COE,USCG,NOAA, Oceanaria,GDNR,NBS MIA,USN,Local Govt's						
R-1,R-11,M-7	Maintain & improve salvage/necropsy program.	11	1	Continuing	*FDEP/FMRI GDNR						
R-1,R-11,M-7	Ensure prompt reporting of manatee carcasses.	111	2	Continuing	*FDEP/FMRI/FMP GFC GDNR						
M-7,O-1,O-2	Train law enforcement officials.	1111	2	Continuing	*FDEP/FMP GDNR GFC						Routine "
M-7,O-1	Encourage public reporting of carcasses.	1112	2	Continuing	*FDEP FWS						Routine "
R-1,R-11,M-7	Maintain salvage/necropsy field stations & staff.	112	2	Continuing	*FDEP/FMRI GDNR NBS FWS						
R-1,R-14,M-7	Provide support for salvage/necropsy program staff & equipment.	1121	2	Continuing	*FDEP/FMRI GDNR	500	510	525	535	550	Routine
R-1,M-7	Develop & coordinate out of state salvage efforts.	1122	3	Continuing	*FWS NBS	14					Routine "
R-1,R-7,R-11	Undertake studies of mortality causes & trends.	113	1	Continuing	*FDEP FWS NBS GDNR						
R-1,R-14	Assess manatee carcass reporting rates.	1131	2	3 Years	*FDEP	10	10	10			

### IMPLEMENTATION SCHEDULE

U.S. Fish and Wildlife Service

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency/ Division	Estimated Fiscal Year Costs \$000					Comments/ Notes
						Current	FY 2	FY 3	FY 4	FY 5	
R-1,R-6,R-11, R-12	Undertake workshop/studies to identify causes of perinatal mortality.	1132	1	5 Year	*FDEP/FMRI NBS FWS	37 25	27 25	29 25	29 25	45 25	Routine
R-11,R-12	Undertake routine & periodic tissue analyses.	1133	2	Continuing	*FDEP/FMRI NBS	35 3	35 3	40 3.5	40 3.5	45 4	
R-4,R-11, M-6,M-7	Investigate & respond to unusual mortality events.	1134	1	As Warranted	*FWS GDNR NBS FDEP/FMRI	15					Contingency funding if needed
M-7,O-3	Minimize collisions between manatees & watercraft.	12	1	Continuing	FDEP/BPSM/FMP GDNR,USCG MIA,USN FWS GFC COE						
M-3,M-7, O-2,O-3	Develop state waterway speed & access rules.	121	1	Continuing	*FDEP/BPSM/FMP GFC FWS	319	250	100	100	100	No Estimate Routine
M-7,O-2,O-3	Develop Federal waterway speed & access rules.	122	1	As Warranted	*FWS COE USN USCG						Routine No Estimate No Estimate No Estimate
M-7,O-2,O-3	Post & maintain regulatory signs.	123	1	Continuing	*FDEP/FIND FWS COE Local Gov'ts	229 7	200 7	150 7	7150 7	150 7	Routine No Estimate No Estimate
O-2,O-3	Enforce & encourage manatee protection regulations.	124	1	Continuing	FDEP/BPSM/FMP FWS,GFC,GDNR MIA,MMC,NOAA, USN,USCG Local Gov'ts						
O-2,O-3	Increase officer time for manatee protection rule enforcement.	1241	1	Continuing	GFC FDEP/BPSM/FMP FWS	50	50	50	50	50	No Estimate No Estimate

**IMPLEMENTATION SCHEDULE**

**Florida Manatee Recovery Plan**

**U.S. Fish and Wildlife Service**

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency/ Division	Estimated Fiscal Year Costs \$000					Comments/ Notes
						Current	FY 2	FY 3	FY 4	FY 5	
O-2	Develop & implement plan for interagency law enforcement.	1242	1	1 Year	*FWS FDEP/BPSM/FMP Local Govt's GFC	5					No Estimate No Estimate No Estimate
O-2,O-3,O-4	Conduct rule compliance surveys.	1243	1	Periodic	*FDEP/BPSM FWS	40 5	20 5			20 5	
O-3	Encourage & cooperate to develop state-wide boating safety measures.	1244	2	Continuing	FWS FDEP/FMP GFC MIA						Routine Routine Routine Routine
M-7,O-2,O-3	Establish policies for authorizing boat races & other water sport events.	125	3	Continuing	*FWS FDEP/BPSM MIA USCG						Routine Routine Routine Routine
M-7	Indicate speed & access zones on nautical charts.	126	3	Continuing	*FWS NOAA FDEP MIA						Routine No estimate Routine Routine
M-7,O-1	Assess & reduce large vessel related mortality.	127	1	2 Years	*FWS USCG USN MMC MIA	75	75				No Estimate No Estimate No Estimate No Estimate
M-7	Evaluate propeller guards for small watercraft.	128	2	Continuing	FWS FDEP/BPSM						Routine Routine
M-3,M-7,O-3	Continue Section 7 & state reviews of boating facilities & water sports events.	129	1	Continuing	FWS FDEP USCG GDNR	100 112	100 115	100 120	100 125	100 125	No Estimate No Estimate
M-7,O-2,O-3	Minimize mortalities at water control structures.	13	1	Continuing	*FDEP/BPSM FWS COE WMD/S						No Estimate No Estimate



**IMPLEMENTATION SCHEDULE**

**Florida Manatee Recovery Plan**

**U.S. Fish and Wildlife Service**

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency/ Division	Estimated Fiscal Year Costs \$000					Comments/ Notes
						Current	FY 2	FY 3	FY 4	FY 5	
M-7	Develop, test, & implement alternative measures.	131	1	2 Years	*WMD'S COE	210	279				No Estimate 1135 Study
M-7,O-2	Promptly investigate structure related deaths.	132	2	Continuing	*FDEP/BPSM FWS						Routine Routine
M-7	Assess & minimize fishery-related mortalities & injuries.	14	2	Continuing	*FDEP/BPSM/FMP FWS GFC GDNR						
M-7	Minimize drownings in shrimp nets.	141	3		*FDEP/BPSM FWS GDNR	0.5	0.5		0.5		- Routine Routine
M-7,O-3	Minimize injury & death in crab pot lines, nets and other fishing gear.	142	3	Continuing	*FDEP/BPSM FWS						Routine Routine
M-7,O-3	Identify waterways with fishing gear conflicts.	143	3	Continuing	FWS FDEP						Routine Routine
O-2	Investigate & prosecute poaching incidents.	15	2	Continuing	*FDEP/FMP FWS/LE GFC						Routine Routine Routine
M-2,M-7,R-13	Rescue, rehabilitate & release distressed manatees.	16	2	Continuing	*FWS, FDEP/FMRI,BPSM Oceanaria						
M-7,O-1,O-4	Authorize cooperators in rescue/rehab program.	161	2	As Needed	FWS						Routine
M-7	Coordinate day to day rescue operations.	162	2	Continuing	*FDEP/FMRI FWS						Routine Routine
M-6,M-7,O-1	Authorize and operate rehabilitation facilities.	163	2	As Needed	*FWS FDEP/BPSM Oceanaria	350 2,000	350 2,000	350 2,000	400 2,000		Routine Homosassa SP
M-6,M-7	Convene periodic meetings of Interagency/Oceanaria Group & Captive Planning Committee.	164	2	As Warranted	*FWS						Routine

## IMPLEMENTATION SCHEDULE

### Florida Manatee Recovery Plan

U.S. Fish and Wildlife Service

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency/ Division	Estimated Fiscal Year Costs \$000					Comments/ Notes
						Current	FY 2	FY 3	FY 4	FY 5	
M-2,M-7, R-13,	Facilitate & evaluate manatee releases.	165	2	Continuing	*FWS FDEP/BPSM/FMRI NBS Oceanaria	40	5	5	5	5	No Estimate
M-2,M-7,R-13	Construct & maintain acclimation pens as needed.	1651	2	5 Years	*FWS FDEP/BPSM Oceanaria	40	5	5	5	5	No Estimate
R-13,M-2	Develop protocols for release & evaluate readaptive success.	1652	2		FWS FDEP/FMRI NBS Oceanaria						Routine Routine Routine Routine
R-13,M-2	Radio-tag & track released manatees.	1653	2		*NBS *FDEP/FMRI FWS	65 55	67.5 57.5	70 60	72 63	75 65	Routine
M-6,M-7,R-11	Develop catastrophic plan for large scale rescues or mortalities.	166	1	Completed by 1/97	*FWS FDEP NBS Oceanaria						Routine Routine Routine Routine
M-3	Protect essential manatee habitat.	2	1	Continuing	Local Govt's,FWS, FDEP/BPSM,DCA, GDNR,FPL,STMC, UTILITIES, NMF,NBS,COE, WMDs,Local Govt's						
A-3,A-6,A-7, M-3	Establish regional protected area networks containing essential manatee habitats.	21	2		*FWS FDEP/BPSM DCA WMDs Local govts						
A-3,A-6,A-7	Acquire & incorporate essential manatee habitats to National Wildlife Refuge System.	211	1	As Warranted	*FWS FDEP/BPSM						Routine Routine
A-3,A-6,A-7	Acquire & incorporate essential manatee habitat to State Aquatic Preserve & Park System.	212	1	As Warranted	FDEP GDNR						5% of CARL No Estimate

**IMPLEMENTATION SCHEDULE**

**Florida Manatee Recovery Plan**

**U.S. Fish and Wildlife Service**

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency/ Division	Estimated Fiscal Year Costs \$000					Comments/ Notes
						Current	FY 2	FY 3	FY 4	FY 5	
M-3,A-6,A-7	Review & advise on priority habitat acquisitions.	213	1	Continuing	*FDEP FWS Local Govt's						Routine Routine Routine
M-3,A-7	Identify & propose new land acquisition projects.	214	2	Continuing	FWS FDEP/BPSM						Routine Routine
M-3,A-7	Coordinate Federal, State, & private land acquisition efforts.	215	2	Continuing	*FWS FDEP GDNR						Routine Routine Routine
M-3,M-7	Establish effective management programs for Federal & State protected areas.	22	2	Continuing	FWS FDEP						
O-1,M-7	Develop/maintain public education programs at protected areas.	221	3	Continuing	*FDEP/BPSM FWS FPL STMC Local Govt's						
O-1,M-7	Develop interpretive/visitor center for Crystal River NWR.	2211	2	3 Years	*FWS FDEP/BPSM	30	5	5			No Estimate
O-1,M-7	Develop new manatee display at Homosassa Springs State Park.	2212	3	1 Year	FDEP/BPSM	30					No Estimate
O-1,M-7	Maintain public education programs at Blue Springs State Park.	2213	3	Continuing	FDEP/BPSM	20	20	20	20	20	
O-1,M-7	Develop public education programs at other State parks & refuges.	2214	3	Continuing	FDEP/BPSM	20	20	20	20	20	
M-7	Incorporate manatee protection measures into management of protected areas & State-owned submerged lands.	222	2	Continuing	*FDEP/BPSM FWS						
M-7	Include manatee protection measures in management of Federal & State protected areas.	2221	2	Continuing	FWS FDEP						Routine Routine

### IMPLEMENTATION SCHEDULE

Florida Manatee Recovery Plan		U.S. Fish and Wildlife Service										
		General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency/ Division	Estimated Fiscal Year Costs \$000				Comments/ Notes
Current	FY 2							FY 3	FY 4	FY 5		
A-1,M-7	Develop policies to guide leasing decisions for State-owned submerged lands.	2222	2	Continuing	FDEP/BPSM							Routine
A-1,A-3, A-6,A-7	Designate/maintain Federal manatee sanctuaries & refuges.	23	1	Continuing	FWS FDEP							Routine Routine
O-3,M-7	Develop/implement county manatee protection plans.	24	1	Continuing	FDEP/BPSM FWS,GDNR,GFC, MIA,NBS, Power Industry Local Govt's							
O-3,M-7	Assist counties to develop manatee protection plans.	241	1	Continuing	FDEP/BPSM FWS NBS Local Govt's	240	250	350	350	300		Routine Routine No Estimate
O-3,M-7	Assist counties in implementing manatee protection plans.	242	2	Continuing	*FDEP/BPSM FWS GFC MIA COE							Routine Routine Routine Routine
O-3,M-7	Assess/review/modify protection plan provisions.	243	2	Continuing	*FDEP/BPSM FWS Local Govt's MIA							Routine Routine Routine Routine
M-3,M-7	Maintain safe/reliable warm-water refuges.	25	1	Continuing	*FWS, FDEP/BPSM GDNR Power Industry							
M-3,M-7	Minimize interruptions to thermal discharges.	251	1	Continuing	*FWS FDEP/BPSM GDNR Power Industry		2	1				Routine Routine No Estimate

**IMPLEMENTATION SCHEDULE**

**Florida Manatee Recovery Plan**

**U.S. Fish and Wildlife Service**

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency/ Division	Estimated Fiscal Year Costs \$000					Comments/ Notes
						Current	FY 2	FY 3	FY 4	FY 5	
M-3,M-7	Protect & promote regeneration of grassbeds.	26	2	Continuing	*FDEP COE FWS NBS NMFS WMDs	70	140	150	200	200	
M-3,M-7	Assess threats to seagrass habitats & develop protection strategies.	261	2	Continuing	*FDEP FWS NMFS NBS						Routine Routine Routine
M-3,M-7	Develop/implement alternative measures to mitigate threats/promote regeneration of seagrass beds.	262	2	Continuing	FDEP FWS						See Above Routine
I-2,M-3,M-7	Review aquatic plant control programs.	27	2	Continuing	FDEP FWS NBS COE WMD'S Local Govt's						See Above Routine Routine Routine Routine Routine
M-7,O-1,O-2	Minimize disturbance & harassment.	28	2	Continuing	*FDEP FWS						
M-7,O-1,O-2	Prepare guidelines for viewing areas.	281	3	By 9/97	*FWS FDEP						Routine Routine
M-7,O-1,O-2	Prepare guidelines or regulations on feeding and watering.	282	3	By 1/97	FWS FDEP						Routine Routine
M-7,O-1,O-2	Develop and keep under review guidelines for close approach to manatees.	283	3	Continuing	*FWS FDEP						Routine Routine
M-7,O-1	Support public education & outreach programs.	29	1	Continuing	*STMC FWS FDEP FPL GDNR Oceanaria						

**IMPLEMENTATION SCHEDULE**

**Florida Manatee Recovery Plan**

**U.S. Fish and Wildlife Service**

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency/ Division	Estimated Fiscal Year Costs \$000					Comments/ Notes
						Current	FY 2	FY 3	FY 4	FY 5	
M-7,O-1	Develop and keep under review curricula & materials for schools.	291	2	Continuing	*STMC FWS FDEP FPL GDNR		2	2	1	1	No Estimate Routine Routine No Estimate
M-7,O-1	Develop/upgrade materials for target user groups.	292	2		*STMC FPL FDEP GDNR FWS		10	2	1	1	No Estimate No Estimate Routine Routine
M-7,O-1	Maintain/encourage voluntary contributions to recovery program.	293	2		STMC FDEP Oceanaria						Routine Routine Routine
I-3,M-3	Determine & monitor populations & essential habitat.	3	1		FWS,FPL FDEP/FMRI NBS,Oceanaria GDNR						
R-1,R-3,R-8	Maintain telemetry program.	31	1		NBS FDEP/FMRI FWS						
R-1,R-3,R-8	Maintain adequate telemetry capabilities.	311	2		NBS FDEP/FMRI GDNR	200 170	202 175 50	205 180 30	207 185 32	210 190 34	
R-3,R-8,M-7	Incorporate telemetry data into GIS database.	312	1	Continuing	*FDEP/FMRI NBS GDNR		3	2	3	4	Routine Routine
R-3,M-7	Prepare/distribute monthly updates of telemetry results.	313	2	Continuing	*FDEP/FMRI NBS						Routine See Above
R-3,M-7	Develop regional atlases of telemetry data.	314	2	As Warranted	*FDEP/FMRI NBS						Routine Routine
R-1,R-3,M-7	Develop and keep under review long-term strategies for telemetry studies.	315	2	Continuing	NBS FDEP/FMRI						Routine Routine

**IMPLEMENTATION SCHEDULE**

**Florida Manatee Recovery Plan**

**U.S. Fish and Wildlife Service**

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency/ Division	Estimated Fiscal Year Costs \$000					Comments/ Notes
						Current	FY 2	FY 3	FY 4	FY 5	
R-1,R-3	Continue & improve aerial surveys.	32	2		FDEP/FMRI/BPSM FWS FPL NBS MIA						
R-1,R-3,M-7	Continue state-wide synoptic aerial survey.	321	1	Continuing	*FDEP/FMRI	12	12	13	14	15	
R-1,R-3,M-7	Undertake regional or local aerial surveys.	322	2	Continuing	*FDEP/FMRI/BPSM FWS	9	9	10	10	11	Routine
M-3,M-7, R-2,I-4	Continue aerial surveys of aggregation sites.	323	1	Continuing	FPL FDEP/FMRI	12	12	5	5	5	No Estimate
R-1,R-3,M-7	Support dedicated aerial survey specialist & convene Aerial Survey Working Group.	324	2	Continuing	*FDEP/FMRI NBS FWS	105	115	120	125	130	Routine Routine
R-1,R-3,M-7	Analyze available aerial survey data.	325	1	Continuing	FDEP/FMRI FWS						Routine Routine
R-6,R-8,R-14	Better define aspects of life history, physiology & ecology.	33	1	Continuing	FDEP/FMRI FWS Oceanaria GDNR NBS						
R-6,R-8,R-14	Maintain/analyze scar catalog data.	331	1	Continuing	*NBS FDEP/FMRI						
R-1,R-6,R-8	Collect photographs of identifiable individuals.	3311	1	Continuing	*NBS FDEP/FMRI						
R-1,R-6,R-8	Maintain staff to support scar catalog data collection/entry/retrieval/analysis.	3312	1		*NBS FDEP/FMRI GDNR	160 35	162 35	165 37	165 37	170 40	Routine
R-1,R-6,R-8	Upgrade/maintain computer /photographic equipment for scar catalog.	3313	2		*NBS FDEP/FMRI GDNR		1				See Above See Above

**IMPLEMENTATION SCHEDULE**

Florida Manatee Recovery Plan		U.S. Fish and Wildlife Service										
		General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency/ Division	Estimated Fiscal Year Costs \$000				
Current	FY 2							FY 3	FY 4	FY 5		
R-1,R-6,R-7	Determine survival rates & other population parameters from scar catalog.	3314	1	Continuing	*NBS FDEP/FMRI							See Above Routine
R-1,R-6, R-7,R-8	Continue/expand long-term studies of individual animals.	332	2	Continuing	*NBS FDEP/FMRI							Routine Routine
R-6,R-7	Analyze data on calf production.	333	1	Continuing	FDEP/FMRI NBS							Routine Routine
I-4,R-4,R-6	Continue aerial photogrammetry analyses.	334	3		FDEP/FMRI							Routine
R-14	Continue deployment of PIT tags.	335	3	Continuing	FDEP/FMRI	5	5	5	5	5		
R-14	Conduct additional studies of thermal tolerances.	336	3	Continuing	Oceanaria							Routine
R-14,M-7	Conduct additional studies to assess hearing capabilities.	337	2	2 Years	FDEP	50						
M-2,M-3,R-4	Complete and conduct additional studies of food habits.	338	3	Continuing	NBS	25	15	10	10	10	10	
R-5,R-6	Conduct additional genetic analysis from tissue samples.	339	2	Continuing	FDEP/FMRI NBS	10	15	15	20	20	20	Routine
R-14	Conduct additional studies of freshwater requirements.	3310	3	Continuing	FDEP Oceanaria	35	10					Routine
R-1,R-6	Continue studies to develop population models by convening a population status working group.	34	1	Continuing	*NBS FDEP/FMRI FWS	65 10	67 5	68 10	70 5	70 5	70 5	Routine
R-2,I-1,M-3	Develop/implement habitat monitoring system.	35	1		FDEP FWS NBS							
R-2,I-4,M-3	Develop methodology/expertise to monitor essential habitat.	351	2	Continuing	FDEP NBS FWS NASA	50	52	55	57	60	60	No Estimate Routine No Estimate



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**Florida Manatee Recovery Plan**

**U.S. Fish and Wildlife Service**

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency/ Division	Estimated Fiscal Year Costs \$000					Comments/ Notes
						Current	FY 2	FY 3	FY 4	FY 5	
R-2,I-4,M-3	Coordinate/implement long-term habitat monitoring program.	352	1	Continuing	FWS FDEP						Routine Routine
R-1,R-2,M-3	Maintain/improve GIS data on manatees & habitats.	36	2	Continuing	FDEP NBS FWS						
R-1,R-2,M-3	Maintain hardware, software, expertise for the GIS program.	361	2	Continuing	FDEP/FMRJ FDEP/BPSM NBS FWS	250 137 38 10	250 140 40 10	260 140 42 10	265 150 45 10	270 150 47 10	
R-1,R-2,M-3	Convene regular meetings of the GIS coordinating team.	362	2	Continuing	*FDEP FWS NBS						See Above Routine See Above
M-7,R-1,R-2	Convene regular meetings of the GIS working group.	363	3	Continuing	*FDEP FWS NBS						See Above Routine See Above
M-7,O-4	Coordinate recovery activities, monitor & evaluate progress, & update/revise the Recovery Plan.	4	2		FWS(Recovery Team) MMC FDEP GDNR						
M-7,O-4	Maintain State & Federal Manatee Coordinator & staff positions.	41	2	Continuing	FWS FDEP GDNR	330 120 14	335 125 15	340 130 16	345 135 17	350 140 18	FMRI only
M-7,O-4	Convene periodic meetings of Florida Manatee Recovery Team & Manatee Technical Advisory Council.	42	2	Continuing	FWS FDEP						Routine Routine
M-7,O-4	Develop annual progress report.	43	3	Continuing	*FWS(Recovery Team)						Routine
M-7,O-4	Update Florida Manatee Recovery Plan.	44	2	As Needed	*FWS(Recovery Team)						Routine
O-1,M-7	Convene panel to evaluate the effectiveness of the Manatee Recovery Program.	45	2	1 Week	*FWS NBS FDEP					5	Routine

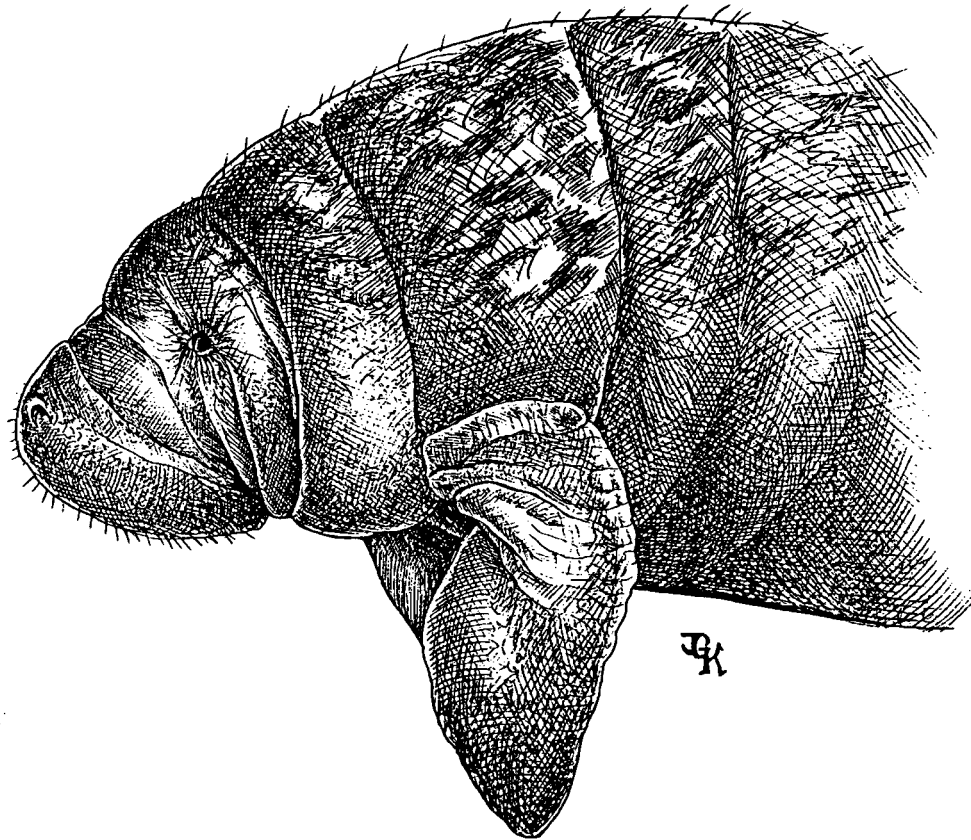
**IMPLEMENTATION SCHEDULE**

**Florida Manatee Recovery Plan**

**U.S. Fish and Wildlife Service**

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency/ Division	Estimated Fiscal Year Costs \$000					Comments/ Notes
						Current	FY 2	FY 3	FY 4	FY 5	
O-1,M-7	Share experience/expertise developed through Manatee Recovery Program.	46	2	Continuing	FWS(Recovery Team) FDEP NBS						Routine Routine Routine
O-1,M-7	Develop cooperative agreements with other states and countries.	461	2	Continuing	*FWS NBS						Routine
O-1,M-7	Participate/assist manatee related work under Caribbean Environment Program.	462	2		*FWS NBS FDEP	5					Routine Routine
O-1,M-7	Participate in national & international conservation & research activities.	463	2		NBS FDEP FWS GDNR	6 10	7 10 1	7 11 1	7.5 11 2	8 12 2	FMRI only

IV. APPENDIX





## APPENDIX A

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Names appearing in bold print denote those who returned comments on the draft revision of the manatee recovery plan.

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