

**PHOTO-IDENTIFICATION AND AERIAL SURVEYS OF MANATEES IN  
SARASOTA COUNTY WATERS**

**SARASOTA COUNTY BOATING IMPROVEMENT PROGRAM 2004-2005  
FINAL REPORT**



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**Introduction:**

As stated in the most recent Florida Manatee Recovery Plan, recovery criteria require knowledge of vital manatee habitat, reproductive histories, and estimates of annual adult survival rates (U.S. Fish and Wildlife Service 2001). Aerial surveys and photo-identification (photo-ID) are cost-effective and useful methods by which to monitor manatee populations in Florida's coastal waters. Aerial surveys provide information on relative abundance and habitat preference of manatees, while photo-identification studies and subsequent analysis permit assessments of population structure, site fidelity, movement and travel patterns, life history and reproductive traits, and adult survival rates (Ackerman 1995, Beck and Reid 1995, O'Shea and Ackerman 1995, Langtimm et al. 2004).

Sarasota County has supported Mote Marine Laboratory in conducting these types of studies for manatees in county waters for a number of years. As a result, the county has gained important insight into manatee biology by establishing the only long-term, non-winter database of manatee distribution, behavior, and reproductive history in Florida. The benefits of such a database include informed management and policy decisions and practices, such as the development of the Manatee Protection Plan in 2003. In addition, recent analysis of the long-term aerial survey database, supported through the Sarasota County Boating Improvement Program, has provided valuable information on spatial and temporal trends in manatee use of Sarasota County waters (Appendices A & B). Mote Marine Laboratory Manatee Research Program staff also presented the results of these analysis at an international conference this winter (see attached PDF for Appendix C). The results suggest that manatee numbers in Sarasota County are currently

in a declining phase, making evident the importance of continued research and monitoring of the manatee population in Sarasota County waters.

The 2004-2005 Florida Boating Improvement grant not only supported ongoing manatee research, but also provided crucial funding during a significant ecological event directly impacting Sarasota County's manatee population. This year's severe red tide event, which began in January and lasted throughout the fall, presented researchers with a unique opportunity to study the impact of a major red tide outbreak on the distribution of manatees. In addition to a summary of data collected this contract period, preliminary aerial survey results, including the possible influence of red tide blooms on manatee distribution in Sarasota County, are reported here. However, careful and complete statistical analysis must be done before making any substantial conclusions.

## **Methods:**

### Aerial-Surveys:

Mote Marine Laboratory's Manatee Research staff surveyed manatees in the inshore and nearshore waters of Sarasota County. A single engine, high-winged Cessna 172 aircraft was used for these flights. Surveys were flown at an altitude of 850 ft and a speed of 90 knots, with the right window open to reduce glare and increase visibility. Flights generally lasted 4-5 hours. An experienced primary observer occupied the front right seat of the survey aircraft for all flights. Whenever possible, a second observer occupied the right rear seat and assisted with verifying counts and scanning the water while the primary observer recorded data. Pilots also had previous manatee aerial survey experience. The primary observer plotted manatee sightings on photocopied maps of the

study area with shoreline, bathymetry and aids to navigation. For each sighting, the observer recorded the number of manatee adults and calves, direction of travel (if any), time, and whenever possible, behavior and habitat. The information recorded on the maps were later transposed into a computerized Geographic Information System (GIS) database using ArcGIS v9.0.

#### Photo-Identification (Photo-ID):

Photo-ID crews conducted surveys from 6-7 meter outboard motorboats, shorelines, bridges, or docks. Vessels were equipped with observation towers, propeller guards and electric trolling motors to minimize disturbance to the manatees. The primary observer operated a Canon EOS 10D or EOS 20D digital camera with 6.3 and 8.20 respective mega pixel resolution and fitted with a 75-300 mm zoom lens with a polarizing filter. All images were taken in RAW format with embedded jpegs. Occasionally a Canon EOS Elan IIE 35mm SLR camera with 100 ISO fujichrome slide film was used when necessary.

A field day included one or more sites surveyed on a single day. A sighting was defined as all individuals at a geographically distinct location (*i.e.* canal, bayou, harbor, boat basin) within an approximately 0.1 - 0.2 km<sup>2</sup> area at the same time (Barton et al. 2005). For each sighting, distinctive manatees were photographed to document the position of scars and mutilations on the body. Observers sketched scar patterns and other features on data sheets for each individual and recorded its location, habitat, size class, gender (noted when either the ventrum or a nursing calf was observed) and exposures taken during the sighting. Crews also recorded environmental data, such as weather, water and air temperature, salinity, wind direction and speed, and photo conditions.

## **Results:**

### Aerial Surveys:

From October 1 2004 to Sept 30 2005, the Manatee Research staff conducted 17 aerial surveys to assess abundance and distribution of manatees in Sarasota County waters (Table 1). Due to a pending contract, only three flights were completed during November through January. In addition, only one survey a month was conducted for both March and August due to poor weather conditions or aircraft maintenance. The counts for each survey depended on the time of year and conditions (i.e., cloud cover, sea-state, and visibility) during each flight. Total counts of manatees decreased from fall to winter as water temperatures dropped below 18°C. By late March, water temperatures warmed to greater than 21°C and total manatee counts started increasing through the spring, peaking in May with 91 and 110 animals counted on May 3 and May 17, respectively (Table 1). Counts decreased slightly after May but remained variable throughout the summer.

Manatee distribution within Sarasota County was influenced primarily by season and, possibly, secondarily by the presence of *Karenia brevis* blooms, or red tide. Forked Creek and the Myakka River were both high use areas during winter and spring (Figure 1), but had very few sightings during summer. During the spring/early summer, manatee distribution was widespread as they migrated through Sarasota County waters from their winter refuges (Figure 1). However, as summer continued, prolonged and re-occurring red tide events in the north areas of the county may have shifted manatee distribution further south (Figure 2). In northern Sarasota County (Sarasota Bay to Siesta Key) lower than expected numbers of manatees were recorded in protected locations typically

considered high use areas for manatees during the warm season, such as Pansy Bayou, City Island Grass Flats (CIGF), Buttonwood Harbor, and North Roberts Bay. Figure 2 shows manatee sightings in Sarasota Bay and Roberts Bay decreasing as *K. brevis* blooms became more intense in this area during mid summer (July to September). Manatee sightings south of Roberts Bay, where the red tide was not as severe, continued increasing at this time. By later summer/early fall, there were high counts of *K. brevis* but no manatee sightings in north Sarasota Bay, including Buttonwood Harbor (Figure 3).

#### Photo-Identification:

From 6 October 2004 to September 30, 2005 192 surveys of 20 sites during 39 field days were completed (Appendix D). Over 3,500 digital and slide images taken during these sightings are currently being sorted and analyzed. Based on field documentation alone, cataloged animals from Sarasota Bay, Tampa Bay, Charlotte Harbor, Fort Myers, and Ten Thousand Island-Everglades were documented in Sarasota County waters this year. Field staff recognized at least 28 previously documented animals, 10 of which had repeated sightings in a 9 month period (Table 2). Two of these animals, SB004 “Boomerang” and SB021 “Jeni”, have been documented in Sarasota County waters since 1994.

Once all of the images have been sorted to determine if they are of known animals catalogued from previous years, sighting information will be entered into MIPS, a state-wide computerized database for manatee photo-identification data. Distinctive animals that are not identified as being catalogued in previous years will either be catalogued and entered in MIPS, or classified as “Distinct Unknown” (DU) and given a temporary

identification number. DU animals may then be matched to individual manatees in future summer field seasons, or to winter sightings in Tampa Bay or southwestern Florida.

**Discussion:**

Manatees have been shown to use Sarasota County waters in relatively high numbers, particularly during spring, when manatees are migrating to summer grounds from their winter refuges. During summer months manatees using Sarasota County waters may account for up to 10% of the population in the entire state. Aerial survey studies have shown that manatees in Sarasota County waters prefer particular locations, such as Pansy Bayou, CIGF, Hudson Bayou and North Roberts Bay. The 2005 year was an exception due to prolonged and re-occurring red tide events. Aerial survey data indicate a possible shift of manatees to the southern portions of Sarasota County during these months. A re-distribution of manatees away from these northerly locations hampered our photo-identification efforts, resulting in the expense of more field effort with fewer sighting observations. Despite this, photo-identification surveys of manatees documented distinct or catalogued manatees repeatedly in specific locations throughout the county. Upon completion of slide analyses, data will be used to update, expand, and improve the collaborative statewide scar catalog (MIPS), and establish sighting histories for new distinct individuals. These findings will allow policy and decision makers to develop plans that can protect both waterborne or coastal human activities and manatees.

## References

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Table 1. Manatee counts from Sarasota County aerial surveys for the 2004/2005 contract year.

<b>Survey Date</b>	<b># Adults</b>	<b># Calves</b>	<b>Total # Manatees</b>
10/29/2004	47	0	47
11/12/2004	67	3	70
1/28/2005	11	1	12
2/14/2005	15	2	17
2/22/2005	2	0	2
3/29/2005	22	1	23
4/5/2005	44	5	49
4/28/2005	47	3	50
5/3/2005	86	5	91
5/17/2005	105	5	110
6/9/2005	41	1	42
6/14/2005	85	4	89
7/1/2005	45	4	49
7/31/2005	65	2	67
8/18/2005	55	4	59
9/04/2005	38	2	40
9/16/2005	50	4	54

Table 2. MIPS cataloged and Distinct-Unknown (DU) animals identified in the field during the 2004/2005 contract year.

Date	Catalog ID	Name	Catalog Origin
8/18/2005	U1347	Astro	Ft. Myers
6/16/2005	SB004	Boomerang	Sarasota Bay
10/6/2004	TB212	Bumblebee	Tampa Bay
10/8/2004	TB212	Bumblebee	Tampa Bay
10/21/2004	TB212	Bumblebee	Tampa Bay
4/8/2005	SB009	Clyde	Sarasota Bay
6/16/2005	SB009	Clyde	Sarasota Bay
10/20/2004	DU723	DU723	Sarasota Bay
6/16/2005	DU723	DU723	Sarasota Bay
6/16/2005	DU780	DU780	Sarasota Bay
8/18/2005	DU816	DU816	Sarasota Bay
8/18/2005	CR379	Duck	Crystal River
5/13/2005	CH111	Georgia O' Keef	Charlotte Harbor
10/6/2004	SB138	Jalan	Sarasota Bay
10/14/2004	SB138	Jalan	Sarasota Bay
10/21/2004	SB138	Jalan	Sarasota Bay
6/16/2005	SB138	Jalan	Sarasota Bay
6/16/2005	SB023	Jeni	Sarasota Bay
5/19/2005	SB112	Manx	Sarasota Bay
6/16/2005	SB076	MereC LA	Sarasota Bay
6/16/2005	CH101	Pangea	Charlotte Harbor
5/16/2005	SB083	Penta	Sarasota Bay
8/18/2005	SB168	Phish	Sarasota Bay
10/7/2004	SB167	Pi	Sarasota Bay
10/8/2004	SB167	Pi	Sarasota Bay
10/21/2004	TNP020	Porter	Collier County
10/26/2004	TNP020	Porter	Collier County
10/26/2004	SB139	Pythagoras	Sarasota Bay
11/4/2004	SB139	Pythagoras	Sarasota Bay
10/14/2004	SB121	Raisin	Sarasota Bay
10/19/2004	SB121	Raisin	Sarasota Bay
11/4/2004	SB093	Seven	Sarasota Bay
6/9/2005	TB002	Slasher	Tampa Bay
9/16/2005	TB002	Slasher	Tampa Bay
8/18/2005	TB017	Tail	Tampa Bay
8/18/2005	SB050	Tanman	Sarasota Bay
6/16/2005	TB 150	TB150	Tampa Bay
11/4/2004	SB052	Tomo-Bella	Sarasota Bay
6/9/2005	SB052	Tomo-Bella	Sarasota Bay
9/2/2005	U1874	U1874	Ft. Myers
5/10/2005	SB058	Victoria	Sarasota Bay

Figure 1. Distribution of manatee sightings during winter (Jan – Feb; left) spring (March – May; middle) and summer/early fall (June – September; right) 2005.

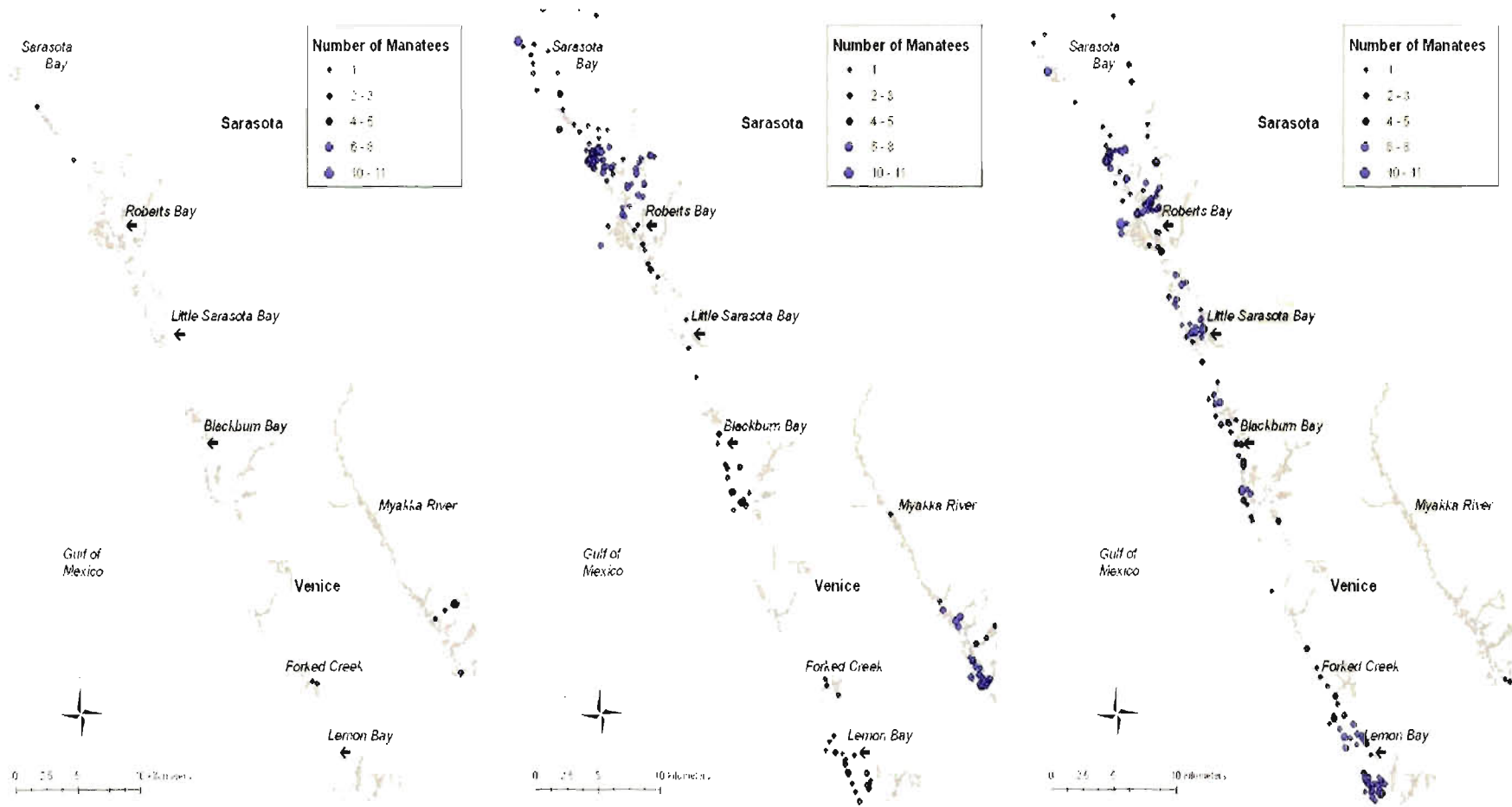


Figure 2. Manatee sightings in Sarasota Bay (triangles), Roberts Bay (diamonds) and locations south of Roberts Bay (squares) in relation to the presence of red tide (crosses) in Sarasota Bay. Monthly manatee sightings are summed sightings divided by the number of surveys flown that month. A sighting represents one or more manatees. *Karenia brevis* cell counts provided by the Red Tide Studies Group at Mote Marine Laboratory. Collection stations located at MML New Pass and bay docks.

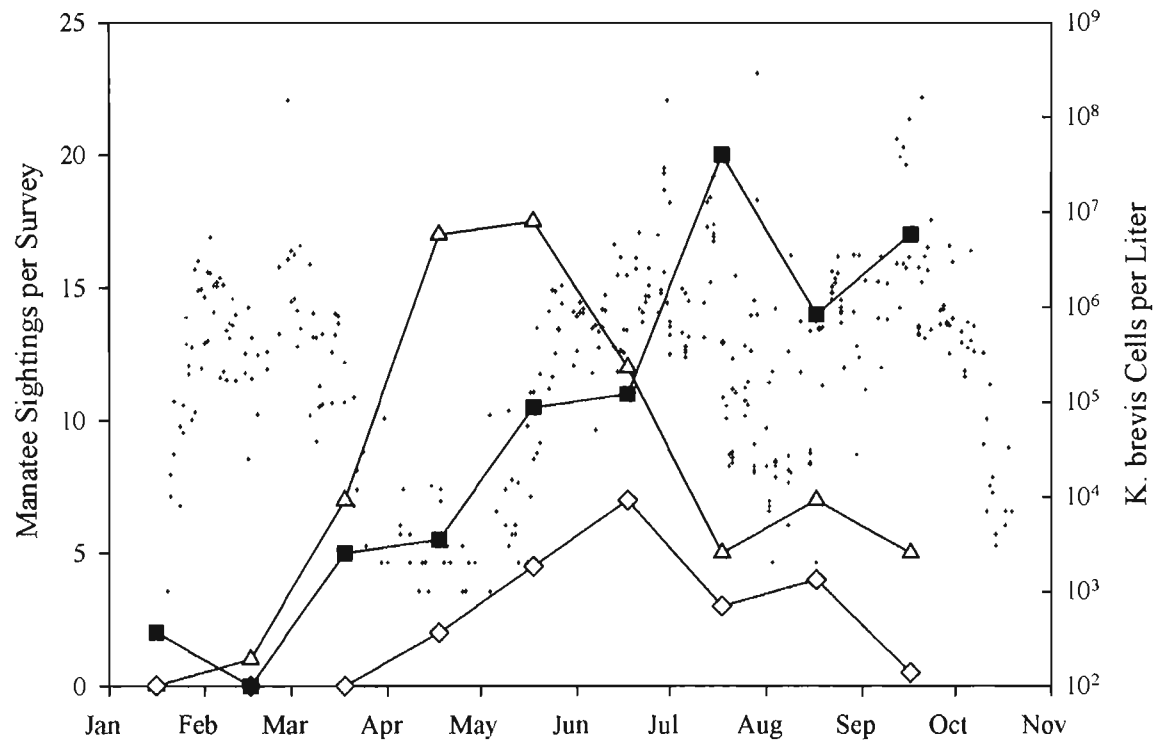
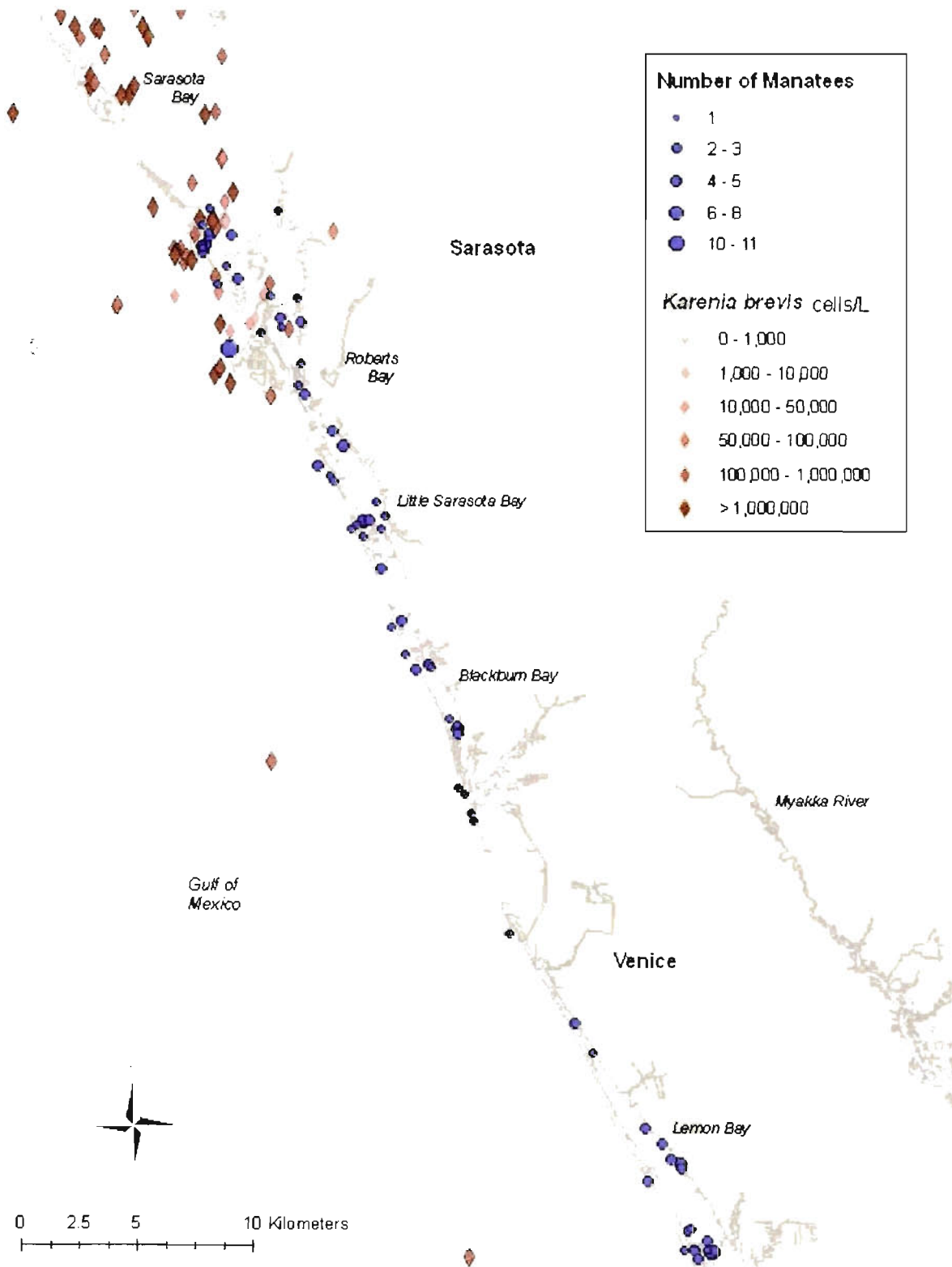


Figure 3. County-wide distribution of manatees and red tide: August - September 2005. Sampling effort for *Karenia brevis* in southern Sarasota County waters was less than that for the northern region, therefore cell counts might be underrepresented for these areas. *K. brevis* cell counts were provided by the Red Tide Studies Group at MML and the Florida Fish and Wildlife Conservation Commission.



Appendix A: Title page from Scolardi et al. manuscript submitted to the journal "Marine Mammal Science" in January 2006.

**Trends in counts of manatees (*Trichechus manatus latirostris*) from 1987-2004 in waters of Sarasota County, Florida**

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**ABSTRACT**

Aerial survey data from Sarasota County, Florida were analyzed to assess temporal trends in manatee counts between 1987 and 2004. The study area was divided into three primary regions: Sarasota Bay Region (SBR; N=324 surveys), Lemon Bay (N=339), and the Myakka River (N=180). Analysis of variance indicated that both year and season significantly affected manatee counts ( $p < 0.0001$ ) for all three regions. Mean counts within SBR and Lemon Bay significantly increased beginning midway through the survey period (1996) until 2001. In contrast, mean yearly counts within the Myakka River decreased over this time period. Winter counts within SBR and fall counts within the Myakka River showed little variation among years, as indicated by a significant interaction between season and year for these regions ( $p < 0.0001$ ). This was not true for Lemon Bay ( $p = 0.066$ ), as differences across years were apparent in all seasons. Manatees within Sarasota County utilized open bays primarily in the warmer months, and such usage could have been influenced by resource availability. Conversely, usage of the Myakka River peaked in cold winter months when manatees seek warm-water refugia such as Warm Mineral Springs. Calf proportions ranged between 0.03 (Myakka River, fall) to 0.11 (Lemon Bay, spring), and were seasonally dependent for each region.

Appendix B: Title page from Gannon et al. manuscript submitted to the Journal “Marine Mammal Science” in January 2006.

## **Habitat selection by manatees in Sarasota Bay, Florida**

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### **ABSTRACT**

Habitat selection by Florida manatees (*Trichechus manatus latirostris*) is influenced by the availability of food, thermal, and freshwater resources. However, habitat selection by female manatees with dependent calves may differ from other demographic groups with regard to the relative importance of these factors. Additional factors might also be important determinants of habitat selection for females with dependent calves. We examined distribution data from aerial surveys of the coastal waters near Sarasota, Florida, between 1994 and 2004 to determine whether habitat selection by groups of manatees containing calves was different from that of other groups. We characterized groups according to their location within seven habitat types, and further separated sightings by season. We used a Chi-square test to determine differences in habitat use by groups with calves and those without. Groups with calves exhibited significantly different habitat selection ( $P \leq 0.001$ ,  $\chi^2 = 43.0$ ,  $df = 6$ ), but this was not consistent across all seasons. However, during the winter and spring, the limiting factor (thermal requirements) influences manatees to such an extent that all demographic groups select habitat based on the same criteria. Further, mother-calf pairs exhibited habitat selection for a manatee “No Entry” refuge.

Appendix C: Poster presented at the 23<sup>rd</sup> Biennial Biology of Marine Mammals Conference, San Diego, California, December 12-16, 2005 (see included CD-ROM).





# Population Trends of Florida Manatees in Sarasota County Waters: Analysis of Aerial Survey Data from 1987 to 2004

## ABSTRACT

Aerial survey data from Sarasota County, Florida were analyzed to assess temporal and spatial trends in manatee counts between 1987 and 2004. Three primary regions were surveyed consistently: Sarasota Bay Region (SBR; N=324), Lemon Bay (LB; N=339), and Myakka River (MR; N=180). Analysis of variance (ANOVA) indicated that manatee counts within the three regions varied significantly among seasons and years ( $p < 0.0001$ ). Counts within both SBR and LB steadily increased midway through the survey period until 2000, and subsequently declined. The mean summer/fall count for SBR in 2000 was more than double the mean count from earlier survey years 1987-1995; however, winter counts for SBR remained low over the 18-year period. Variation in counts within LB among years was consistent for all seasons. Despite significant variation in spring and winter counts, mean yearly counts decreased steadily within MR from 1996 to 2003. Manatees within Sarasota County appear to utilize open bays primarily during the winter months, and such usage seems influenced by resource availability. Conversely, usage of MR peaks in cold winter months when manatees seek warm-water refugia.

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## INTRODUCTION

Florida manatees (*Trichechus manatus latirostris*) utilizing Sarasota County during non-winter months make up an important component of the manatee sub-population in southwestern Florida. Sarasota County contains 131 km<sup>2</sup> of water, much of it habitable by manatees. In fact, Nabor and Patton (1969) deduced from four years of aerial survey data that the rivers and inland bays of Sarasota County provide important feeding and resting areas for manatees during the summer, and serve as a travel corridor for manatees migrating to and from winter refuge sites in the fall and spring. The use of county waters by a substantial manatee population prompted the Sarasota County government to voluntarily join 12 other "key" counties with significant manatee populations in establishing best speed zones and developing a comprehensive Manatee Protection Plan (MPP), as directed by Florida's Governor and Cabinet in 1989. In addition to the MPP, prior Florida legislation enacted in 1985, informally known as the Growth Management Act, mandated local governments to develop growth management plans that accounted for habitat conservation and endangered species protection. To accomplish these tasks, the Sarasota County government has supported an ongoing, long-term aerial survey study of manatees in county waters, conducted by Mote Marine Laboratory, since 1987. Temporal trends in counts of manatees in Sarasota County between 1987 and 2004 are described here.

## ANNUAL VARIATION

### Sarasota and Adjacent Southern Bays (SBR)

- Manatee counts varied significantly among years ( $p < 0.0001$ ; Table 1)
- Mean counts increased beginning midway through the survey period (1996), continuing until 2000, and declined thereafter (Figure 2)
- Mean summer/fall count during 2001 (=46.7, 95% CI=37.7-56.8) double the 1987-1995 mean count (=19.2, 95% CI=15.7-22.9)
- No significant difference among years for winter ( $p = 0.81$ )

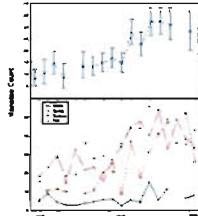


Figure 2. Mean counts with 95% confidence intervals (above) and categorized by season (below) for SBR over an 18-year period. Data for 1991 and 2002 are not represented due to conduct of fewer than 5 surveys for winter and spring seasons for these years. N=324 surveys.

### Lemon Bay (LB)

- Manatee counts varied significantly among years ( $p < 0.0001$ ; Table 1)
- Mean counts increased sharply from 1996 to 1999, and subsequently declined over the next two years (Figure 3)
- Mean counts increased in 2004
- No significant interaction between year and season ( $p = 0.066$ )

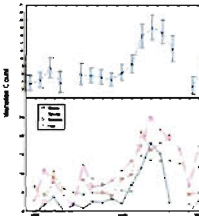


Figure 3. Mean counts with 95% confidence intervals (above) and categorized by season (below) for LB over an 18-year period. Data for 1991 and 2002 are not represented due to conduct of fewer than 5 surveys for winter and spring seasons for these years. N=339 surveys.

### Myakka River (MR)

- Manatee counts varied significantly among years ( $p < 0.0001$ ; Table 1)
- Mean counts decreased steadily from 1996 to 2003 (Figure 4)
- Mean counts increased in 2004
- Significant interaction effect between season and year ( $p < 0.0001$ )

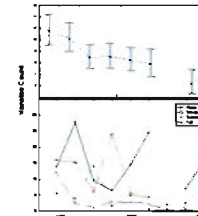


Figure 4. Mean counts with 95% confidence intervals (above) and categorized by season (below) for MR between 1996 and 2004. Data for 2002 are not represented due to conduct of fewer than 5 surveys for winter and spring seasons for these years. N=180 surveys.

## METHODS

### Survey

- Surveyed inshore and near-shore waters of Sarasota County from 1987 to 2004
- Flights conducted at an altitude of 200 m and a speed of 150 to 160 km/h using a single-engine, high-winged Cessna 172
- Employed extended area survey technique (Packard 1983)



Figure 1. Study area showing zones continuously surveyed over the 1987-2004 period. The shaded region on within zone 12 shows an area of MR not surveyed before 1996.

### Data treatment - Statistical analysis

- Zones grouped into three regions, from north to south: 1) Sarasota Bay Region (SBR; Zones 3 through 6); 2) Lemon Bay (LB; Zone 8); and 3) the Myakka River (MR; Zone 12)
- Total count of manatees used as an index of abundance
- Seasons defined as: winter (December-February), spring (March-May), summer (June-August) and fall (September-November)
- ANOVA used to examine temporal variation within SBR and LB for the years 1987-2004, and within MR for the years 1996-2004
- Pairwise comparisons between each of the four seasons using a Tukey's Honestly Significant Difference (HSD) test for unequal cell sizes (Sjöqvist & Stofsa 1973)

## SEASONAL VARIATION

### Sarasota and Adjacent Southern Bays (SBR)

- Manatee counts varied significantly among seasons ( $p < 0.0001$ ; Table 1)
- No significant difference between summer and fall counts (Figure 5)
- Highest counts during summer and fall, lowest during winter

### Lemon Bay (LB)

- Manatee counts varied significantly among seasons ( $p < 0.0001$ ; Table 1)
- Spring and summer counts did not differ significantly (Figure 5)
- Highest counts during fall, lowest counts during winter

### Myakka River (MR)

- Manatee counts varied significantly among seasons ( $p < 0.0001$ ; Table 1)
- No significant difference between summer and fall counts (Figure 5)
- Highest counts during winter, lowest counts during summer and fall

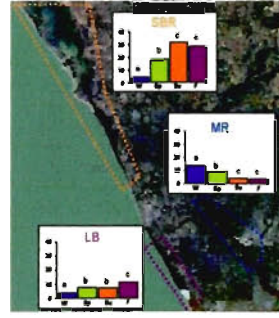


Figure 5. Mean or manatee counts across seasons for SBR, LB and MR. Letters indicate homogeneous groups determined using a Tukey's HSD test. Winter, Spring, Summer and Fall.

Table 1. Results from two-factor ANOVA for examining differences in manatee counts between season and year.

Year	Sarasota Bay Region			Lemon Bay			Myakka River					
	SS	DF	F	SS	DF	F	SS	DF	F			
Year	208.620	16	16.077	0.0000*	178.000	16	12.880	0.0000*	31.800	7	6.500	0.0000*
Season	708.880	3	86.415	0.0000*	61.560	3	28.282	0.0000*	84.464	3	28.177	0.0000*
Year*Season	148.076	48	2.882	0.0007*	53.826	48	1.378	0.0063	88.828	21	4.817	0.0000*

## CONCLUSIONS

Manatees use Sarasota County waters year-round; however, different regions assume differential importance seasonally. MR is most important during winter and early spring, when manatees congregate near the warm waters of Warm Mineral Springs. During late spring, summer and fall, manatees disperse into locations such as SBR and LB, where adequate forage, freshwater to drink, and quiet locations for females and calves are available. Annually, manatee counts varied significantly over time for all three regions. In SBR and LB, mean counts steadily increased between 1996 and 2000, but declined thereafter. In contrast, mean counts from 1996 to 2001 decreased within MR. Potential reasons for the changes in counts include the following: a) changes in primary observers; b) differences over time in water clarity or other factors that could make manatees more or less visible; and c) changes in use of Sarasota County waters by manatees. The first option is negated, as each primary observer is required to have extensive (> 30 hours) aerial survey experience. Alternatively, water clarity within Sarasota Bay increased beginning in the early 1990s due to reductions in point source pollution (Kurz et al. 1999, Johansson & Gressing 1999), which coincides with increased manatee counts within SBR and LB during this period. However, water clarity has remained good (Tomasko et al. 2005), but manatee counts have dropped since 2000. It is likely that use of Sarasota County waters by manatees has changed over time, due to either migration, or as a result of increases/decreases in the regional population of Florida manatees, or both. Increased manatee mortality in southwestern Florida (FWRI 2004) and losses in forage could account for the recent lower counts in all three regions. Sarasota County has consistently developed a Manatee Protection Plan based on scientific data regarding manatees and habitat; however, greater efforts may be needed to prevent further increases in mortality of manatees in the area.

## ACKNOWLEDGMENTS

We wish to thank all of the divers, pilots and observers who assisted in the study, including Angela Tidmore, Bud Perry, Jay Deering, Paul Haggitt, Lisa Lanning, Van Hahn, Barbara Johnson, Barbara Johnson, Jay Spalding, Gary Quisenberry, and others. We would also like to acknowledge Cliff Perry who piloted the manatee used survey program in 1987. Funding was provided through the Sarasota County Sealing Department Program, West Coast Island Sealing District, the Florida Fish and Wildlife Conservation Commission, and the manatee was kindly loaned by the Florida Fish and Wildlife Commission.



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Appendix D: Summary of photographic identification effort in Sarasota County from 6 October 2004 to Sept 30, 2005.

Date	Location	On Survey Time		Observation Time		Weather	Conditions	Water Temp(°C)	Surface Salinity	Total Manatees		# Photographers	
		Start	End	Start	End					Min	Max	Min	Max
10_06_04	CIGF, N	1000	1010			Clear	Fair			0	0	0	0
10_06_04	CIGF, W	1011	1016			Clear	Fair			0	0	0	0
10_06_04	Pansy Bayou	1017	1141	1031	1036	PC	Good	31.2	34	7	7	6	7
10_06_04	CIGF, S	1142	1156			PC	Fair			0	0	0	0
10_06_04	CIGF, E	1157	1206			PC	Fair			0	0	0	0
10_06_04	CIGF, N	1207	1212			PC	Fair			0	0	0	0
10_07_04	Pansy Bayou	1000	1030	1000	1030	PC	Poor	30.1	34	4	6	2	3
10_08_04	Pansy Bayou	943	1026	943	1026	PC	Good	28.2	34	6	7	6	7
10_14_04	CIGF, N	901	954	901	954	PC	Good	27.4	34	2	4	1	2
10_14_04	CIGF, W	955	1004	955	1004	PC	Good						
10_14_04	Pansy Bayou	1005	1116	1014	1113	Clear	Good	27.7	32	4	5	3	3
10_14_04	CIGF, S	1117	1154	1139	1145	Clear	Good	27.1	33	1	4	1	1
10_14_04	CIGF, E	1154	1203			PC	Fair			0	0	0	0
10_14_04	CIGF, N	1204	1210			PC	Fair			0	0	0	0
10_19_04	CIGF, N	1024	1034			PC	Fair			0	0	0	0
10_19_04	CIGF, W	1035	1040			PC	Fair			0	0	0	0
10_19_04	Pansy Bayou	1041	1217	1045	1213	MC	Good	27.9	34	6	6	5	5
10_19_04	CIGF, W	1208	1223	1218	1223								
10_19_04	CIGF, N	1224	1231			PC	Fair			0	0	0	0
10_20_04	CIGF, N	1147	1156			Clear	Good			0	0	0	0
10_20_04	CIGF, W	1158	1202			Clear	Good			0	0	0	0
10_20_04	Pansy Bayou	1203	1230	1204	1229	PC	Good	29.9	32	5	7	4	6
10_20_04	CIGF, W	1231	1233			Clear	Good			0	0	0	0
10_20_04	CIGF, N	1234	1241			Clear	Good			0	0	0	0
10_21_04	CIGF, N	939	949			PC	Fair			0	0	0	0
10_21_04	CIGF, W	950	954			PC	Fair			0	0	0	0
10_21_04	Pansy Bayou	955	1154	959	1152	Clear	Good	29.0	34	15	18	13	16
10_21_04	CIGF, W	1154	1201			Clear	Good			0	0	0	0
10_21_04	CIGF, N	1202	1210			Clear	Good			0	0	0	0
10_26_04	CIGF, N	1006	1013			Clear	Fair			0	0	0	0
10_26_04	Marina Jack	1019	1031			Clear	Fair			0	0	0	0
10_26_04	CIGF, S	1035	1051			Clear	Fair			0	0	0	0
10_26_04	Pansy Bayou	1052	1120	1053	1120	Clear	Good	28.1	36	6	9	4	4
10_26_04	CIGF, W	1121	1130			Clear	Good			0	0	0	0
10_26_04	CIGF, N	1131	1140			Clear	Fair			0	0	0	0
10_28_04	CIGF, N	926	935			Clear	Fair			0	0	0	0

10\_28\_04 CIGF, W 936 939 Clear Fair 0 0 0 0

Appendix D (continued): Summary of photographic identification effort in Sarasota County from 6 October 2004 to Sept 30, 2005.

Date	Location	On Survey Time		Observation Time		Weather	Conditions	Water Temp(°C)	Surface Salinity	Total Manatees		# Photographers	
		Start	End	Start	End					Min	Max	Min	Max
10_28_04	Pansy Bayou	940	1027	946	1016	Clear	Fair			2	2	2	2
10_28_04	CIGF, W	1033	1039			Clear	Good			0	0	0	0
10_28_04	CIGF, N	1040	1052			Clear	Fair			0	0	0	0
11_04_04	CIGF, N	1024	1128	1029	1126	Clear	Fair			9	11	8	9
11_04_04	CIGF, W	1129	1134			PC	Fair			0	0	0	0
11_04_04	Pansy Bayou	1135	1218	1137	1213	Clear	Fair			3	3	2	2
11_04_04	CIGF, W	1219	1224			PC	Fair			0	0	0	0
11_04_04	CIGF, N	1225	1234			PC	Fair			0	0	0	0
11_10_04	CIGF, N	1120				PC	Fair			0	0	0	0
11_12_04	Otter Key	1220	1257	1230	1257	PC	Fair			2	2	2	2
04_08_05	Pansy Bayou - Bridge	1530	1608	1530	1608	Clear	Good	27.2	37	1	1	1	1
04_12_05	CIGF, Mote Dock	1550	1645	1550	1645	PC	Good	27.2	38	1	1	1	1
04_29_05	Pansy Bayou	1213	1240	1216	1240	Clear	Excellent	24.3		3	4	1	1
05_10_05	CIGF, E	1000	1020			Clear	Excellent						
05_10_05	Hyatt Boat Basin	1030	1040			Clear	Excellent						
05_10_05	Harbor Acres, N.	1053	1145	1058	1125	Clear	Excellent						
05_10_05	Hudson Bayou	1147	1208	1158	1208	Clear	Excellent						
05_10_05	San Remo	1226	1242			Clear	Excellent						
05_10_05	CIGF, S	1340	1400			Clear	Good						
05_10_05	CIGF, W	1400	1509			Clear	Good						
05_15_05	Pansy Bayou	1109	1141			Clear	Excellent		38	0	0	0	0
05_17_05	CIGF, N	937	1010			Clear	Good						
05_17_05	Pansy Bayou	1010	1049	1010	1040	Clear	Good						
05_17_05	CIGF, W	1049	1100			PC	Fair						
05_17_05	CIGF, N	1100	1120			PC	Fair						
05_17_05	Sarasota Bay, S	1222	1243			PC	Fair						
05_17_05	San Remo	1243	1258			PC	Fair						
05_17_05	Sarasota Bay, S	1300	1320			PC	Fair						
05_17_05	Otter Key	1320	1351			PC	Fair						
05_17_05	CIGF, S	1354	1439			PC	Fair						
05_17_05	CIGF, W	1439	1516	1450	1509	PC	Fair						
05_17_05	CIGF, N	1516	1532			PC	Fair						
05_19_05	Pansy Bayou	1315	1340			PC	Good						
05_19_05	LBK, Dock On The Bay	1400	1420	1400	1420	PC	Fair						
05_26_05	Pansy Bayou	1400	1410			Rainy	Fair	28.2	36	0	0	0	0
05_26_05	LBK, Dock On The Bay	1430	1448			PC	Fair	28.2	35	0	0	0	0

05_31_05	LBK, Dock On The Bay	1446	1501			PC	Good	30.4	34	0	0	0	0
06_07_05	Pansy Bayou - Bridge	1325	1339			PC	Good	31.0	31	0	0	0	0

Appendix D (continued): Summary of photographic identification effort in Sarasota County from 6 October 2004 to Sept 30, 2005.

Date	Location	On Survey Time		Observation Time		Weather	Conditions	Water Temp(°C)	Surface Salinity	Total Manatees		# Photographers	
		Start	End	Start	End					Min	Max	Min	Max
06_07_05	Pansy Bayou	1345	1401	1347	1401	PC	Good	31.8	31	1	1	0	0
06_07_05	Hudson Bayou	1410	1424			PC	Good	32.9	10	0	0	0	0
06_07_05	LBK, Dock On The Bay	1503	1517			PC	Good	31.9	32	0	0	0	0
06_07_05	LBK, 4500 Gulf of Mexico Dr.	1525	1633	1526	1633	PC	Good	31.8	33	7	10	8	9
06_08_05	Pansy Bayou - Bridge	1040	1101			Clear	Good	30.2	34	0	0	0	0
06_08_05	Pansy Bayou	1108	1122			Clear	Good	30.8	32	0	0	0	0
06_09_05	CIGF, N	930	940			PC	Fair			0	0	0	0
06_09_05	CIGF, W	940	1045	940	1033	MC	Fair	28.9	30.5	5	8	4	6
06_09_05	CIGF, S	1045	1105			MC	Poor			0	0	0	0
06_09_05	S. Sarasota Bay, near Harbor Acres	1114	1200			MC	Poor			0	0	0	0
06_09_05	N. Roberts Bay, NW												
06_09_05	Edwards Islands	1205	1225			MC	Fair	29.8	25	0	0	0	0
06_09_05	Netti Bayou	1225	1240			MC	Fair	30.0	25	0	0	0	0
06_09_05	S. Sarasota Bay/North of Siesta Br.	1255	1305			MC	Fair	29.8	30	0	0	0	0
06_09_05	N. Roberts Bay, NW												
06_09_05	Edwards Islands	1405	1515	1412	1515	MC	Fair	31.1	24	7	12	7	12
06_14_05	CIGF, N	1200	1250	1242	1300	PC	Good	32.3	34	2	2	2	2
06_14_05	CIGF, W	1250	1300			PC	Good						
06_14_05	CIGF, S	1310	1330			PC	Good						
06_14_05	N. Roberts Bay, NW												
06_14_05	Edwards Islands	1350	1615	1416	1615	PC	Good	32.6	15	9	12	5	13
06_15_05	CIGF, N	904	915			PC	Fair			0	0	0	0
06_15_05	CIGF, W	916	923			PC	Fair			0	0	0	0
06_15_05	CIGF, S	924	943			PC	Fair	31.5	32	0	0	0	0
06_15_05	CIGF, E	944	1050	959	1042	PC	Fair			3	3	2	2
06_15_05	W. Roberts Bay	1100	1301			PC	Fair			0	0	0	0
06_15_05	CIGF, E	1311	1328			PC	Fair			0	0	0	0
06_15_05	CIGF, N	1329	1317										
06_16_05	Pansy Bayou	1429	1501	1429	1501	Clear	Good						
06_16_05	Pansy Bayou	1507	1528	1510	1526	Clear	Good						
06_24_05	CIGF, N	906	921			PC	Good						
06_24_05	CIGF, W	922	925			PC	Good						
06_24_05	Pansy Bayou	926	954			PC	Fair						

06_24_05	CIGF, S	955	1015	MC	Fair
06_24_05	Roberts Bay, W	1044	1100	PC	Fair
06_24_05	Cocoanut Bayou	1101	1115	PC	Fair

Appendix D (continued): Summary of photographic identification effort in Sarasota County from 6 October 2004 to Sept 30, 2005.

Date	Location	On Survey Time		Observation Time		Weather	Conditions	Water Temp(°C)	Surface Salinity	Total Manatees		# Photographers	
		Start	End	Start	End					Min	Max	Min	Max
06_24_05	Netti Bayou	1116	1135			PC	Fair						
06_24_05	Roberts Bay, W	1136	1203			PC	Fair						
06_24_05	LBK, Dock On The Bay LBK, 4500 Gulf of Mexico	1023	1043	1027	1043	PC	Fair	28.9	34	3	4	0	0
06_24_05	Dr.	1053	1111			PC	Fair	28.3	32	0	0	0	0
06_24_05	Pansy Bayou	1354	1404			MC	Fair	30.7	34	0	0	0	0
06_24_05	Pansy Bayou - Bridge	1408	1420			MC	Poor	28.7	32	0	0	0	0
07_01_05	CIGF, N	942	954			PC	Good			0	0	0	0
07_01_05	CIGF, W	754	1003			PC	Good			0	0	0	0
07_01_05	Pansy Bayou	1003	1105			PC	Good	30.4	33.1	0	0	0	0
07_01_05	CIGF, S	1105	1115			Clear	Fair			0	0	0	0
07_01_05	Roberts Bay, N	1200	1222			PC	Good			0	0	0	0
07_01_05	Cocoanut Bayou	1222	1352	1222	1343	PC	Good	33.1	13	7	10	6	9
07_01_05	Roberts Bay, N	1352	1403			PC	Good			0	0	0	0
07_07_05	LBK, Dock On The Bay LBK, 4500 Gulf of Mexico	1510	1521			PC	Good	33.5	31	0	0	0	0
07_07_05	Dr. LBK, 3960 Gulf of Mexico	1530	1536			PC	Good	32.9	30	0	0	0	0
07_07_05	Dr.	1539	1544			PC	Good	32.9	30	0	0	0	0
07_07_05	Pansy Bayou	1556	1524	1556	1524	PC	Good	34.4	30	2	2	2	2
07_11_05	Pansy Bayou	1125	1139			PC	Good	28.2	30	0	0	0	0
07_11_05	Pansy Bayou - Bridge	1143	1156			PC	Good	30.1	31	0	0	0	0
07_11_05	LBK, Dock On The Bay LBK, 4500 Gulf of Mexico	1245	1251			PC	Good	30.5	30	0	0	0	0
07_11_05	Dr. N. Roberts Bay, NW	1300	1322	1300	1322	PC	Fair	29.8	28	1	3	0	0
07_15_05	Edwards Islands	949	1004			Clear	Good			0	0	0	0
07_15_05	Netti Bayou	1004	1016			PC	Good			0	0	0	0
07_15_05	Cocoanut Bayou	1019	1043			PC	Good			0	0	0	0
07_15_05	Roberts Bay, W	1043	1104			PC	Good			0	0	0	0
07_15_05	Roberts Bay, E	1104	1112			PC	Good			0	0	0	0
07_15_05	San Remo	1115	1140			PC	Good	33.0	12	0	0	0	0
07_15_05	Harbor Acres, S.	1152	1208			PC	Good	33.8	27	0	0	0	0
07_15_05	Harbor Acres, N.	1211	1222			PC	Good	35.2	26	0	0	0	0
07_15_05	Hudson Bayou	1226	1236			MC	Good	32.2	18	0	0	0	0

07_15_05	CIGF, S	1257	1328			PC	Good	33.2	29	0	0	0	0
07_15_05	CIGF, W	1329	1339			PC	Good	34.2	30	0	0	0	0
07_15_05	Pansy Bayou	1340	1452	1356	1445	PC	Good	32.1	30	8	10	8	10
07_22_05	CIGF, N	940	955			clear	Excellent	32.0	30	0	0	0	0

Appendix D (continued): Summary of photographic identification effort in Sarasota County from 6 October 2004 to Sept 30, 2005.

Date	Location	On Survey Time		Observation Time		Weather	Conditions	Water Temp(°C)	Surface Salinity	Total Manatees		# Photographer	
		Start	End	Start	End					Min	Max	Min	Max
07_22_05	CIGF, W	955	1009			clear	Excellent	32.0	30	0	0	0	0
07_22_05	Pansy Bayou - Grassflats	1009	1115	1027	1052	clear	Excellent	31.9	29	0	0	0	0
07_22_05	CIGF, W	1115	1120			clear	Excellent	31.9	29	3	3	3	3
07_22_05	CIGF, S	1120	1135			clear	Excellent	32.4	26	0	0	0	0
07_22_05	N. Roberts Bay, NW Edwards Islands	1145	1205			clear	Good	32.1	26	0	0	0	0
07_22_05	Cocoanut Bayou	1205	1220			clear	Excellent	32.2	28	0	0	0	0
07_22_05	Cocoanut Bayou	1220	1318	1220	1310	clear	Good	32.4	18	6	7	2	4
07_22_05	Roberts Bay, Skiers Island	1318	1325			clear	Good	32.4	17	0	0	0	0
07_31_05	CIGF, S-SW	958	1032			PC	Good	31.5	30	2	2	2	2
07_31_05	Otter Key, S - grassbed Cocoanut Bayou - grass flats	1100	1131			PC	Good	31.6	29	2	2	2	2
07_31_05	E. Little Sara Bay, near Midnight Pass	1243	1304			Clear	Good			1	1	0	0
07_31_05	Little Sara Bay, N. of Turtle Beach	1418	1445			Clear	Good		15	0	0	0	0
07_31_05	NE of Marker #45	1500	1504			Clear	Good			0	0	0	0
07_31_05	SE of Marker #47	1510	1525			Clear	Good	33.6	15	4	6	0	0
08_11_05	LBK, Dock On The Bay	1526	1550			Clear	Excellent	32.5	30	0	0	0	0
08_11_05	Pansy Bayou	1053	1105			PC	Good	33.8	29	0	0	0	0
08_11_05	Pansy Bayou - Bridge	1430	1445			PC	Good	32.6	25	0	0	0	0
08_18_05	Big Pass, N of Mkr 11	1448	1502			PC	Good	32.6	25	0	0	0	0
08_18_05	CIGF, S	1035	1130	1050	1130	Clear	Excellent	33.0	26	11	11	10	11
08_18_05	CIGF, S	1155	1225	1204	1221	PC	Good	33.1	29	1	1	1	1
08_18_05	Pansy Bayou	1225	1341	1229	1341	PC	Good	34.8	29	7	7	6	6
09_02_05	CIGF, N	1015	1022			PC	Good						
09_02_05	CIGF, W	1022	1039			PC	Good						
09_02_05	CIGF, S	1039	1054			PC	Good						
09_02_05	N. Roberts Bay, NW Edwards Islands	1112	1120			PC	Good						
09_02_05	Cocoanut Bayou	1120	1146			PC	Good						
09_02_05	Netti Bayou	1146	1156			PC	Good						
09_02_05	Roberts Bay, E	1156	1210			PC	Good						

09_02_05	Roberts Bay, S	1213	1223			PC	Good						
09_02_05	Sarasota Bay, S	1233	1312	1233	1312	PC	Good	32.2	35	4	4	4	4
09_02_05	OKC	1331	1350			PC	Good						
09_02_05	CIGF, E	1352	1359			MC	Fair	32.1	35				
09_02_05	CIGF, N	1359	1410			MC	Fair	32.1	35				
09_16_05	Hyatt Boat Basin	1015	1049	1027	1049	Clear	Good	30.6	35	1	1	0	0

Appendix D (continued): Summary of photographic identification effort in Sarasota County from 6 October 2004 to Sept 30, 2005.

Date	Location	On Survey Time		Observation Time		Weather	Conditions	Water Temp(°C)	Surface Salinity	Total Manatees		# Photographers	
		Start	End	Start	End					Min	Max	Min	Max
09_16_05	Otter Key	1116	1150	1137	1150	Clear	Fair	30.1	35	1	1	1	1
09_16_05	Midnight Pass	1145	1401	1256	1401	PC	Fair	30.1	29	8	10	5	8
09_27_05	CIGF, N	945	957			Clear	Excellent	29.5	36				
09_27_05	CIGF, W	957	1006			Clear	Excellent						
09_27_05	Pansy Bayou	1006	1102			PC	Good	30.2	35				
09_27_05	CIGF, W	1102	1107			PC	Excellent						
09_27_05	CIGF, S	1107	1119			PC	Excellent						
09_27_05	OKC/Sailing Squadron	1119	1123			PC	Excellent						
09_27_05	Otter Key	1123	1203			Clear	Excellent						
09_27_05	Big Pass to N Siesta Grass Beds	1203	12221			Clear	Excellent	30.2	25				
09_27_05	N. Roberts Bay, NW					Clear	Excellent						
09_27_05	Edwards Islands	1222	1242			Clear	Excellent						
09_27_05	N. Roberts Bay, entrance to					Clear	Excellent						
09_27_05	Nettie Bayou	1242	1250			Clear	Excellent						
09_27_05	Cocoanut Bayou	1250	1310			Clear	Excellent	31.2	30				
09_27_05	San Remo	1320	1337			Clear	Excellent	31.2	30				
09_27_05	S. Sarasota Bay, near					Clear	Excellent						
09_27_05	Harbor Acres	1347	1357			Clear	Excellent						
09_27_05	Hudson Bayou	1400	1420			Clear	Excellent						

