

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 warmer 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 subpopulation in southwestern Florida. Sarasota County contains 131 km² of water, much of it habitable by manatees. In fact, Nabor and Patton (1989) 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 boat 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.

METHODS

Surveys

- Surveys inshore and near-shore waters of Sarasota County from 1987 to 2004
- Flights conducted at an altitude of 230 m and a speed of 150 to 160 km/h using a single-engine, high-winged Cessna 172
- Employed extended area survey technique (Packard 1985)



Figure 1. Study area showing zones consistently surveyed over the 1987-2004 period. The shaded region 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 (Sjotvoll & Stolne 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

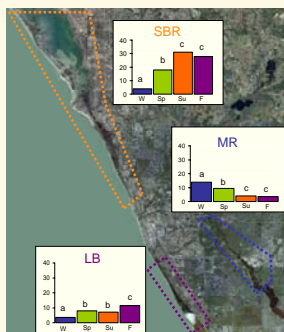


Figure 5. Mean manatee counts across seasons for SBR, LB and MR. Letters indicate homogeneous groups determined using a Tukey's HSD test. W=winter, Sp=spring, Su=summer and F=fall.

ANNUAL VARIATION

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 ($p = 0.066$)

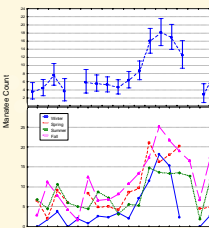


Figure 3. Mean counts with 95% confidence intervals (above) and categorized by season (below) for LB over an 18-year period. Data for 1991 and 2002 are not represented due to conduct of fewer than 5 surveys for winter and spring seasons for these years. N= 339 surveys.

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 ($p < 0.0001$)

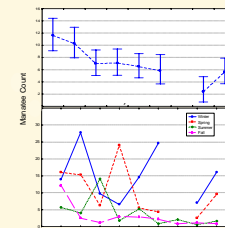


Figure 4. Mean counts with 95% confidence intervals (above) and categorized by season (below) for MR between 1996 and 2004. Data for 2002 are not represented due to conduct of fewer than 5 surveys for winter and spring seasons for these years. N= 180 surveys.

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	DOF	F	p-value	SS	DOF	F	p-value	SS	DOF	F	p-value
Season	230.628	15	10.077	0.0000*	176.696	15	13.880	0.0000*	31.999	7	5.108	0.0000*
Year	368.068	3	80.415	0.0000*	51.567	3	20.255	0.0000*	94.444	3	35.177	0.0000*
Year*Season	140.870	45	2.052	0.0000*	52.625	45	1.378	0.0663	90.520	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 & Greening 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 emigration, 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 commendably 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.

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