

DRAFT
(05/18/09)

WEST INDIAN MANATEE (*Trichechus manatus*)

FLORIDA STOCK
(Florida subspecies, *Trichechus manatus latirostris*)

U.S. Fish and Wildlife Service, Jacksonville, Florida

STOCK DEFINITION AND GEOGRAPHIC RANGE

Florida manatees are found throughout the southeastern United States. Because manatees are a sub-tropical species with little tolerance for cold, they are generally restricted to the inland and coastal waters of peninsular Florida during the winter, when they shelter in and/or near warm-water springs, industrial effluents, and other warm water sites (Hartman 1979, Lefebvre *et al.* 2001, Stith *et al.* 2007). In warmer months, manatees leave these sites and can disperse great distances. Individuals have been sighted as far north as Massachusetts, as far west as Texas, and in all states in between (Rathbun *et al.* 1982, Schwartz 1995, Fertl *et al.* 2005, USFWS Jacksonville Field Office, unpub. data 2008a). Warm weather sightings are most common in Florida and coastal Georgia.

Previous studies of the manatee in Florida identified four, relatively distinct, regional management units (formerly referred to as subpopulations): an Atlantic Coast unit that occupies the east coast of Florida, including the Florida Keys and the lower St. Johns River north of Palatka; an Upper St. Johns River unit that occurs in the river south of Palatka; a Northwest unit that occupies the Florida Panhandle south to Hernando County; and a Southwest unit that occurs from Pasco County south to Whitewater Bay in Monroe County (USFWS 2001 and 2007). See Figure 1. Each of these management units includes individual manatees that tend to return to the same warm-water site(s) each winter and have similar non-winter distribution patterns. The exchange of individuals between these units is limited during the winter months, based on data from telemetry studies (Rathbun *et al.* 1990, Reid *et al.* 1991, Weigle *et al.* 2001, Deutsch *et al.* 1998 and 2003) and photo-identification studies (Rathbun *et al.* 1990, USGS FISC Sirenia Project, unpubl. data 2007, Higgs, pers. comm. 2007a, b).

Warm weather exchanges between management units commonly occur, as documented by Reid *et al.* (1991), Deutsch *et al.* (1998 and 2003), and Beck, pers. comm. (2007a). These exchanges are further corroborated through recent genetic analyses, which show that there is little genetic differentiation or structure within the Florida manatee population (genetic differentiation values did not reach a 0.05 cut-off value; the largest, identified F_{ST} value was 0.033 and the largest R_{ST} value was 0.027) (Kellogg 2008). The absence of significant differentiation suggests that

extensive mixing occurs throughout the population, consistent with the animals' large dispersal capabilities, the apparent absence of gene flow barriers, and regularly distributed and available resources. As such, the Florida manatee population is not partitioned into strongly divergent subpopulations (Kellogg 2008).

While the Florida manatee population has been separated into management units, the Service identifies the Florida manatee population as a single stock. As stated, the management unit construct was originally based on studies of regional manatee wintering sites. Given that these sites do not constitute physical or genetic barriers, there is no data to support distinguishing these units as stocks. Furthermore, Federal and State conservation activities are consistently applied throughout Florida, given the absence of any "management unit-specific" anthropogenic threats; as such, there is no conservation benefit to managing these units as stocks. Given this, significant genetic differences between the manatees of Florida and Puerto Rico do exist and, as a result, these populations are identified as separate stocks (Vianna *et al.* 2006). (Vianna *et al.* (2006) identified a gene flow barrier between Florida and Puerto Rico using mtDNA analyses.)

POPULATION SIZE

One to three times each winter, a coordinated series of statewide aerial surveys and ground counts, known as the synoptic surveys, are conducted by the Florida Fish and Wildlife Conservation Commission (FWC) to count wintering manatees (FWC FWRI Manatee Synoptic Aerial Surveys 2009). These counts, conducted since 1991, identify a number of animals observed in wintering sites at the time of the count and suggest that there is at least this number of manatees in the population, if not more. Because the counts do not include the number of manatees located away from the wintering sites on the day of the count, the counts do not accurately represent the total number of manatees in the population. Furthermore, survey methods preclude any analysis of precision and variability in the counts. In the absence of a comprehensive count, these counts cannot be used to describe population trends. Information based on Florida manatee population demographic data obtained from photo-identification studies is used to accurately describe population trends as they relate to growth rates, adult survival rates, and reproductive rates.

Minimum Population Estimate

The best available count of Florida manatees is 3,807 animals, based on a single synoptic survey of warm-water refuges in January 2009 (FWC FWRI Manatee Synoptic Aerial Surveys 2009).

Current Population Trends

Recent demographic analyses indicate that, with the exception of the Southwest management unit, manatee populations are increasing or stable throughout much of Florida. See Table 1. Population growth rates reported by Runge *et al.* (2004 and 2007a) are as follows: the Northwest Region 4.0% (95% CI 2.0 to 6.0%), the Upper St. Johns River Region 6.2% (95% CI 3.7

to 8.1%), the Atlantic Coast Region 3.7% (95% CI 1.1 to 5.9%), and the Southwest Region -1.1% (95% CI -5.4 to +2.4%). In three of the four management units, reproductive rates and adult survival rates are cited as positive (Runge *et al.* 2007a, Kendall *et al.* 2004, Langtimm *et al.* 2004, and Koelsch 2001). In southwest Florida, estimates of adult survival and reproduction are less precise than for manatees in other regions of Florida because the data time series is comparatively shorter for this unit and no demographic data is available for manatees in the southernmost part of this region. Craig and Reynolds (2004) additionally suggested that populations of wintering manatees in the Atlantic Coast Region have been increasing at rates of between 4 and 6% per year since 1994.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

The Marine Mammal Protection Act defines net productivity rate as “the annual per capita rate of increase in a stock resulting from additions due to reproduction, less losses due to natural mortality.” Recently published information on Florida manatee population demographics include studies by Runge *et al.* (2004 and 2007a), Craig and Reynolds (2004), Kendall *et al.* (2004), and Langtimm *et al.* (2004). Per Runge *et al.* (2004), the maximum growth rate for Florida manatees (incorporating reproductive and adult survival rates), is 6.2% (95%, CI 3.7 to 8.1%). This rate, reported for the Upper St. Johns River management unit, is identified as R_{max} inasmuch as it describes a maximum rate of increase and reflects both additions and losses to this population, including losses due to both natural and human-causes.

POTENTIAL BIOLOGICAL REMOVAL (PBR)

PBR is the product of three elements: the minimum population estimate (N_{min}), half of the maximum net productivity rate ($0.5 R_{max}$), and a recovery factor (F_r). Recovery factor values range between 0.1 and 1.0 and population simulation studies demonstrate that a default value of 0.1 should be used for endangered (depleted) stocks and a default value of 0.5 should be used for threatened stocks or stocks of unknown status (NMFS 2005).

$$\begin{aligned} N_{min} &= 3,807 \\ R_{max} &= 6.2\% \\ F_r &= 0.1 \end{aligned}$$

$$PBR = (3,807) (0.031) (0.1) = 11.80 \text{ (or 12)}$$

HUMAN CAUSED MORTALITY AND SERIOUS INJURY

Sources of human caused manatee mortality and injury include watercraft, water control structures, recreational and commercial fishing gear, and others. These sources were identified and are documented through manatee carcass salvage and rescue programs (FWC FWRI Manatee Mortality Statistics 2008, USFWS Jacksonville Field Office, unpub. data 2008b and

2008c, Rommel *et al.* 2007, Lightsey *et al.* 2006, Pitchford *et al.* 2005, Wright *et al.* 1995, Ackerman *et al.* 1995, O'Shea *et al.* 1985, Bonde *et al.* 1983). For the period 2003 – 2007, annual estimated average human-caused mortality was 87 (86.6) manatees per year (FWC FWRI Manatee Mortality Statistics 2008).

While “serious injury” has been described “as any injury that will likely result in mortality” (NMFS 2005), the Service has yet to define this term. Absent a definition, the Service receives reports of distressed or injured manatees and responds to these reports through a manatee rescue, rehabilitation, and release program. Responses to reports of manatees entangled in fishing gear can include disentangling a superficially entangled manatee *in situ* or can involve transporting a more than superficially entangled animal to a rehabilitation center for disentanglement and further treatment. It is assumed that animals treated *in situ* have not been seriously injured.

Manatees transported to a rehabilitation center may or may not be seriously injured. Animals treated at rehabilitation centers for entanglement-related injuries are almost always successfully treated and returned to the wild. Many animals in the wild exhibit evidence of significant entanglement injuries (scarring, amputations, etc.), injuries that would likely have resulted in rehabilitative treatment, had they been reported. These animals thrive, absent any intervention, suggesting that some animals transported to rehabilitation centers with injuries of a “serious” nature should not be described as “seriously injured.” Given that all animals rescued and treated for entanglement-related reasons during the 2003 to 2007 period have not died, it’s reasonable to conclude that there have been no serious injuries for the period of record.

Fisheries-related Mortality and Injury

Manatees are known to entangle in and/or ingest fishing gear used by both commercial and recreational fisheries. As reported in death and rescue reports, fishing gear used by commercial fishers known to entangle or be ingested by manatees includes shrimp trawls, shrimp nets, crab traps (traps and/or associated buoys and lines), seines, shiner nets and hoop nets, and trot lines. Similarly, recreational fishery gear known to either entangle or be ingested by manatees includes monofilament fishing line and/or associated tackle, cast nets, and crab traps. Manatees also become entangled in ropes and lines, possibly related to recreational and commercial fisheries (*e.g.*, float lines detached from traps, etc.) (FWC FWRI Manatee Mortality Statistics 2008, USFWS Jacksonville Field Office, unpub. data 2008b and 2008c, Smith 1998, Nill 1998). Manatees are struck and killed or injured by a variety of watercraft, including watercraft of a size and type comparable to those used by commercial and recreational fishers (Rommel *et al.* 2007, Lightsey *et al.* 2006, Pitchford *et al.* 2005).

Mortality

From 1978 through 2007, 6,373 manatee carcasses were salvaged in the southeastern United States. Of these carcasses, 1,877 were of animals that died from human causes. Eighty-two percent of manatees (1,538) that died from human causes were killed by watercraft. Water

control structures (including flood gates and navigation locks) killed 182 manatees and the deaths of the remaining 157 manatees were attributed to other human causes (including entanglement in and ingestion of marine debris [including fishing gear], entrapment in pipes and culverts, etc.) (FWC FWRI Manatee Mortality Statistics 2008, USFWS Jacksonville Field Office, unpub. data, 2008c).

For the most recent five year period (2003 - 2007), at least 10 manatees died due to entanglements in/ingestion of marine debris; six of these deaths were associated with fishing line and/or associated gear, two deaths were attributed to research nets, and two to other sources (FWC FWRI Manatee Mortality Statistics 2008, USFWS Jacksonville Field Office, unpub. data 2008b, Nill 1998, Smith 1998). See Table 2. There were no known sources of commercial fishery gear implicated in these deaths.

Rescues

The Service's manatee rescue, rehabilitation, and release program has rescued manatees since 1973. From 2003 to 2007, there were 80 rescues associated with fishing gear and other sources of marine debris. Thirty-five of these were related to crab trap entanglements, 15 to fishing line and/or associated gear, and 5 were due to net entanglements. Nine of the 35 crab trap-related rescues required treatment at rehabilitation centers and the remaining 26 were resolved in the field (USFWS Jacksonville Field Office, unpub. data 2008b). See Table 3. Crab trap-related rescues likely involve gear from both commercial and recreational fishers, who use the same type of gear.

Commercial Fishing Gear-related Interactions

The majority of known fishing gear interactions have occurred in Florida waters (280 of 290 known deaths and rescues, including interactions that occurred before 1978). Prior to 1995, when the State of Florida adopted a statewide, in-shore net ban, manatees were known to entangle in a variety of fishing gear used by commercial fishers, including blue crab fishery gear. Subsequent to 1995, entanglements in non-blue crab fishery gear used by commercial fishers are virtually unknown, both in the State of Florida and elsewhere (there is a single record of a manatee being rescued from commercial fishing gear in 1997 in Georgia, when a manatee was rescued from an inshore bait shrimp trawl) (FWC FWRI Manatee Mortality Statistics 2008, USFWS Jacksonville Field Office, unpub. data 2008b and 2008c, Nill 1998, Smith 1998). However, blue crab fishery gear entanglements continue in Florida. From 2003 to 2007, no manatee deaths and 35 rescues are attributable to the blue crab fisheries.

Given greater fishing effort by commercial blue crab fishers in contrast to blue crab fishing efforts by recreational fishers (which suggests more commercial fishing gear in the water than recreational gear in the water), it's thought that a majority of manatee entanglements in blue crab fishing gear should be attributed to the commercial blue crab fisheries. In the past, efforts to distinguish between animals entangled in commercial blue crab trap gear versus recreational blue

crab trap gear were hindered by a lack of gear data collection protocols for rescuers and salvagers and state gear identification requirements were not necessarily adequate to identify gear ownership. Protocols have subsequently been modified, as have state regulations requiring better identification of gear owners, and the attribution of entangling gear to its source has significantly improved.

Two commercial blue crab fisheries identified in NMFS' "2009 List of Fisheries" (73 FR 73032; December 1, 2008) known to entangle Florida manatees include:

Atlantic blue crab trap/pot fishery

The Category II Atlantic blue crab trap/pot fishery targets blue crabs using pots baited with fish or poultry typically set in rows in shallow water. The pot position is marked by either a floating or sinking buoy line attached to a surface buoy. The fishery occurs year round and involves more than 16,000 vessels/persons. Twenty-seven percent of Florida's 2006 blue crab landings came from Florida's Atlantic Coast Region, within the operational area of the Atlantic blue crab trap/pot fishery (FWC FWRI 2007).

Gulf of Mexico blue crab trap/pot fishery

The Category III Gulf of Mexico blue crab trap/pot fishery targets blue crabs using pots baited with fish or poultry typically set in rows in shallow water. The pot position is marked by either a floating or sinking buoy line attached to a surface buoy. The fishery occurs year round and involves more than 4,113 vessels/persons. Seventy-three percent of Florida's 2006 blue crab landings came from Florida's Gulf Coast Region, within the operational area of the Gulf of Mexico blue crab trap/pot fishery (FWC FWRI 2007).

Fifty-five percent of known Florida manatee-crab fishery interactions occurring between 2003 and 2007 were documented within the area of the Gulf of Mexico blue crab trap/pot fishery. The majority of these interactions occurred in southwest Florida, with most occurring in Lee County (seven rescues occurred in this county alone) (FWC FWRI Manatee Mortality Statistics 2008, USFWS Jacksonville Field Office, unpub. data 2008b). Within the area of the Atlantic blue crab trap/pot fishery, most interactions occurred in east central Florida (Brevard County) (FWC FWRI Manatee Mortality Statistics 2008, USFWS Jacksonville Field Office, unpub. data 2008b).

The NMFS' "2009 List of Fisheries" (73 FR 73032; December 1, 2008) also identifies the Category III "Southeastern U.S. Atlantic/Gulf of Mexico shrimp trawl fishery" as a fishery known to take Florida manatees.

Southeastern U.S. Atlantic/Gulf of Mexico shrimp trawl fishery

The Category III Southeastern U.S. Atlantic/Gulf of Mexico shrimp trawl fishery targets a variety of pelagic shrimp species (brown, pink, white, rock, etc.) by means of a large

trawl net towed behind a single shrimp trawler. Nets, held open by paired doors, are towed on coastal bottoms for varying lengths of time. This fishery occurs year round and involves more than 18,000 vessels/persons. Shrimp trawling occurs along Florida's Atlantic and Gulf coasts, well outside of Florida shoreline areas regulated pursuant to Florida net ban regulations.

From 2003 to 2007, no manatee deaths or injuries attributable to this fishery have been reported from the Atlantic and Gulf coasts in the southeastern U.S. Furthermore, this commercial fishery is not known to have taken any manatees since 1987, when the last confirmed report of a manatee captured and drowned in this fishery was recorded. (Three unconfirmed deaths were documented in 1990. Necropsy findings and/or circumstances associated with these cases suggested that an inshore bait shrimp fishery may have been responsible for the deaths but definitive information was lacking. A manatee that died in a shrimp trawl in 1997 was captured by a research trawler investigating excluder devices; the researchers used a shrimp trawl, identical to those used by commercial fishers, but they were not engaged in commercial fishing operations.)

Additional Sources of Mortality

Data on manatee mortality in the southeastern United States have been collected since 1974 by the Manatee Carcass Salvage Program (O'Shea *et al.* 1985, Ackerman *et al.* 1995, Lightsey *et al.* 2006). Based on these data, primary human-related threats include watercraft-related strikes (direct impact and/or propeller) which cause injury and death (Rommel *et al.* 2007, Lightsey *et al.* 2006), entrapment and/or crushing in water control structures (gates, locks, *etc.*), and, as previously described, entanglement in fishing gear, and ingestion of marine debris. Natural threats include exposure to cold and red tide. Mortality associated with these natural threats includes cold stress syndrome and brevetoxicosis, respectively.

Causes of death for many salvaged carcasses cannot be determined. These "undetermined" causes can be the result of a carcass that is too decomposed to diagnose, a carcass that was reported but never retrieved, or when no specific factor or set of factors can be identified as a cause of death. In addition, small manatees (less than or equal to 150 cm in length) that die at or near the time of birth and whose deaths cannot be attributed to one of the known human-related causes are described as "perinatal" deaths, an undetermined cause.

During the most recent five year period for which data have been verified (2003 – 2007), 1,805 manatee carcasses were salvaged in the southeastern United States. See Table 4. Of these carcasses, 433 were of animals that died from human causes. Based on this, the annual estimated average human-caused mortality is 87 (86.6) manatees per year. Eighty-nine percent of manatees (386) that died from human causes were killed by watercraft. Water control structures (including flood gates and navigation locks) killed 18 manatees and the deaths of the remaining 29 manatees were attributed to other human causes (including entanglement in and ingestion of marine debris [including fishing gear], entrapment in pipes and culverts, *etc.*) (FWC FWRI

Manatee Mortality Statistics 2008).

STATUS OF STOCK

The Florida manatee is protected by the State of Florida under the Florida Manatee Sanctuary Act of 1978, as amended (§ 379.2431(2), FS). Federally, Florida manatees were originally listed as an endangered species in 1967 under the Endangered Species Preservation Act of 1966. The original listing was subsequently adopted under the Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq.*), as amended, and manatees continue to be identified as a federally endangered species. As an endangered species, manatees are considered by default to be a “strategic stock” and “depleted” under the Marine Mammal Protection Act of 1972, as amended (16 U.S.C. 1361 *et seq.*).

The recent threats assessment (Runge *et al* 2007b) states that “watercraft-related mortality is having the greatest impact on manatee population growth and resilience” and “elimination of this threat alone would greatly reduce the probability of quasi-extinction. Anticipated losses of winter warm-water habitat could also be a significant, long-term threat.” The threats assessment describes mortality associated with fisheries interactions and red tides as “noticeable” and, when compared to other anthropogenic threats, is thought to have less of an impact on the persistence of the manatee population (Runge *et al* 2007b).

The Service and its recovery partners have taken significant steps to reduce the number of human caused manatee mortalities and injuries. To address the threat of watercraft collisions, the most significant source of human-caused mortality and injury, the Service and FWC have adopted manatee protection areas (Federal manatee refuges and sanctuaries and State manatee protection zones) in areas of high manatee use and potential watercraft conflict. Water control structures have been retrofitted with devices that eliminate crushings and many culverts and pipes have been grated to prevent manatee entrapment.

Efforts have also been made to reduce the incidence of lethal and non-lethal entanglements in and ingestion of marine debris, including fishing gear (Spellman *et al.*, 2003 and 1999). Manatees entangled in or ingesting marine debris are rescued each year by the manatee rescue and rehabilitation program; manatee mortalities and serious injuries are minimized as a result of this activity (FWC FWRI Manatee Mortality Statistics 2008, USFWS Jacksonville Field Office, unpub. data 2008b and 2008c, Nill 1998, Smith 1998). The Service has funded studies to assess manatee behavior in the presence of fishing gear and to identify “manatee-safe” crab fishing gear that, if used, will minimize the number of manatee-crab trap entanglements (Bowles *et al.* 2003 and Bowles 2000). Derelict crab trap removals and monofilament removal and recycling programs are helping to reduce the likelihood of manatee interactions with this gear (Koelsch *et al.* 2003). In February 2009, FWC adopted regional blue crab harvest closures across the state; derelict crab traps will be removed during the closures, further reducing the likelihood of crab trap gear entanglements (FWC 2009).

While the threats posed by watercraft and the anticipated loss of wintering habitat on the Florida manatee are significant, the threat posed by commercial fishery activities is small and has a comparatively lesser impact on the persistence of the Florida manatee population. The number of lethal and live takes of manatees in blue crab trap/pot fishery gear during the past year (no lethal takes and nine live takings) is well below the calculated PBR level of 12 takings. Over the past five years, there have been no lethal takings of manatees in the blue crab fishery and a total of 35 non-lethal takings of crab fishery gear-entangled manatees (rescued by the manatee rescue and rehabilitation program), an average of 6.8 takes per year. Similarly, there are no known lethal or non-lethal takes of manatees in the shrimp trawl fishery for this period. Therefore, the annual estimated level of incidental mortality and serious injury due to the shrimp trawl fishery is zero. Given the largely non-lethal effect of these takings, total fishery mortality and serious injury for this stock is less than the calculated PBR and, therefore, can be considered insignificant and approaching a zero mortality and serious injury rate.

Inasmuch as an optimal sustainable population (OSP) level has not been identified for the Florida manatee, we do not know what this stock's status is in relation to OSP. In the face of existing threats, "the Florida manatee population is exhibiting positive growth, good reproductive rates, and high adult survival throughout most of the state" (USFWS 2007). For these reasons, the Service's 2007 status review recommends reclassifying the Florida manatee from its endangered status to that of a threatened species.

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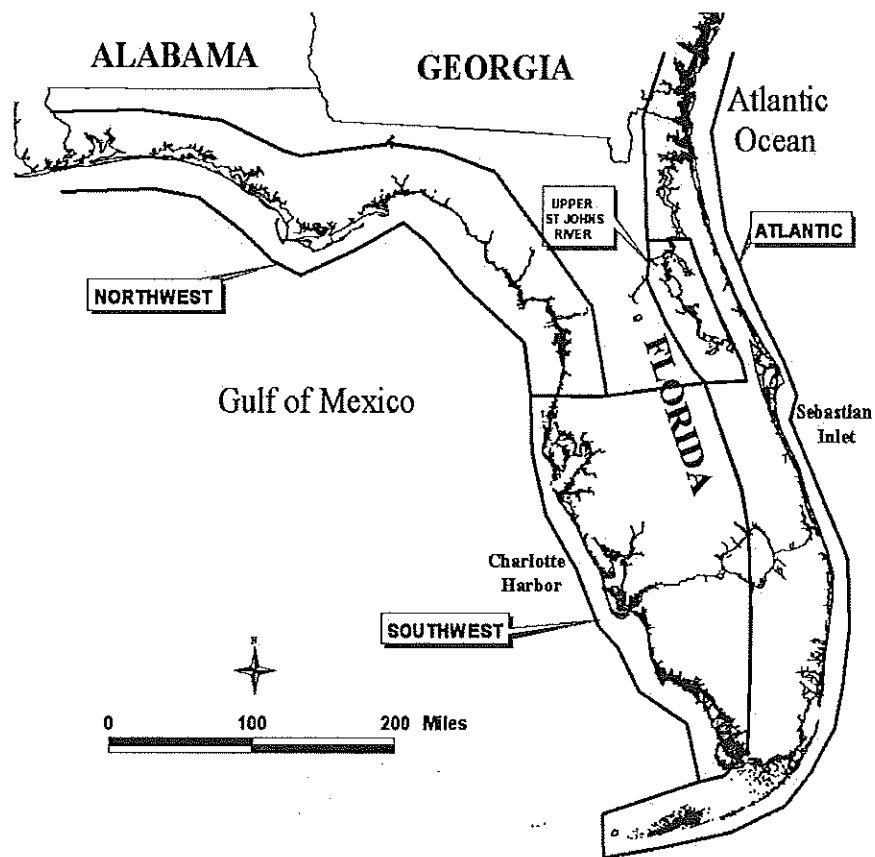


Figure 1. Florida manatee distribution within the four designated regional management units. USFWS (2001).

Table 1. Demographic indicators for Florida manatees by management unit.

Management Unit	Population Growth Rate (per year)	Minimum Population Size	Annual Conditional Reproductive Rate	Adult Survival Rates	Comments
Northwest	4.0% (95% CI 2.0 to 6.0%) 1986 – 2000 (Runge <i>et al.</i> 2007a)	377 (FWC Manatee Synoptic Aerial Surveys 2009)	0.43 (95% CI 0.22 – 0.54) 1982 – 1999 (Kendall <i>et al.</i> 2004)	0.959 SE 0.006 1986 – 2000 (Runge <i>et al.</i> 2007a)	The number of manatees throughout the region, including Crystal River and Kings Bay, has been increasing since the 1960s. A recent high count of 274 manatees was documented in 2005 (Kleen, <i>pers. comm.</i> 2006).
Upper St. Johns River	6.2% (95% CI 3.7 to 8.1%) 1990 – 1999 (Runge <i>et al.</i> 2004)	112 (FWC Manatee Synoptic Aerial Surveys 2009)	0.61 (95% CI 0.51 – 0.71) 1980 – 2000 (Runge <i>et al.</i> 2004)	0.960 SE 0.011 1990 – 1999 (Langtimm <i>et al.</i> 2004)	The number of manatees using Blue Spring has increased significantly. A recent high count of manatees (182) was documented during the 2005 – 2006 winter season (Hartley, <i>pers. comm.</i> 2006). At this site, survival of 1 st year calves was estimated at 0.810 (0.727 – 0.873) and 2 nd year calves at 0.915 (0.827-0.960) (Langtimm <i>et al.</i> 2004).
Atlantic Coast	3.7% (95% CI 1.1 to 5.9%) 1986 – 2000 (Runge <i>et al.</i> 2007a)	1447 (FWC Manatee Synoptic Aerial Surveys 2009)	0.38 (95% CI 0.29 – 0.47) 1982 – 1999 (Kendall <i>et al.</i> 2004)	0.963 SE 0.010 1986 – 2000 (Runge <i>et al.</i> 2007a)	In contrast to FWC's estimate, Craig and Reynolds (2004) estimated the population size of animals using Atlantic Coast power plants in 2001 at 1606 (Bayesian credible interval: 1353 – 1972). They also identified trends in corrected aerial counts: 1982-1989, 5 to 7%; 1990-1993, 0 to 4%; and, since 1994: 4 to 6%.
Southwest ¹	-1.1% (95% CI -5.4 to +2.4%) 1995 – 2000 (Runge <i>et al.</i> 2004)	1364 (FWC Manatee Synoptic Aerial Surveys 2009)	0.60 (95% CI 0.42 – 0.75) 1993 – 1997 (Koelsch 2001)	0.908 SE 0.019 1995 – 2000 (Langtimm <i>et al.</i> 2004)	Estimated conditional, annual reproductive rate based on warm weather data from Sarasota Bay only, may not be representative of other regions.

¹Parameter estimates for the Southwest have broader confidence intervals than those for the other management units. This is due to a number of factors, including: fewer years of photo-identification monitoring data, turbid water making photography difficult, and warmer weather in the south reducing the number of cold days when manatees are available for photography. Nonetheless, the current parameter estimates are the first published for this region and therefore reflect the best available information. More reliable information is expected for this management unit as geographic coverage, sample size, and years of study increase over time.

Table 2. Marine debris-related manatee deaths, 2003 - 2007. (Source: FWC FWRI Manatee Mortality Statistics 2008)

Year	Crab trap(s)	Nets		Fishing line and/or associated tackle			Other		Total no. of deaths
		Shrimp trawl	Other	Fishing line	Fishing line and hooks	Hook(s)	Rope	Various	
2003			1	1				1	3
2004				1					1
2005									
2006				1	1	1			3
2007			1			1	1		3
TOTAL	0	0	2	3	1	2	1	1	10
5-Year Avg	0	0	0.4	0.6	0.2	0.4	0.20	0.20	2.00

Table 3. Marine debris-related manatee rescues, 2003 - 2007. (Source: USFWS Jacksonville Field Office, unpub. data 2008c)

Year	Crab trap(s)		Crab trap(s) and other		Net(s)		Trawl(s) and other		Fishing line and/or associatedackle								Rope		Rope and other		Vessels		Total no. of rescues
	Rescues	Aired and Released	Rescues	Aired and Released	Rescues	Aired and Released	Rescues	Aired and Released	Fishing line		Fishing line and other		Hook(s) and other		Hook(s)		Rescues	Aired and Released	Rescues	Aired and Released	Rescues	Aired and Released	
									Manatee	Aired and Released	Rescues	Aired and Released	Rescues	Aired and Released	Rescues	Aired and Released							
2003	3	5							1	5							3	1					16
2004	3	4	1				1		1	2		1	1				1						14
2005	1	4								2		1					2		1	1			13
2006		5				2				3													15
2007	1	8				2				1							1						20
TOTAL	9	26	1	0	0	4	1	0	2	11	0	2	0	1	0	0	7	1	1	0	0	0	80
5-Year Avg.	1.60	5.20	0.20	0.00	0.00	0.80	0.20	0.00	0.40	2.20	0.00	0.40	0.00	0.20	0.00	0.00	1.40	2.00	0.20	0.20	0.00	1.00	16.00

Table 4. All manatee deaths (number of deaths, percent of annual total), 2003 - 2007¹. (Source: FWC FWRI Manatee Mortality Statistics 2008)

Year	Watercraft	Water Control Structures	Other Human-related	Perinatal	Cold Stress	Other ²	Total
2003	75 (20%)	3 (1%)	7 (2%)	72 (19%)	48 (13%)	178 (46%)	383
2004	69 (24%)	3 (1%)	4 (1%)	72 (26%)	52 (18%)	82 (29%)	282
2005	80 (20%)	5 (1%)	9 (2%)	89 (22%)	29 (7%)	186 (47%)	398
2006	87 (21%)	5 (1%)	4 (1%)	70 (17%)	21 (5%)	233 (55%)	420
2007	75 (23%)	2 (1%)	5 (1%)	59 (18%)	19 (6%)	162 (50%)	322
TOTAL	386 (21%)	18 (1%)	29 (2%)	362 (20%)	169 (9%)	841 (47%)	1805
5-Year Avg.	77.2	3.6	5.8	72.4	33.8	168.2	361

¹Numbers include reported, dead manatees that were salvaged and confirmed/verified carcasses that were not salvaged (included in "Other").

²Includes known and/or suspected red tide deaths, including 96 in 2003, 92 in 2005, 62 in 2006, and 38 in 2007.

