

Manatee Data Review and Summary for Western Pinellas County

November 2013

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A. Overview of Data Analysis

1. Notes on data analysis and data sources

- a. For this review, “western Pinellas County” means the portion of Pinellas County west of the Skyway Bridge, extending past the north end of the county to include small portions of St. Joseph Sound and the Anclote River in Pasco County.
- b. For purposes of analyzing and summarizing data, western Pinellas County was divided into a North Region and a South Region, with each region subdivided into four zones (**Figure 1**). The zones in the North Region were: Anclote River Area; North of Honeymoon Island Causeway; Honeymoon Island Causeway to Clearwater Causeway; and, Clearwater Causeway to Indian Rocks Causeway. The Anclote River Area and North of Honeymoon Island Causeway zones include small parts of southern Pasco County. The zones in the South Region were: Indian Rocks Causeway to Stuart Causeway; Stuart Causeway to Treasure Island Causeway; Treasure Island Causeway to Pinellas Bayway; and, South of Pinellas Bayway. The South of Pinellas Bayway zone includes a very small portion of Hillsborough County and a small area east of the Skyway Bridge.
- c. Because manatee use of western Pinellas County varies significantly by season, data were analyzed using a cold season (Nov – Mar) and a warm season (Apr – Oct) rather than as combined year-round data.
- d. The primary data used in this review are listed below and/or discussed in the following sections. Other data that are not discussed in this document were also considered as needed, such as manatee telemetry data, bathymetry data, locations of channel markers, etc.
- e. The manatee distribution data used in this review were collected between 2008 and 2010 using aerial surveys.
- f. The boating data used in this review were collected between September 2008 and August 2009 using aerial surveys.
- g. Manatee mortality data have been collected since 1974. Data through December 2012 were used for this review. Data for 2012 were preliminary.
- h. Concerted efforts have been made since the mid 2000s to maintain a database of manatee-boat collisions that are not associated with a manatee death (reported by the boat operator or a witness). There are currently 147 reports in the database (statewide). The earliest documented report is from 1987 but only six of the reports are from before 2005.
- i. A database for manatee rescues has been maintained since the early 1990s. The database includes records for earlier events as available. There are currently 1468 records in the database (statewide), with 285 due to injuries caused by boat collisions. The earliest record in the database is from July 1948.
- j. Seagrass data are from the Southwest Florida Water Management District. The most recent data for Pinellas County are for 2012 while data for Pasco County are for 2007.
- k. The locations and types of existing state boating safety regulations are from the FWC Division of Law Enforcement while information on existing local (county and city) regulations are from Pinellas County. Currently, there are no federal boating regulations in western Pinellas County. All of the existing regulations in western Pinellas County are for boating safety or general resource protection. Manatee protection is not an official purpose of any of the existing zones.

2. Notes on manatee aerial survey data

- a. The data do not account for manatees that may have been present but not counted during the surveys due to a variety of potential survey biases (e.g., detection and availability biases). These biases can and likely do vary spatially and temporally so counts should not be assumed to represent the absolute number of manatees that were using the area when the surveys were flown. Failure to account for the biases (which cannot be done after-the-fact given the survey design) limits how much significance should be placed on the results. This same situation exists in almost all other areas where data have been collected. Nevertheless, we believe the data are still useful in assessing the relative abundance and distribution of manatees and potential changes over time.
- b. The 2008-10 manatee data were collected during 47 surveys, flown between August 2008 and August 2010. The same protocols and general survey route were used for all surveys. With the exception of a few portions of

central St. Joseph Sound, almost all of western Pinellas County was included in the surveys (**Figure 2**). A total of 29 manatees that were seen in the nearshore waters of the Gulf of Mexico were not included in the analyses.

- c. The manatee data are shown on maps using two different display methods. The first method shows each sighting as one point, with the symbol size graduated based on group size (i.e., the number of manatees recorded at the point). The second method displays the data as a density cover. The point data were transformed into a density cover in ArcGIS using the kernel density tool with a cell size of 25 meters and a search radius of 325 meters. The density cover was then divided by the number of surveys to create a density per survey cover. The kernel density tool uses a quadratic formula to transform each sighting into a smoothly tapered surface with the highest density value in the 25 meter by 25 meter cell where the sighting occurred and a diminishing density with increasing distance from the point (reaching zero at the edge of the search radius). As an example, if density was calculated for a group of four manatees seen at one point, the calculated density at a cell half of the search radius away (162.5 meters from the point) would be about half of what it was in the cell where the group was seen (i.e., the same as if two manatees had been seen in this cell). For display purposes, the range of density values was divided into five categories based on how each cell value compared to the overall mean density for all of western Pinellas County, with the lowest category including only areas with a density of zero. The breakpoints calculated for the warm season were used for all density maps so that the same colors represent the same densities on all maps.

3. Notes on boat aerial survey data

- a. The 2008-09 boat data were collected during a total of 16 surveys, flown between September 2008 and August 2009. Surveys were split evenly between weekdays and weekends. One survey was flown on a holiday (Memorial Day, 2009). The same protocols and survey route were used for all surveys. With the exception of the eastern portion of the Anclote River, all of western Pinellas County was included in the surveys. A total of 8687 boats were recorded.
- b. The boat data used in the manatee-boat spatial overlap analysis (see below) was a subset of the overall dataset. Not included in the analysis were the following categories of boats: Type = BG (barges); Type = KC (canoes and kayaks); and, Type = Sailboat and Size < 16 feet (predominately unpowered sailboats). There were 1091 boats in these excluded groups. The reduced subset ("All Boats") included a total of 7596 boats.
- c. The "All Boats" dataset was further subdivided to create a "Fast Boats" dataset, which included only boats with Speed = Plowing/Cruising, or Planing. The Fast Boats dataset included a total of 1854 boats (24% of the All Boats dataset).
- d. The boat data are displayed on maps that show each boat as a point, with different colors used to differentiate between "fast boats" and all other boats. Density covers were also created for the boat data (using the same process as was used for the manatee data) for use in the manatee-boat spatial overlap analysis but maps of boat density were not prepared.

4. Notes on manatee-boat spatial overlap

- a. Manatee-boat spatial overlap values were calculated by multiplying the per survey manatee density cover by the per survey boating density cover.
- b. Two spatial overlap covers were created for each season, one using the All Boats dataset ("*Overlap*") and one using just the Fast Boats dataset ("*Fast Overlap*"), as described above. The ratio of Fast Overlap to Overlap gives an indication of how much of the overall overlap was the result of boats traveling at higher speeds.
- c. For display purposes, the range of overlap values was divided into five categories based on how each cell value compared to the overall mean overlap value for all of western Pinellas County, with the lowest category including only areas with no manatee-boat overlap. The breakpoints calculated for the warm season "All Boats" overlap were used for all overlap maps so that the same colors represent the same values on all maps.

5. Notes on manatee mortality data, reported boat strikes, and rescues

- a. Each data point in the mortality database represents the location where a carcass was recovered and not necessarily the location where a manatee died. In many cases, winds and currents can move a carcass after a manatee has died and, in the case of boat-related deaths, if a manatee is not killed immediately it can move under its own power before ultimately succumbing to its injuries. Depending on the nature and extent of the injuries, manatees can sometimes survive for days or weeks (and occasionally even months) after being hit by a boat. For these reasons, care should be taken when interpreting these data because the absence of data points cannot be assumed to mean no deaths occurred and vice versa.

- b. The recovery locations of the boat-related deaths are displayed on maps, with different colors used to differentiate between the cold and warm seasons.
- c. There currently are 31 manatee deaths (statewide) associated with known boats (i.e., the boats, locations, and circumstances were reported and confirmed) and 15 deaths where the responsible boat is suspected but not known for certain. None of these deaths occurred in western Pinellas County.
- d. Many reported manatee-boat collisions that are not associated with a manatee death are unconfirmed because it is often difficult to find the manatee (and sometimes the boat) that was reportedly involved. Even if the manatee is found, it can be difficult to confirm that a collision occurred unless there are visible injuries.
- e. The rescue database includes a unique record for each rescue, assist and release, and unsuccessful rescue attempt, as well as for each captive-born manatee and each manatee that was incidentally captured during attempts for other manatees. The same manatee can be the subject of multiple records. Therefore, the number of records in the database does not reflect the total number of manatees that have been rescued. Discussions of the rescue data in this document only address manatees that were rescued due to injuries related to a boat collision, and only if the manatee did not subsequently die as a result of the injuries. Manatees that were rescued but later died are included in the mortality data.

B. Data Summary for Overall Area

1. Manatee aerial survey data

- a. The mean number of manatees seen for all of western Pinellas County was 35.7 per survey over all surveys. This represents a mean density of 0.18 manatees per km² per survey. The mean manatee density for the warm season was 0.22 (43.3 manatees per survey), while it was 0.13 (24.5 manatees per survey) for the cold season. **Table 1** summarizes the aerial survey data by zone and season.
- b. Manatee density in the South Region (0.26) was over twice as high as it was in the North Region (0.11) over all surveys. The difference was greater for the warm season (2.9 times greater) than it was for the cold season (1.46 times greater).

2. Manatee-boat spatial overlap

- a. The mean overall All Boats spatial overlap value ("*Overlap*") and the mean overall Fast Boats spatial overlap value ("*Fast Overlap*") were over 7 times and 13 times greater, respectively, for the warm season (Overlap = 0.49; Fast Overlap = 0.11) than the corresponding values for the cold season (Overlap = 0.07; Fast Overlap = 0.01). **Table 2** summarizes the spatial overlap analysis results by zone and season.
- b. The overall Overlap Ratio (Fast Overlap to Overlap) was greater for the warm season (0.22) than it was for the cold season (0.12).
- c. These data suggest the overall boating risk to manatees is substantially higher during the warm season and that fast boats also represent a higher proportion of the risk during this time.

3. Manatee mortality, reported boat strikes, and rescues

- a. 124 carcasses were recovered in the western Pinellas County area through 2012, with 78 (63%) recovered during the warm season and 46 (37%) recovered during the cold season. (The warm season accounts for 58% of the year while the cold season accounts for 42%.) The "boat-related" category had the most deaths (45). "Perinatal" and "Other Natural" deaths were the next two highest categories, with 27 and 21 deaths, respectively. **Table 3** summarizes the mortality data by zone and season.
- b. Of the 45 boat-related deaths, 34 (76%) were recovered during the warm season and 11 (24%) were recovered during the cold season. More boat-related deaths were recovered in July (12) than were recovered during the entire cold season.
- c. Of the 45 boat-related deaths, 39 (87%) were recovered between 2000 and 2012. The annual average for this time period (3.00) is six times greater than the average for the 1990-99 time period (0.50). **Table 4** summarizes the mortality data by zone and time period.
- d. As compared to the 13 counties that were identified in 1989 as key counties most in need of manatee protection (and where protection zones were subsequently established), the annual average number of boat-related deaths in Pinellas County exceeds the average in all but five of these counties for the 2000-12 period, and all but four for the 2008-12 period. The annual average for western Pinellas County by itself exceeds the average in five of these counties for the 2008-12 period. Pinellas County ranked behind all of the 13 counties for the 1980-89 period and behind all but one for the 1990-99 period.

- e. Six boat-related deaths are the most ever recovered in the area in one year (in 2003, 2005, and 2008; followed by five in 2011). **Table 5** summarizes the mortality data by year and category.
- f. There have been 13 reported manatee-boat collisions in western Pinellas County that are not associated with a manatee death. None of these reports resulted in a rescue. Of the 13 collisions, 10 (77%) occurred during the warm season and 3 (23%) occurred during the cold season.
- g. One manatee has been rescued in western Pinellas County where the rescue was needed due to injuries related to a boat collision and the manatee did not subsequently die. The rescue occurred in July 2006.

C. North Region

1. Manatee aerial survey data (**Table 1; Figures 3-6**)

- a. The mean number of manatees seen in the North Region was 11.0 per survey over all surveys. This represents a mean density of 0.11 manatees per km² per survey. The mean manatee density for the warm season was 0.11 (11.4 manatees per survey), while it was 0.10 (10.3 manatees per survey) for the cold season.
- b. With the exception of the Anclote River Area zone, the zones in this region had manatee density values that were 3.7 times or more greater for the warm season than for the cold season.
- c. The cold-season mean manatee density values for the four zones in this region were all fairly similar except for the Anclote River Area zone, which had a mean density over 33 times greater than the next highest cold-season density in the region. This very high density value was the result of large numbers of manatees that were seen in two locations that are known to serve as secondary warm water aggregation sites for manatees: the discharge canal area of the power plant at the mouth of the Anclote River, and the Spring Bayou area of Tarpon Springs. The Anclote River Area zone was the only zone in either region that had a higher manatee density for the cold season than for the warm season.
- d. The warm-season mean manatee density values for the four zones in this region were all fairly similar except for the North of Honeymoon Island Causeway zone, which had a considerably lower mean density.

2. Manatee-boat spatial overlap (**Table 2; Figures 9-12**)

- a. Warm Season: Overlap for the North Region was 0.33 and Fast Overlap was 0.09. The zones with the highest Fast Overlap were the Clearwater Causeway to Indian Rocks Causeway zone (0.22) and the Anclote River Area zone (0.20), both of which had Fast Overlap values that were well above the values for the region as a whole (0.09) and the overall area (0.11).
- b. Cold Season: Overlap for the North Region was 0.06 and Fast Overlap was 0.01. Only the Anclote River Area zone had a Fast Overlap (0.09) above the values for the region as a whole (0.01) and the overall area (0.01).

3. Manatee mortality, reported boat strikes, and rescues (**Tables 3-4; Figure 13**)

- a. 52 carcasses were recovered in the North Region, with 17 of these attributed to boats. Of the 17 boat-related deaths, 15 (88%) were recovered between 2000 and 2012. Twelve (71%) of the boat-related deaths were recovered during the warm season and five (29%) were recovered during the cold season.
- b. Of the 13 reported manatee-boat collisions in western Pinellas County that are not associated with a manatee death, three (23%) occurred in the North Region. One was a boat operator report of a collision while traveling at Idle Speed in a 19-foot boat in Indian Rocks Beach in May 2006; one was a report by a witness of a personal watercraft striking a manatee while operating at high speed in Clearwater Harbor in August 2009, and; one was a boat operator report of a collision while traveling at approximately 20 mph in a 21-foot boat in Palm Harbor in November 2009. Injuries were confirmed in this latter incident and a rescue was planned; however, there was not enough daylight left that day to perform a rescue and the manatee was not relocated for a subsequent rescue attempt.
- c. No manatees have been rescued in the North Region where the rescue was needed due to injuries related to a boat collision and the manatee did not subsequently die.

4. Other information

- a. **Figure 14** shows the locations of seagrass in 2012 (2007 for Pasco County).
- b. **Figure 15** shows the existing FWC boating safety zones as well as other local (county or city) regulatory zones. Non-regulatory zones, such as “shallow water” and “seagrass” caution zones that do not have any specific regulatory requirements, are not included.

D. South Region

1. Manatee aerial survey data (**Table 1; Figures 16-19**)

- a. The mean number of manatees seen in the South Region was 24.7 per survey over all surveys. This represents a mean density of 0.26 manatees per km² per survey. The mean manatee density for the warm season was 0.33 (31.9 manatees per survey), while it was 0.15 (14.3 manatees per survey) for the cold season.
- b. All of the zones in this region had higher manatee density values for the warm season than for the cold season. The magnitude of the difference ranged between a high of 10.3 times greater (Indian Rocks Causeway to Stuart Causeway zone) to a low of 1.6 times greater (Treasure Island Causeway to Pinellas Bayway zone).
- c. The cold-season mean manatee density values for the four zones in this region were greater than the cold-season density values for the zones in the North Region (except for the Anclote River Area zone), with the Treasure Island Causeway to Pinellas Bayway zone (0.22) and the South of Pinellas Bayway (0.15) having significantly higher density values than the other two zones in this region.
- d. The warm-season mean manatee density values for the four zones in this region were all substantially greater than the warm-season density values for the zones in the North Region. The Indian Rocks Causeway to Stuart Causeway zone had the highest mean density (0.62). The other three zones had lower, but still relatively high, warm-season mean manatee density values that ranged between 0.30 and 0.33.

2. Manatee-boat spatial overlap (**Table 2; Figures 22-25**)

- a. Warm Season: Overlap for the South Region was 0.66 and Fast Overlap was 0.13. The zones with the highest Fast Overlap were the Indian Rocks Causeway to Stuart Causeway zone (0.22) and the Stuart Causeway to Treasure Island Causeway zone (0.22), followed by the Treasure Island Causeway to Pinellas Bayway zone (0.17). All of these zones had Fast Overlap values that were well above the values for the region as a whole (0.13) and the overall area (0.11).
- b. Cold Season: Overlap for the South Region was 0.08 and Fast Overlap was 0.01. All of the Fast Overlap values were relatively low.

3. Manatee mortality, reported boat strikes, and rescues (**Tables 3-4; Figure 26**)

- a. 72 carcasses were recovered in the South Region, with 28 of these attributed to boats. Of the 28 boat-related deaths, 24 (86%) were recovered between 2000 and 2012. Twenty-two (79%) of the boat-related deaths were recovered during the warm season and six (21%) were recovered during the cold season.
- b. Of the 13 reported manatee-boat collisions in western Pinellas County that are not associated with a manatee death, 10 (77%) occurred in the South Region. Eight of the 10 (80%) occurred during the warm season and two (20%) occurred during the cold season. One was a boat operator report of a collision north of the Madeira Beach Bridge in Sept 2010 (minimal information provided); one was a boat operator report of a collision while traveling at 10-15 mph in a 15-foot boat about one mile north of the Pinellas Bayway in May 2011; the other eight reported collisions occurred between June 2008 and May 2013 in the southern section of Boca Ciega Bay. None of the 10 manatees that were reportedly struck in these incidents were located so it was not possible to confirm if a collision had occurred or to assess if there were any injuries. Minimal information was provided for several of the reports.
- c. One manatee has been rescued in the South Region where the rescue was needed due to injuries related to a boat collision and the manatee did not subsequently die. The rescue occurred in Gulfport in July 2006. The manatee was rehabilitated at Lowry Park Zoo and released back into the wild in January 2007.

4. Other information

- a. **Figure 27** shows the locations of seagrass in 2012.
- b. **Figure 28** shows the existing FWC boating safety zones as well as other local (county or city) regulatory zones. Non-regulatory zones, such as “shallow water” and “sea grass” caution zones that do not have any specific regulatory requirements, are not included.

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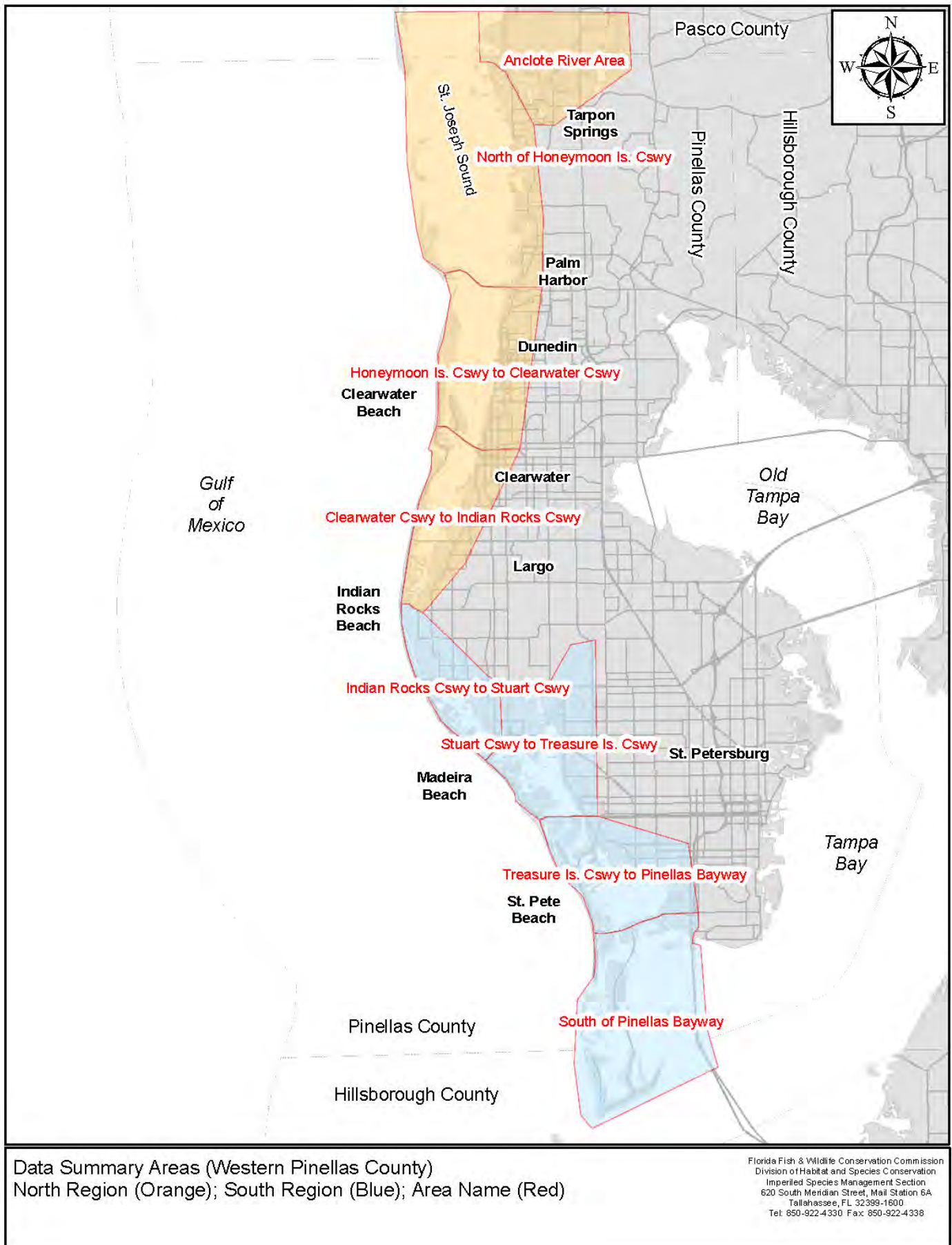
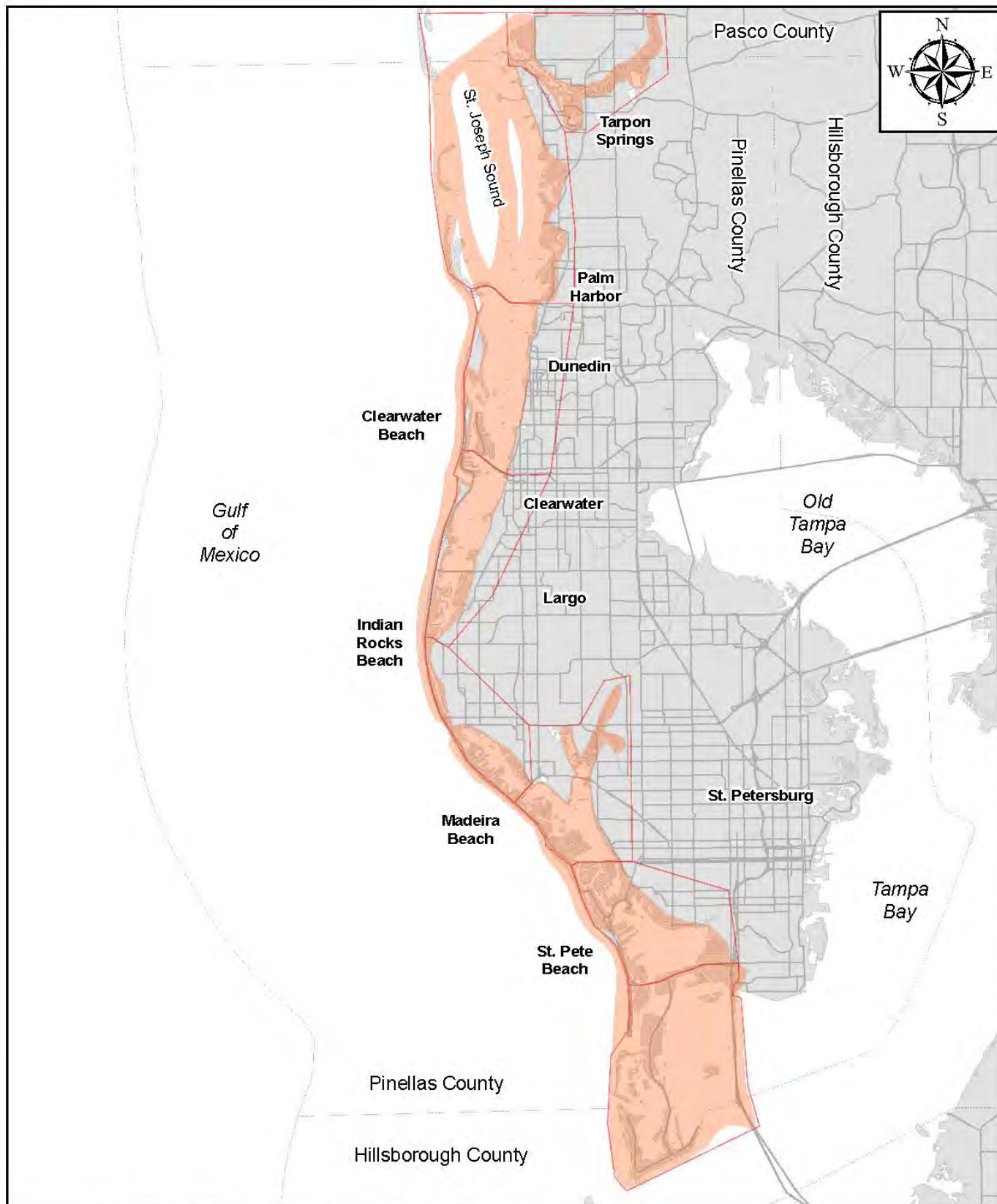


Figure 1



Approximate Area Covered by 2008-10 Manatee Aerial Surveys of Western Pinellas County

Florida Fish & Wildlife Conservation Commission
 Division of Habitat and Species Conservation
 Imperiled Species Management Section
 620 South Meridian Street, Mail Station 6A
 Tallahassee, FL 32399-1600
 Tel: 850-922-4330 Fax: 850-922-4338

Figure 2

Table 1: Western Pinellas County Aerial Survey Data (2008-10): Numbers of Manatees Seen by Area and Season

Aerial Survey Period:		April - October							November - March						
Location	Surveyed Area [1]	No. of Surveys [2]	Total Surveys Seen [3]	Per Survey [4]	Manatee Density [5]	Surveys Seen [6]	Percent Surveys [7]	No. of Surveys [2]	Total Surveys Seen [3]	Per Survey [4]	Manatee Density [5]	Surveys Seen [6]	Percent Surveys [7]		
North County		99.5	28	320	11.43	0.11	27	19	195	10.26	0.10	19	100.0%		
Anclote River Area [a]		6.2	28	32	1.14	0.19	11	19	163	8.58	1.39	17	89.5%		
North of Honeymoon Island Cswy [a]		54.5	28	120	4.29	0.08	24	19	10	0.53	0.01	4	21.1%		
Honeymoon Is. Cswy to Clearwater Cswy		23.7	28	103	3.68	0.16	26	19	19	1.00	0.04	7	36.8%		
Clearwater Cswy to Indian Rocks Cswy		15.3	28	65	2.32	0.15	21	19	3	0.16	0.01	1	5.3%		
South County		95.1	28	892	31.86	0.33	28	19	271	14.26	0.15	14	73.7%		
Indian Rocks Cswy to Stuart Cswy		6.2	28	107	3.82	0.62	19	19	7	0.37	0.06	5	26.3%		
Stuart Cswy to Treasure Is. Cswy		13.0	28	121	4.32	0.33	22	19	19	1.00	0.08	7	36.8%		
Treasure Is. Cswy to Pinellas Bayway		17.7	28	179	6.39	0.36	26	19	74	3.89	0.22	11	57.9%		
South of Pinellas Bayway [b]		58.2	28	485	17.32	0.30	28	19	171	9.00	0.15	13	68.4%		
Western Pinellas County (from above)		194.7	28	1212	43.29	0.22	28	19	466	24.53	0.13	19	100.0%		
Gulf of Mexico		--	28	28	1.00	--	13	19	1	0.05	--	1	5.3%		

Aerial Survey Period:		All Months					
Location	Surveyed Area [1]	No. of Surveys [2]	Total Surveys Seen [3]	Per Survey [4]	Manatee Density [5]	Surveys Seen [6]	Percent Surveys [7]
North County		99.5	47	515	10.96	46	97.9%
Anclote River Area [a]		6.2	47	195	4.15	28	59.6%
North of Honeymoon Island Cswy [a]		54.5	47	130	2.77	28	59.6%
Honeymoon Is. Cswy to Clearwater Cswy		23.7	47	122	2.60	33	70.2%
Clearwater Cswy to Indian Rocks Cswy		15.3	47	68	1.45	22	46.8%
South County		95.1	47	1163	24.74	42	89.4%
Indian Rocks Cswy to Stuart Cswy		6.2	47	114	2.43	24	51.1%
Stuart Cswy to Treasure Is. Cswy		13.0	47	140	2.98	29	61.7%
Treasure Is. Cswy to Pinellas Bayway		17.7	47	253	5.38	37	78.7%
South of Pinellas Bayway [b]		58.2	47	656	13.96	41	87.2%
Western Pinellas County (from above)		194.7	47	1678	35.70	47	100.0%
Gulf of Mexico		--	47	29	0.62	14	29.8%

[1] Surveyed Area: Estimated amount of area that could be seen during each aerial survey (sq. km)

[2] No. of Surveys: Number of times surveys were flown over the area

[3] Total Seen: Total number of manatees seen

[4] Per Survey: Mean number of manatees seen per survey (Column [3] value divided by Column [2] value)

[5] Density: Mean number of manatees seen per survey per sq. km (Column [4] value divided by Column [1] value)

[6] Surveys Seen: Number of surveys during which at least one manatee was seen in the area

[7] Percent Surveys: Percentage of all surveys during which at least one manatee was seen in the area (Column [6] value divided by Column [2] value)

[a] Includes some area in southern Pasco County

[b] Includes very small portion of Hillsborough County

Table 2: Western Pinellas County Manatee Density, "Fast" Boat Density, and Manatee-Boat Spatial Overlap by Area and Season

Location	Seasonal Period:					November - March				
	April - October					Fast Boat				
	Manatee Density [1]	Fast Boat Density [2]	Overlap [3]	"Fast" Overlap [4]	Overlap Ratio [5]	Manatee Density [1]	Fast Boat Density [2]	Overlap [3]	"Fast" Overlap [4]	Overlap Ratio [5]
North County	0.09	0.68	0.33	0.09	0.26	0.05	0.15	0.06	0.01	0.12
Anclote River Area [a]	0.11	1.35	0.60	0.20	0.33	0.58	0.43	1.10	0.09	0.08
North of Honeymoon Island Cswy [a]	0.07	0.47	0.18	0.02	0.11	0.01	0.09	0.004	0.002	0.59
Honeymoon Is. Cswy to Clearwater Cswy	0.14	0.90	0.37	0.14	0.38	0.03	0.20	0.04	0.01	0.19
Clearwater Cswy to Indian Rocks Cswy	0.12	1.24	0.76	0.22	0.29	0.01	0.34	0.01	0.001	0.20
South County	0.27	0.67	0.66	0.13	0.20	0.10	0.16	0.08	0.01	0.13
Indian Rocks Cswy to Stuart Cswy	0.46	0.96	0.94	0.22	0.23	0.04	0.34	0.07	0.01	0.20
Stuart Cswy to Treasure Is. Cswy	0.26	1.30	1.07	0.22	0.21	0.06	0.30	0.08	0.01	0.18
Treasure Is. Cswy to Pinellas Bayway	0.28	0.68	0.44	0.17	0.38	0.14	0.13	0.07	0.02	0.26
South of Pinellas Bayway [b]	0.25	0.49	0.61	0.09	0.14	0.11	0.12	0.08	0.01	0.07
Western Pinellas County	0.18	0.68	0.49	0.11	0.22	0.08	0.16	0.07	0.01	0.12

[1] Manatee Density: Mean manatee density per survey for the 2008-10 period (ArcGIS kernel density using a 325 m search radius)

[2] Fast Boat Density: Mean boat density per survey for the 2008-09 period for only boats with observed speeds of "planing," "cruising," or "plowing" (ArcGIS kernel density using a 325 m search radius)

[3] Overlap: Mean manatee-boat spatial overlap value (ArcGIS kernel density for manatees times the kernel density for boats)

[4] "Fast" Overlap: Mean manatee-boat spatial overlap value using only boats with observed speeds of "planing," "cruising," or "plowing" (ArcGIS kernel density for manatees times the kernel density for "fast" boats)

[5] Overlap Ratio: Ratio of Fast Overlap to Overlap (Column [4] value divided by Column [3] value). In some cases this ratio may appear incorrect based on the Overlap and Fast Overlap values but this is due to the Overlap and Fast Overlap values only being shown to two decimal places.

[a] Includes some area in southern Pasco County

[b] Includes very small portion of Hillsborough County

Note on Manatee Density (Column [1]) : These values are the mean kernel density values calculated in ArcGIS and are not the same as the values shown for the aerial survey summary table. The kernel density calculation includes a distance decay function and the water grid was used as a mask (so means are based on only values that occurred over water). The density values reported in the aerial survey summary table were calculated by dividing the number of manatees seen within each area by the amount of area surveyed. In most cases, the kernel density process results in lower density values than the mean densities reported in the aerial survey summary table.

Table 3: Manatee Mortality by Area and Season (through December 2012) (Pinellas County)

Location	April - October										November - March										All Months									
	Recoveries by Death Code [†]										Recoveries by Death Code [†]										Recoveries by Death Code [†]									
	Total	1	2	3	4	5	6	7	8	9	Total	1	2	3	4	5	6	7	8	9	Total	1	2	3	4	5	6	7	8	9
North County	31	12	0	2	7	0	6	4			21	5	0	0	8	5	0	3			52	17	0	2	15	5	6	7		
Anclote River Area [a]	13	3	0	2	2	0	3	3			15	4	0	0	7	3	0	1			28	7	0	2	9	3	3	4		
North of Honeymoon Island Cswy [a]	4	4	0	0	0	0	0	0			3	1	0	0	0	1	0	1			7	5	0	0	0	1	0	1		
Honeymoon Is. Cswy to Clearwater Cswy	5	2	0	0	1	0	1	1			1	0	0	0	1	0	0	0			6	2	0	0	2	0	1	1		
Clearwater Cswy to Indian Rocks Cswy	9	3	0	0	4	0	2	0			2	0	0	0	0	1	0	1			11	3	0	0	4	1	2	1		
South County	47	22	0	0	9	0	11	5			25	6	0	0	3	8	4	4			72	28	0	0	12	8	15	9		
Indian Rocks Cswy to Stuart Cswy	11	5	0	0	2	0	3	1			1	0	0	0	0	1	0	0			12	5	0	0	2	1	3	1		
Stuart Cswy to Treasure Is. Cswy	16	7	0	0	2	0	4	3			4	2	0	0	0	1	1	0			20	9	0	0	2	1	5	3		
Treasure Is. Cswy to Pinellas Bayway	10	4	0	0	3	0	3	0			12	2	0	0	1	5	2	2			22	6	0	0	4	5	5	2		
South of Pinellas Bayway [b]	10	6	0	0	2	0	1	1			8	2	0	0	2	1	1	2			18	8	0	0	4	1	2	3		
Western Pinellas County [a][b]	78	34	0	2	16	0	17	9			46	11	0	0	11	13	4	7			124	45	0	2	27	13	21	16		
Eastern Pinellas County	50	12	0	0	17	0	5	16			30	7	0	1	5	3	7	7			80	19	0	1	22	3	12	23		
Pinellas County [c]	131	46	0	2	33	0	24	26			79	18	0	1	16	16	12	16			210	64	0	3	49	16	36	42		

[a] Includes small portion of southern Pasco County (4 boat-related and 20 deaths total, in the Anclote River area)

[b] Includes very small portion of Hillsborough County (no carcass recoveries)

[c] Includes 6 carcasses recovered in the Gulf of Mexico (no boat-related)

[†] Death Codes: 1 = Boat-related; 2 = Flood Gate / Lock; 3 = Other Human; 4 = Perinatal; 5 = Cold Stress; 6 = Other Natural; 7-9; Undetermined or Verified/Not Recovered

Mortality Breakdown by Month and Death Code (Western Pinellas County only) [a]

Death Code [†]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1	1	3	2	1	7	3	12	4	3	4	2	3	45
2	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	2	0	0	0	0	0	0	0	2
4	1	2	7	4	4	4	1	2	0	1	1	0	27
5	8	3	1	0	0	0	0	0	0	0	0	1	13
6	0	0	1	2	0	1	0	4	4	6	2	1	21
7-9	1	0	3	0	1	2	0	2	3	1	2	1	16
All Codes	11	8	14	7	14	10	13	12	10	12	7	6	124

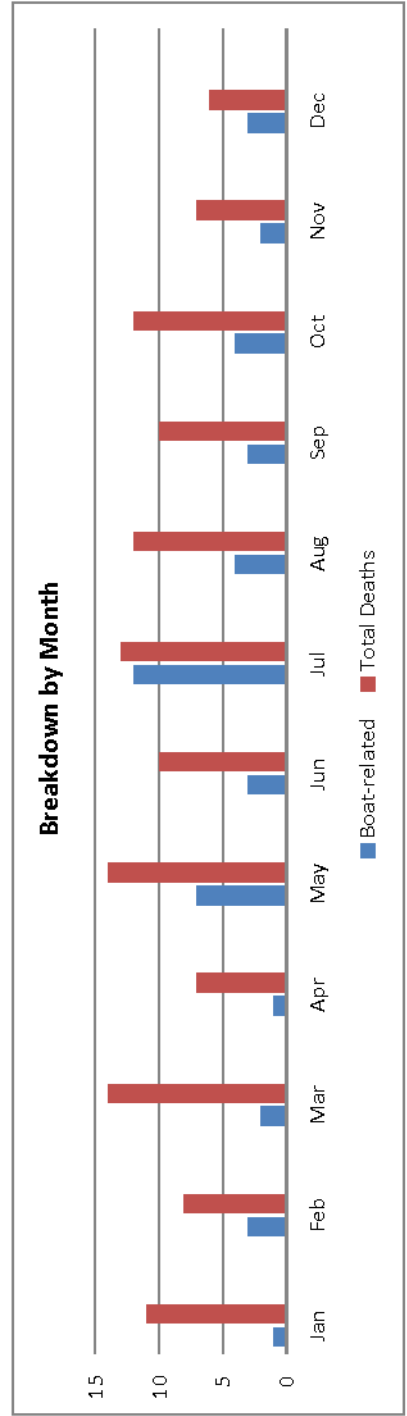


Table 4: Boat-Related Manatee Mortality by Area and Time Period (Pinellas County)

Location	Total	Time Period							
		1974-79		1980-89		1990-99		2000-12	
		Annual Avg	Total	Annual Avg	Total	Annual Avg	Total	Annual Avg	Total
North County [a]	17	0.00	0	0.00	0	0.20	2	1.15	15
Other than boat-related	35	0.00	0	0.20	2	1.30	13	1.54	20
South County	28	0.00	0	0.10	1	0.30	3	1.85	24
Other than boat-related	44	0.00	0	0.10	1	0.80	8	2.69	35
Western Pinellas County [a]	45	0.00	0	0.10	1	0.50	5	3.00	39
Other than boat-related [a]. [b]	85	0.00	0	0.40	4	2.20	22	4.54	59
Eastern Pinellas County	19	0.00	0	0.40	4	0.40	4	0.85	11
Other than boat-related	59	0.50	3	0.30	3	2.40	24	2.23	29
Pinellas County [a]	64	0.00	0	0.50	5	0.90	9	3.85	50
Other than boat-related [a]. [b]	144	0.50	3	0.70	7	4.60	46	6.77	88

[a] Includes small portion of southern Pasco County (4 boat-related and 20 deaths total, in the Anclote River area

[b] Includes 6 "other category" carcasses recovered outside of the summary areas (in the Gulf of Mexico)

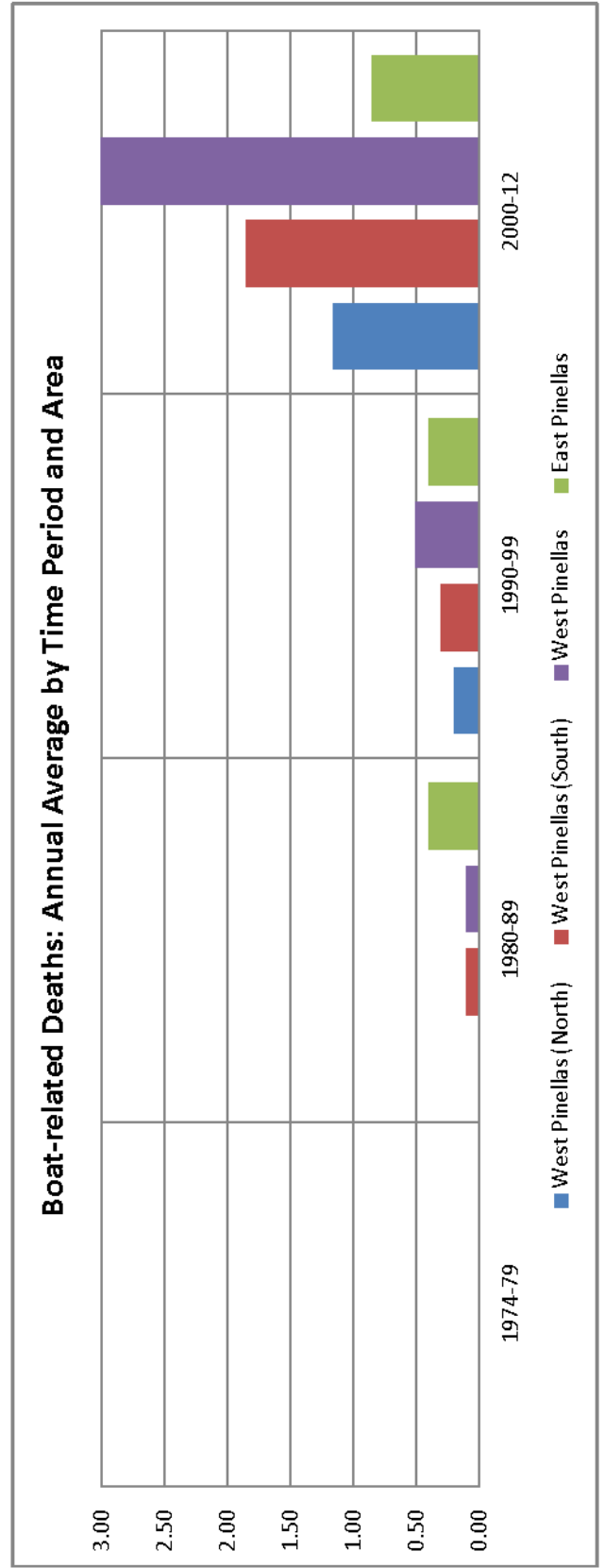


Table 5: Western Pinellas County [*] Manatee Mortality by Year and Category

REPYEAR	D_Code1	D_Code2	D_Code3	D_Code4	D_Code5	D_Code6	D_Code7-9	D-Code2-9	All Causes
1974	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	1	1	1
1984	0	0	0	0	0	0	1	1	1
1985	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	1	0	0	1	1
1988	0	0	0	1	0	0	0	1	1
1989	1	0	0	0	0	0	0	0	1
1990	0	0	0	0	0	0	1	1	1
1991	0	0	0	3	0	0	0	3	3
1992	1	0	0	0	0	0	0	0	1
1993	0	0	0	0	0	1	1	2	2
1994	0	0	0	1	0	1	2	4	4
1995	1	0	0	1	0	1	2	4	5
1996	0	0	0	2	0	0	0	2	2
1997	2	0	0	1	0	0	1	2	4
1998	1	0	0	2	0	0	0	2	3
1999	0	0	1	0	0	0	1	2	2
2000	0	0	1	1	1	1	1	5	5
2001	1	0	0	0	1	4	0	5	6
2002	2	0	0	2	1	2	0	5	7
2003	6	0	0	1	2	2	0	5	11
2004	2	0	0	0	0	0	0	0	2
2005	6	0	0	2	0	6	2	10	16
2006	0	0	0	2	0	1	1	4	4
2007	2	0	0	1	1	0	2	4	6
2008	6	0	0	2	0	0	1	3	9
2009	3	0	0	0	1	1	0	2	5
2010	2	0	0	1	3	1	0	5	7
2011	5	0	0	2	2	1	0	5	10
2012	4	0	0	2	0	2	2	6	10
Total	45	0	2	27	13	24	19	85	130

D_Codes: 1 = Boat-related; 2 = Structure; 3 = Other Human; 4 = Perinatal; 5 = Cold Stress;
6 = Other Natural; 7-9 = Undetermined or Verified/Not Recovered

Data for 2012 are preliminary

[*] Includes 20 deaths in southern Pasco County in the Anclote River area (affected cells are shaded)
DCode1 (4); DCode3 (2); DCode4 (6); DCode5 (3); DCode6 (2); DCode7-9 (3)

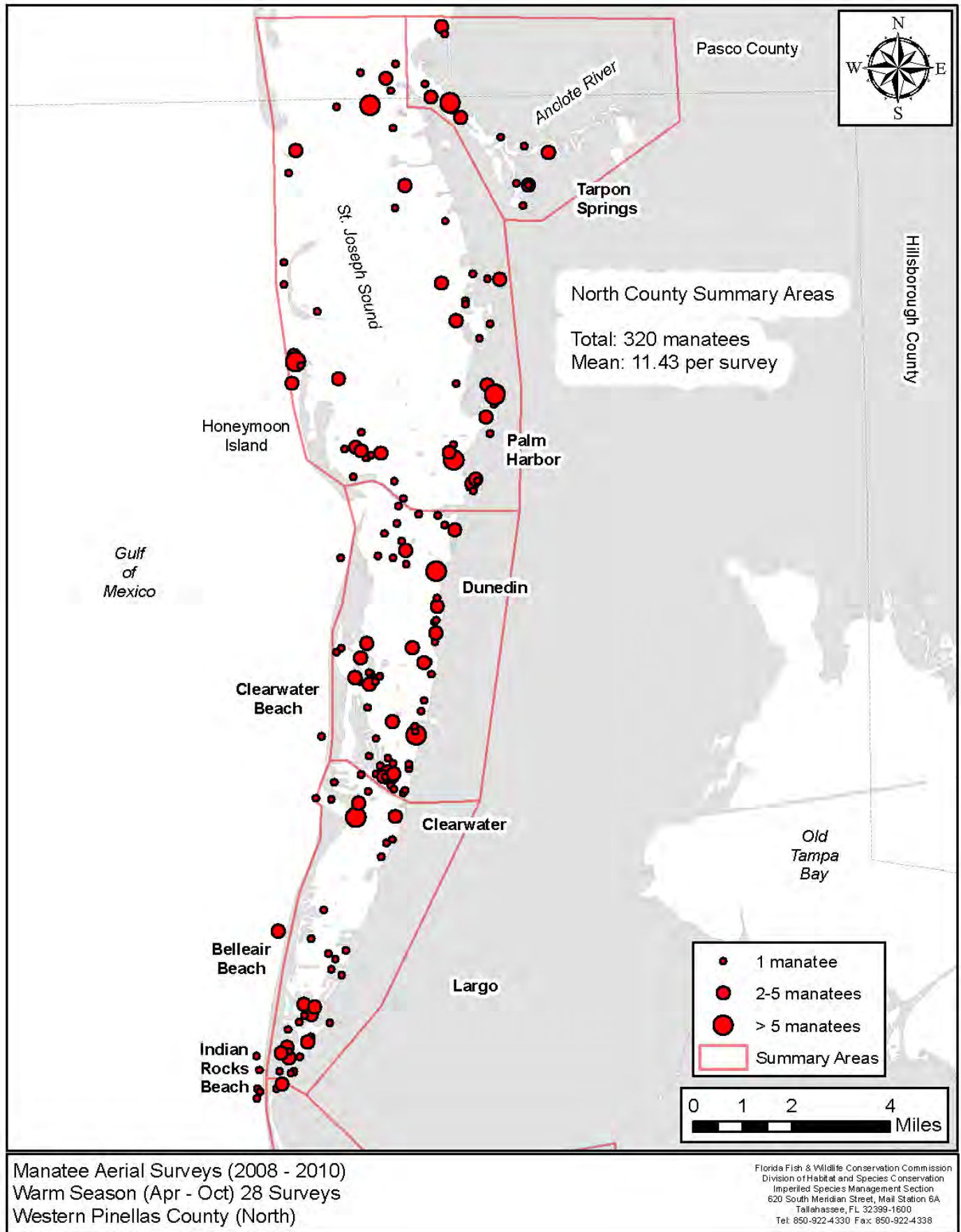


Figure 3

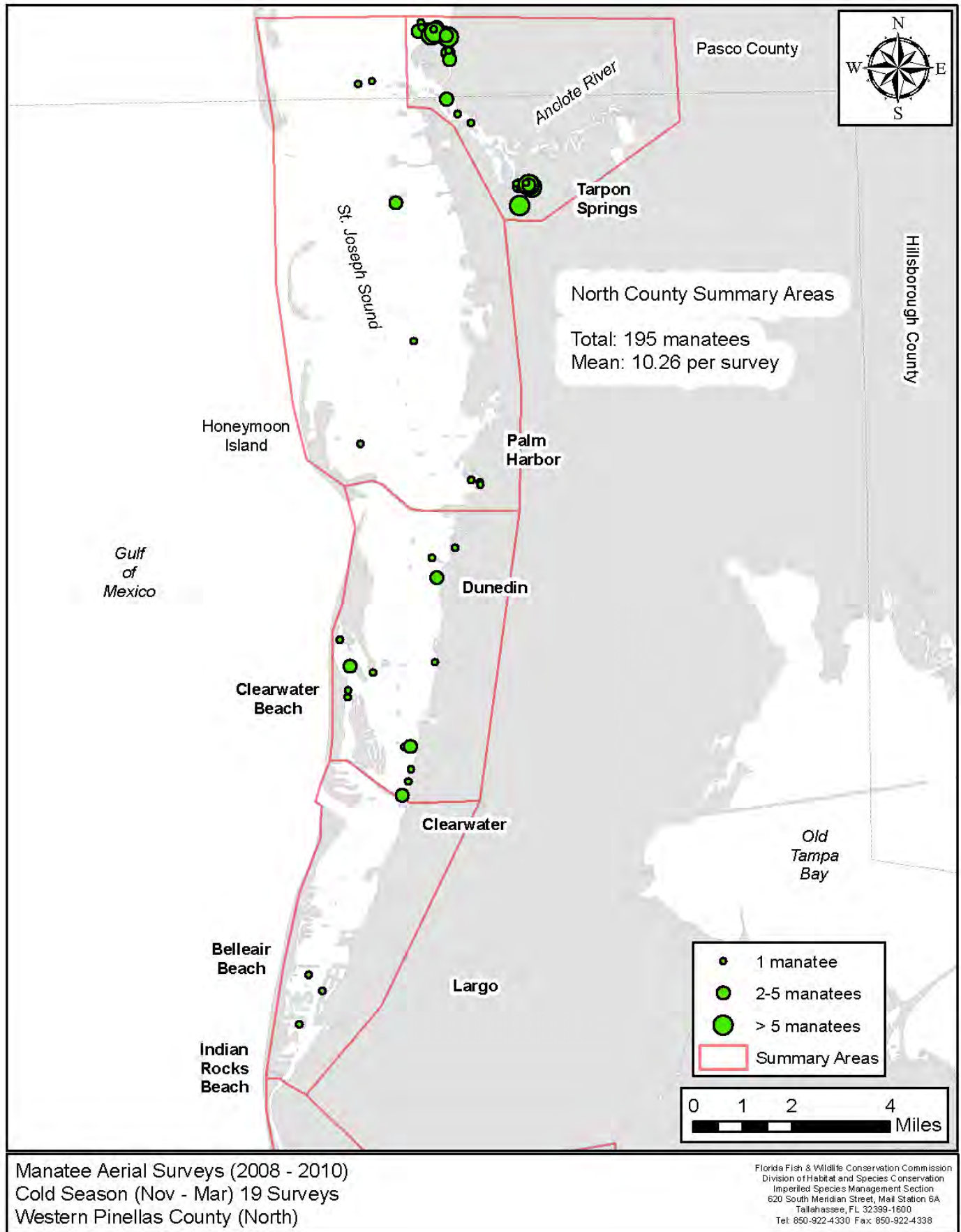
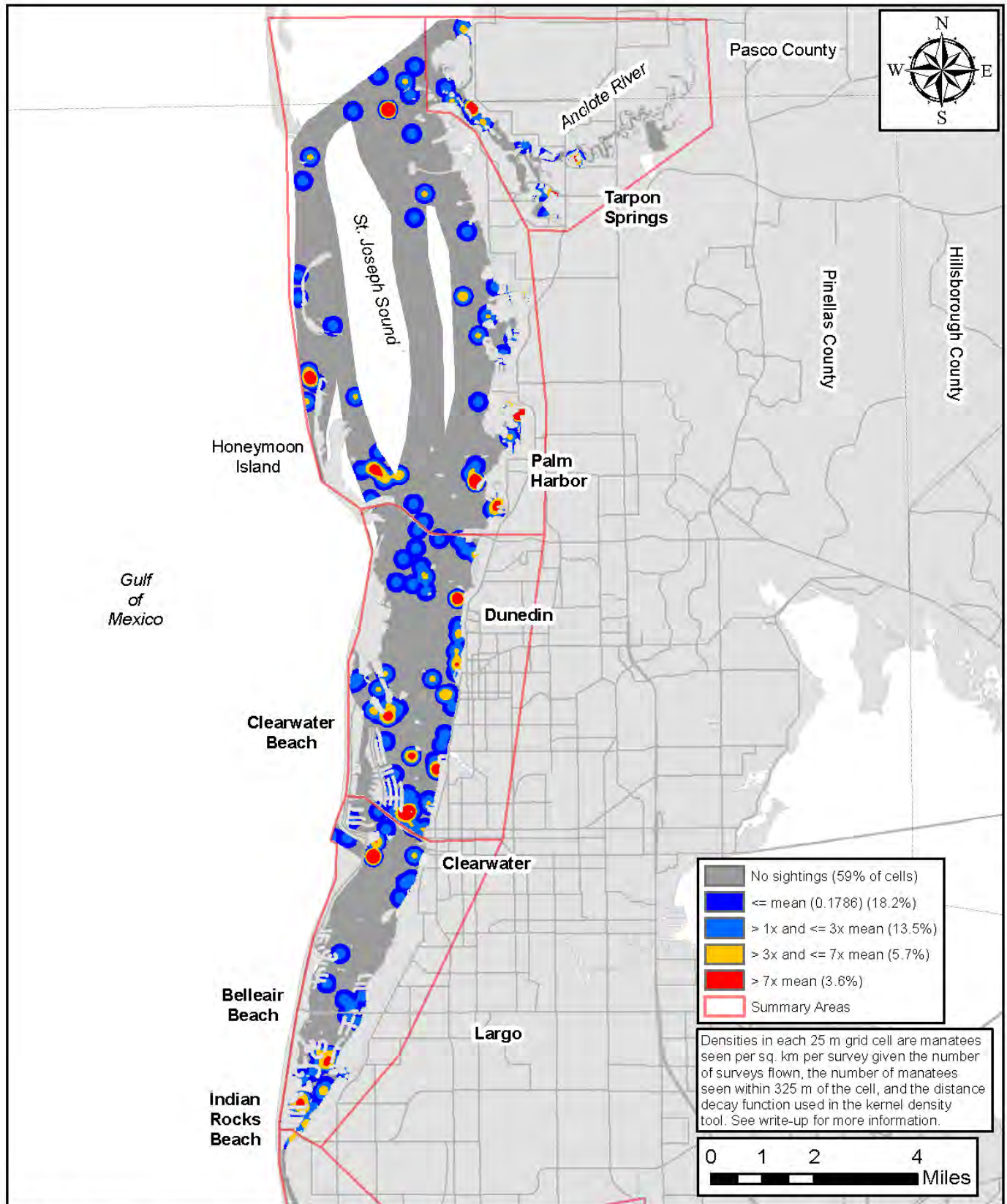


Figure 4



2008 - 2010 Manatee Aerial Surveys (Kernel Density; 325 m Radius)
 Warm Season (Apr - Oct) 28 Surveys
 Western Pinellas County (North)

Florida Fish & Wildlife Conservation Commission
 Division of Habitat and Species Conservation
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Figure 5

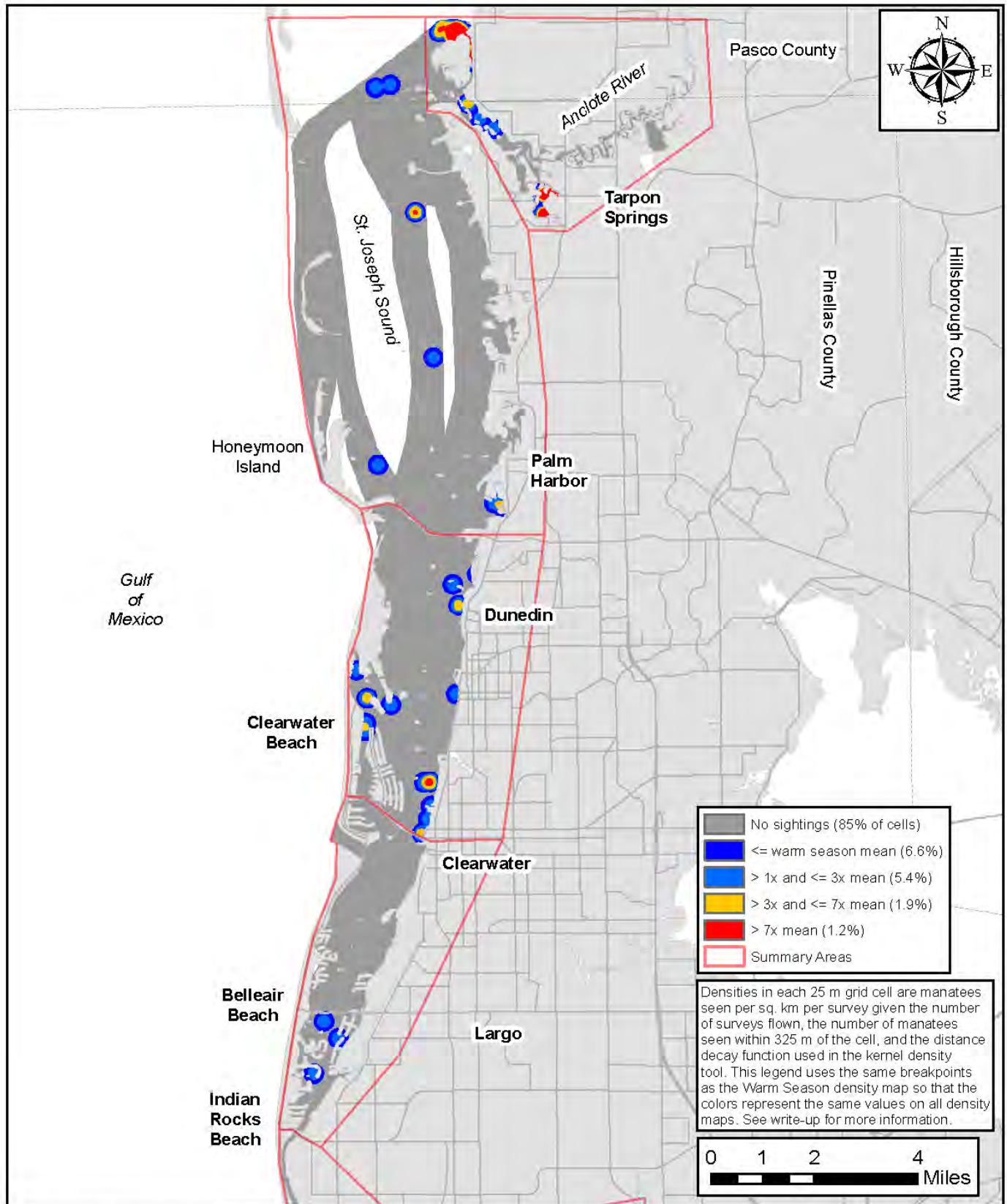


Figure 6

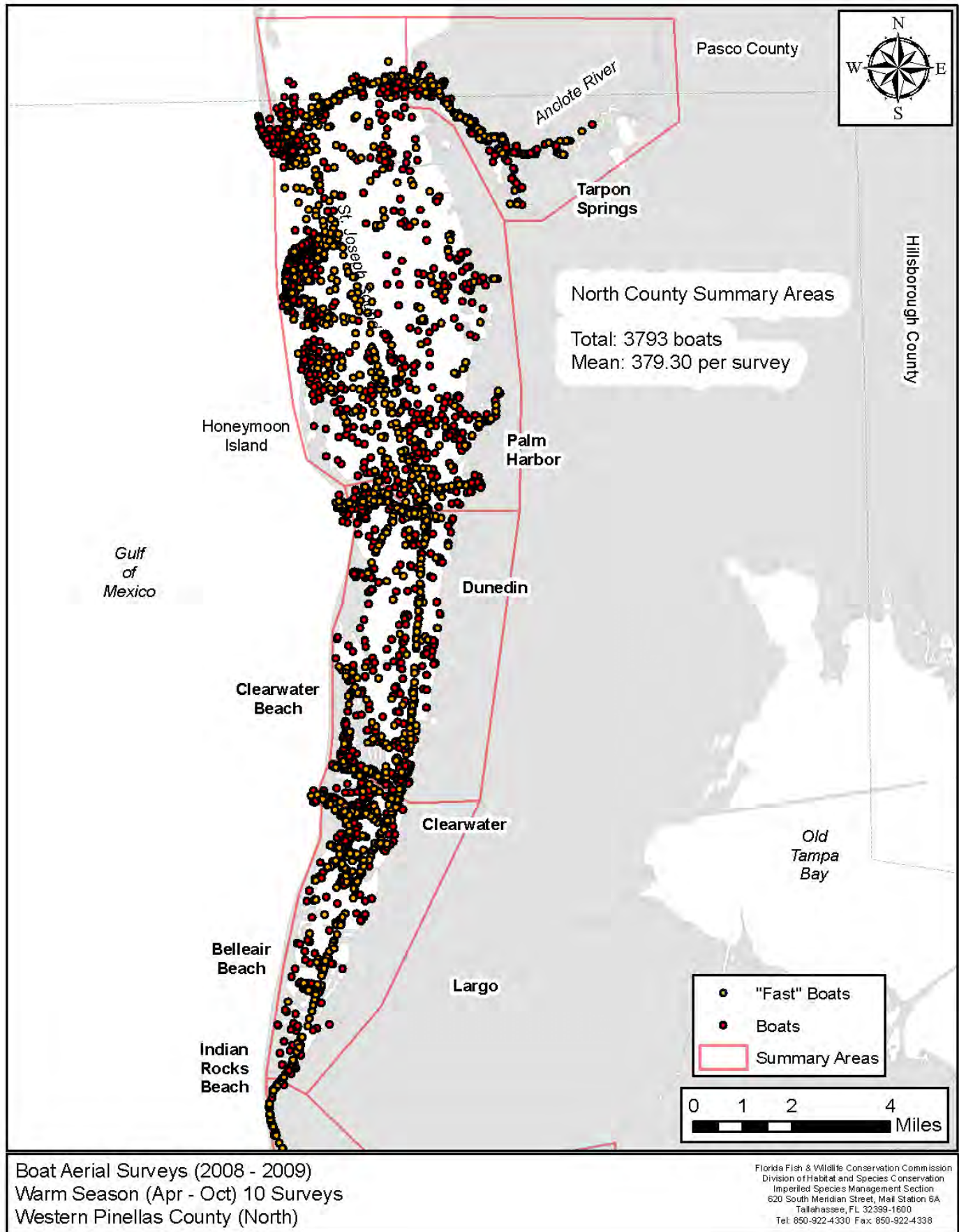


Figure 7

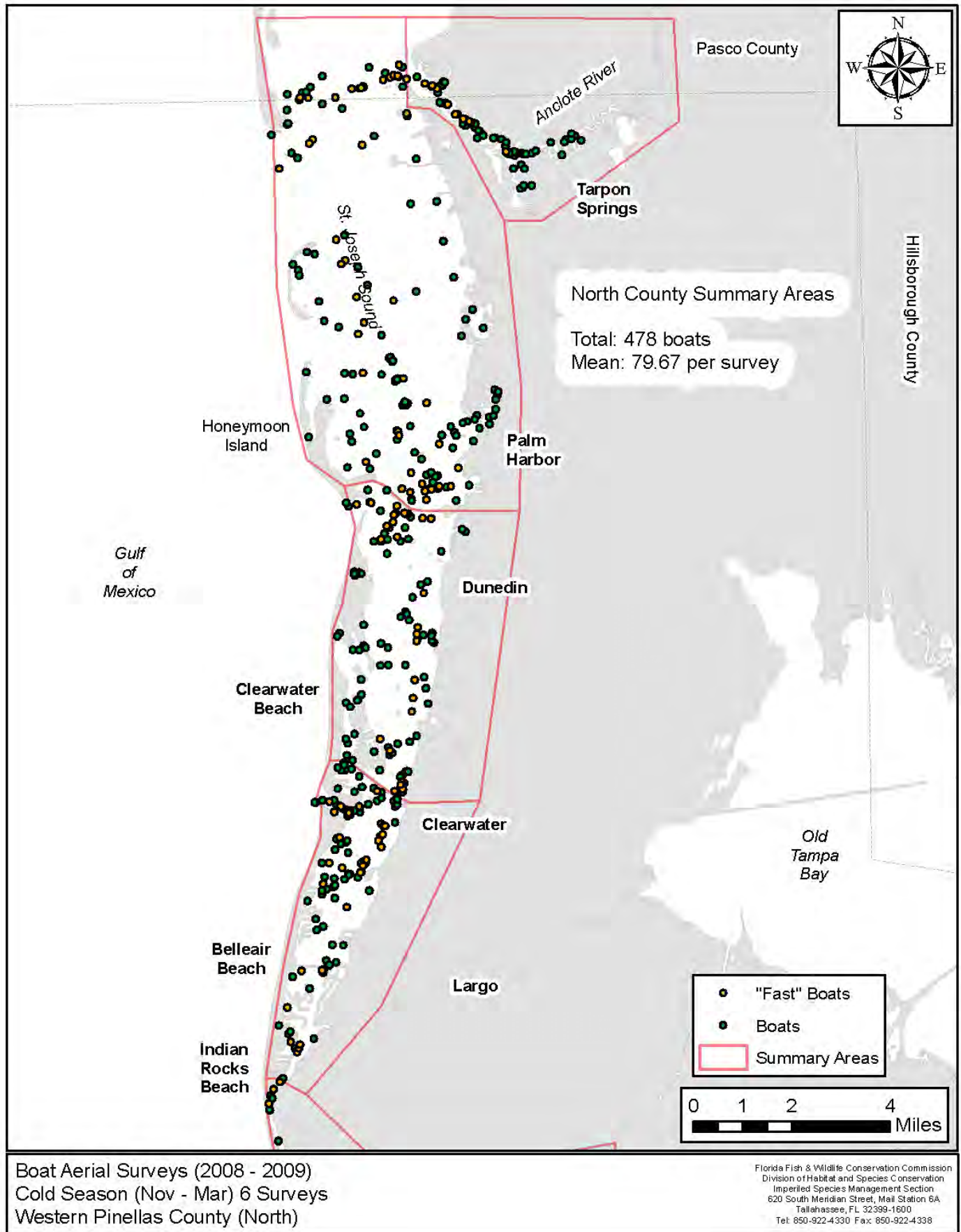


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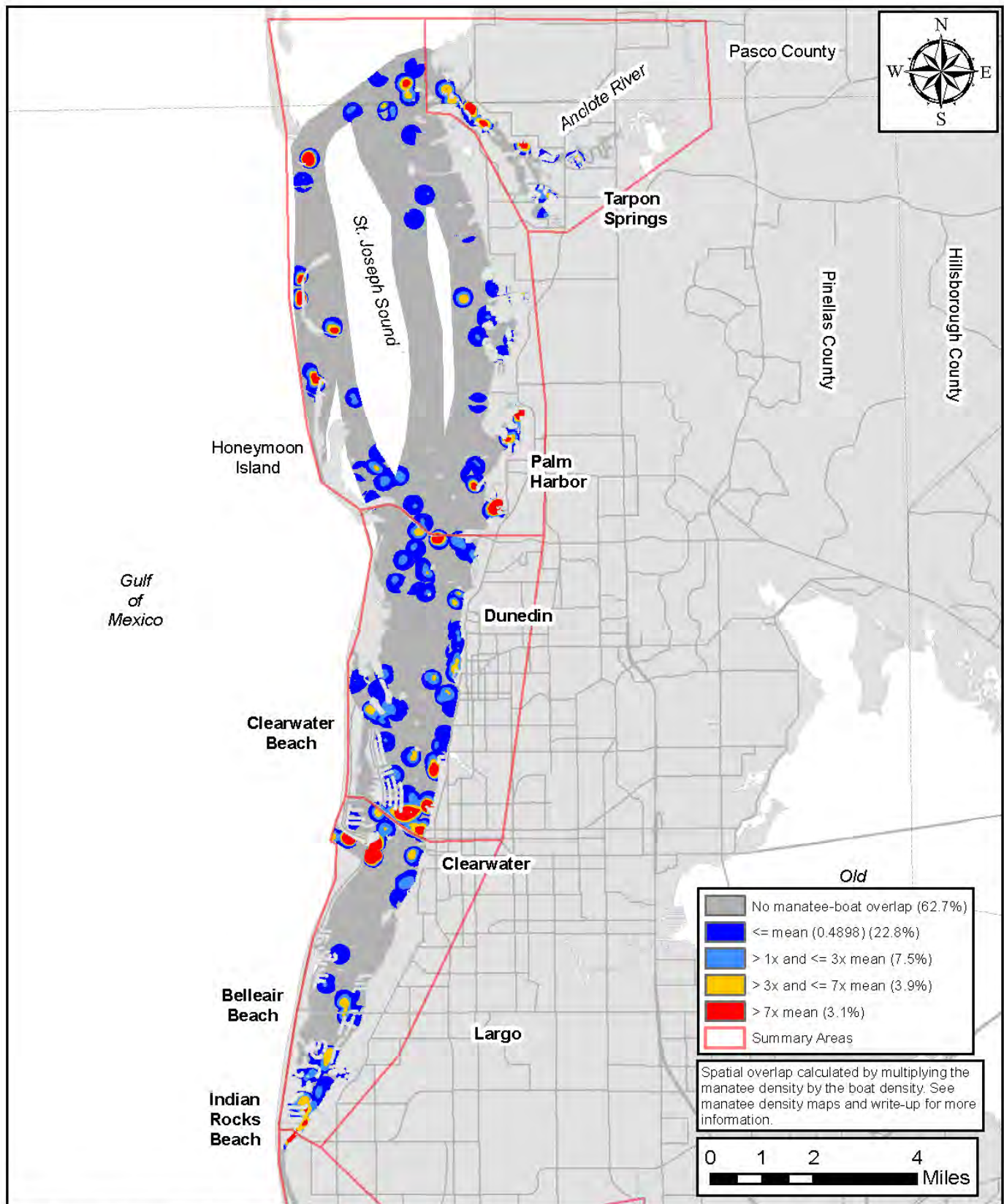
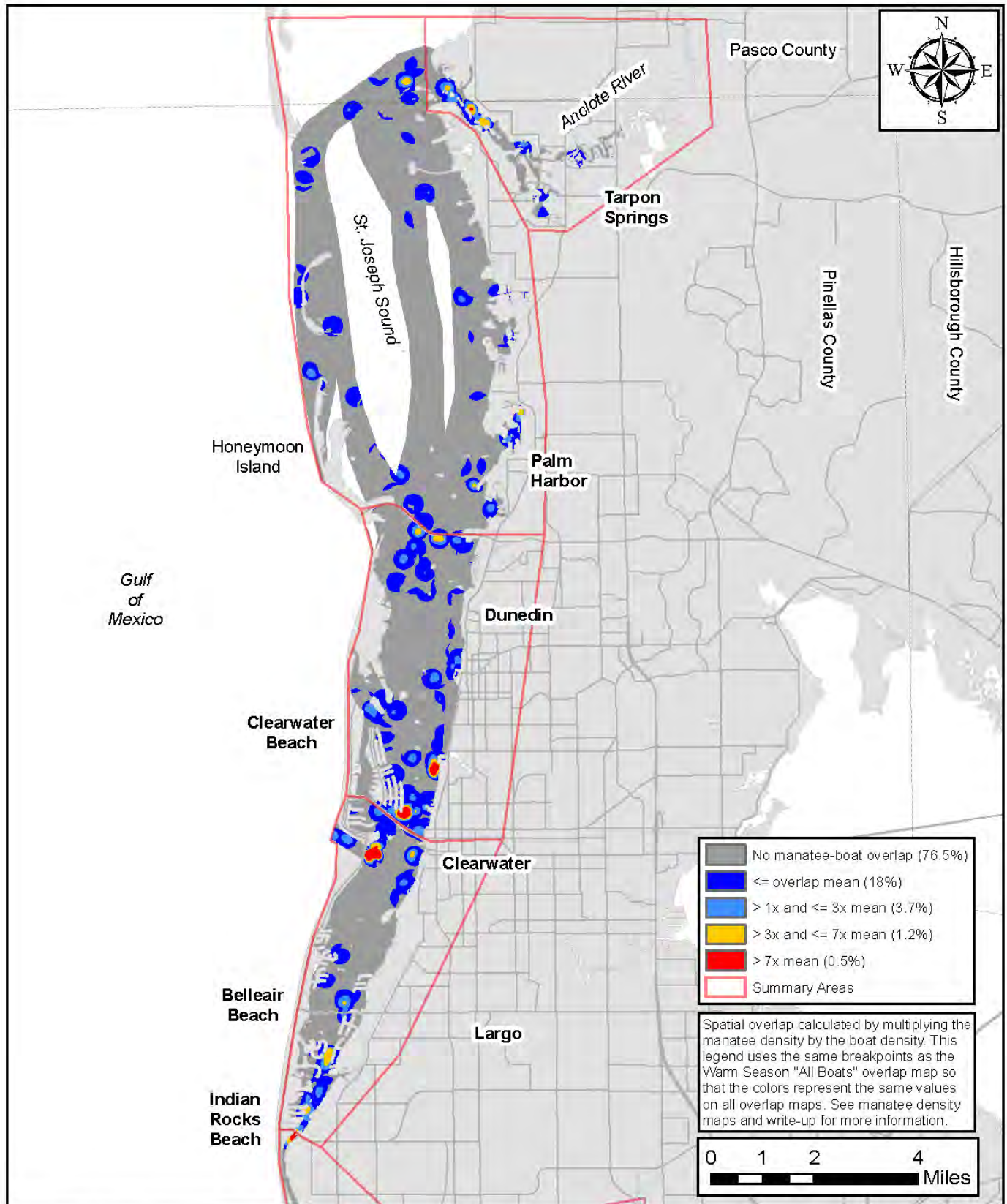


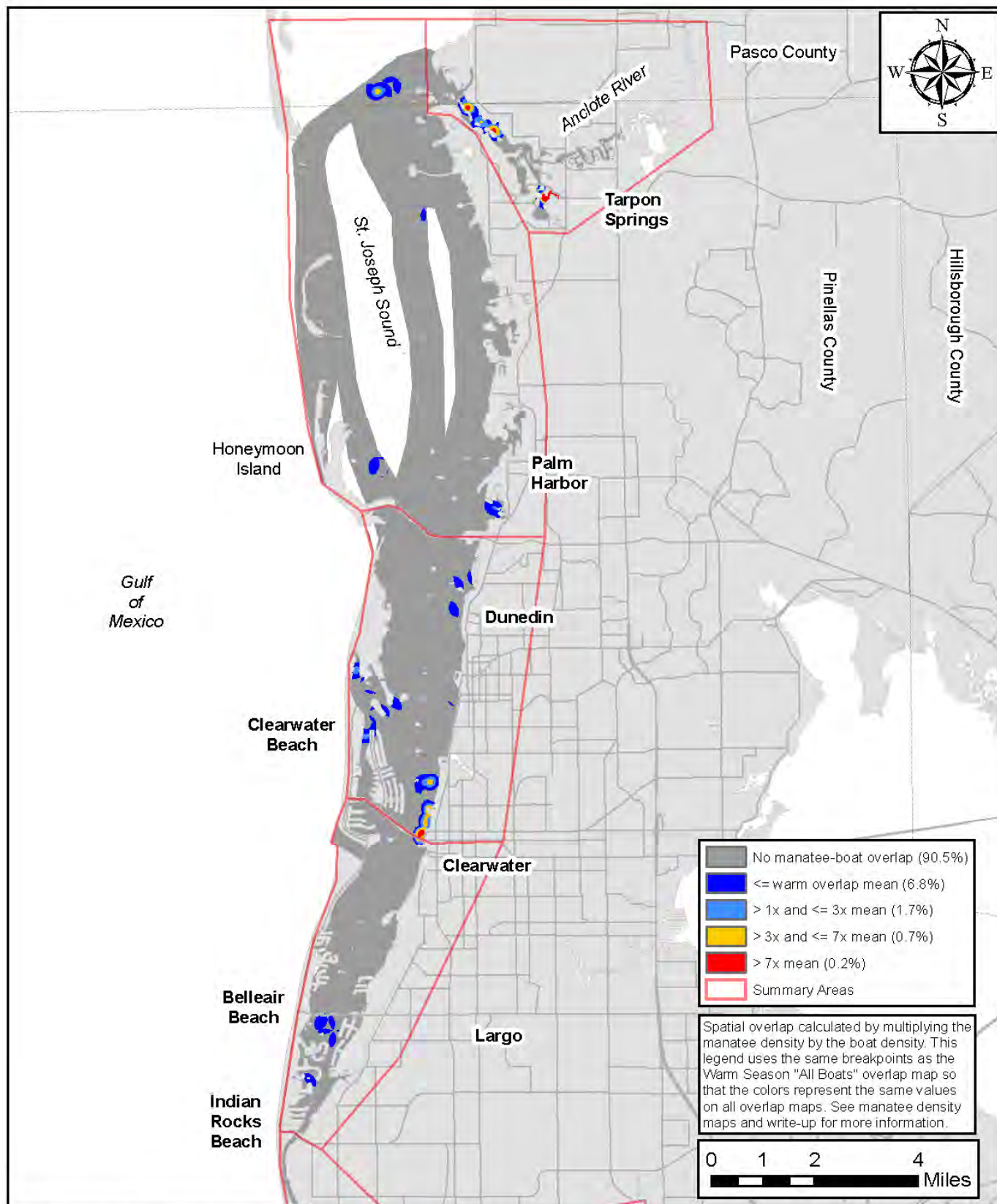
Figure 9



"Fast Boats" Manatee-Boat Spatial Overlap (2008-10 Manatees; 2008-09 Boats)
 Warm Season (Apr - Oct)
 Western Pinellas County (North)

Florida Fish & Wildlife Conservation Commission
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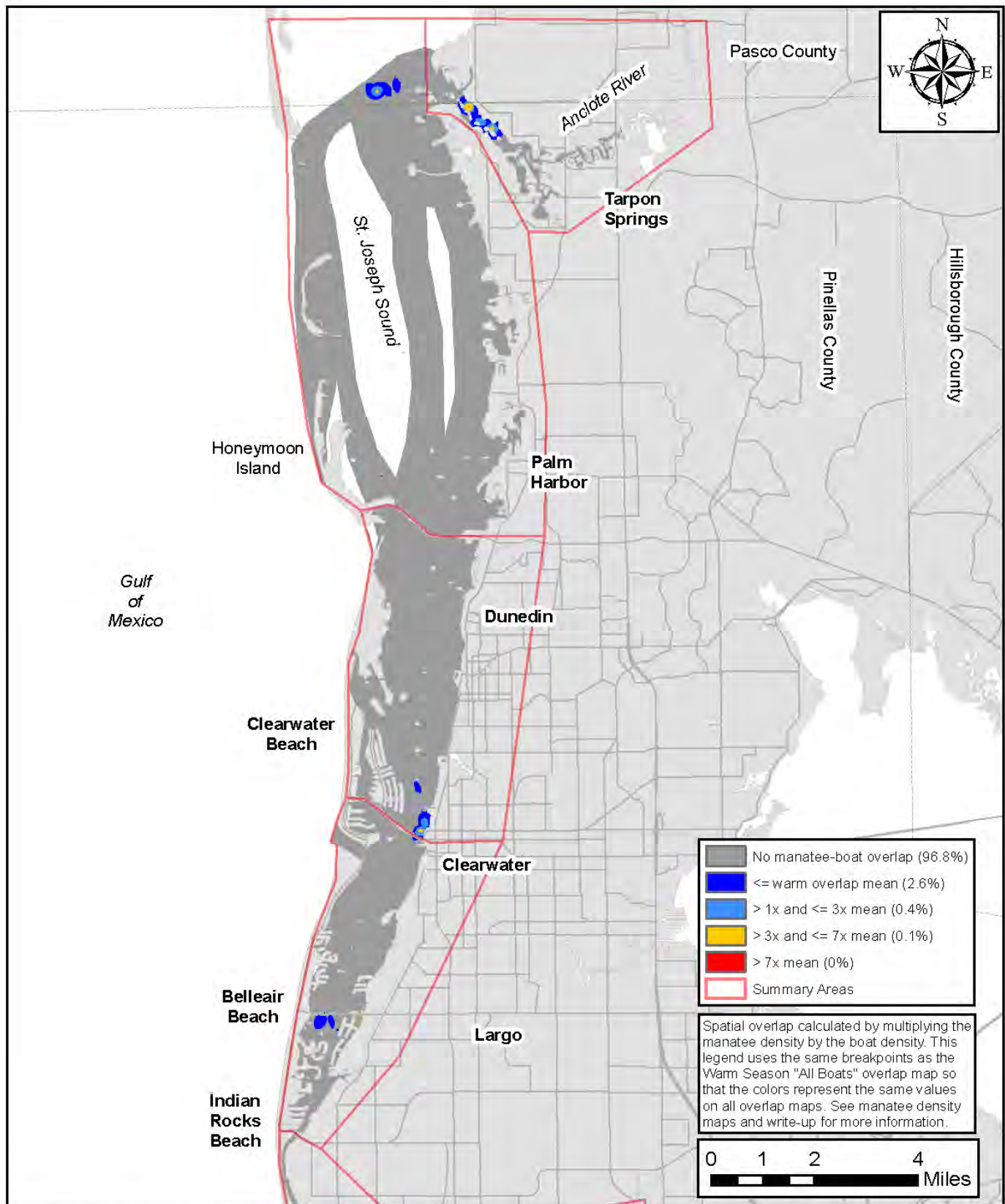
Figure 10



"All Boats" Manatee-Boat Spatial Overlap (2008-10 Manatees; 2008-09 Boats)
Cold Season (Nov - Mar)
Western Pinellas County (North)

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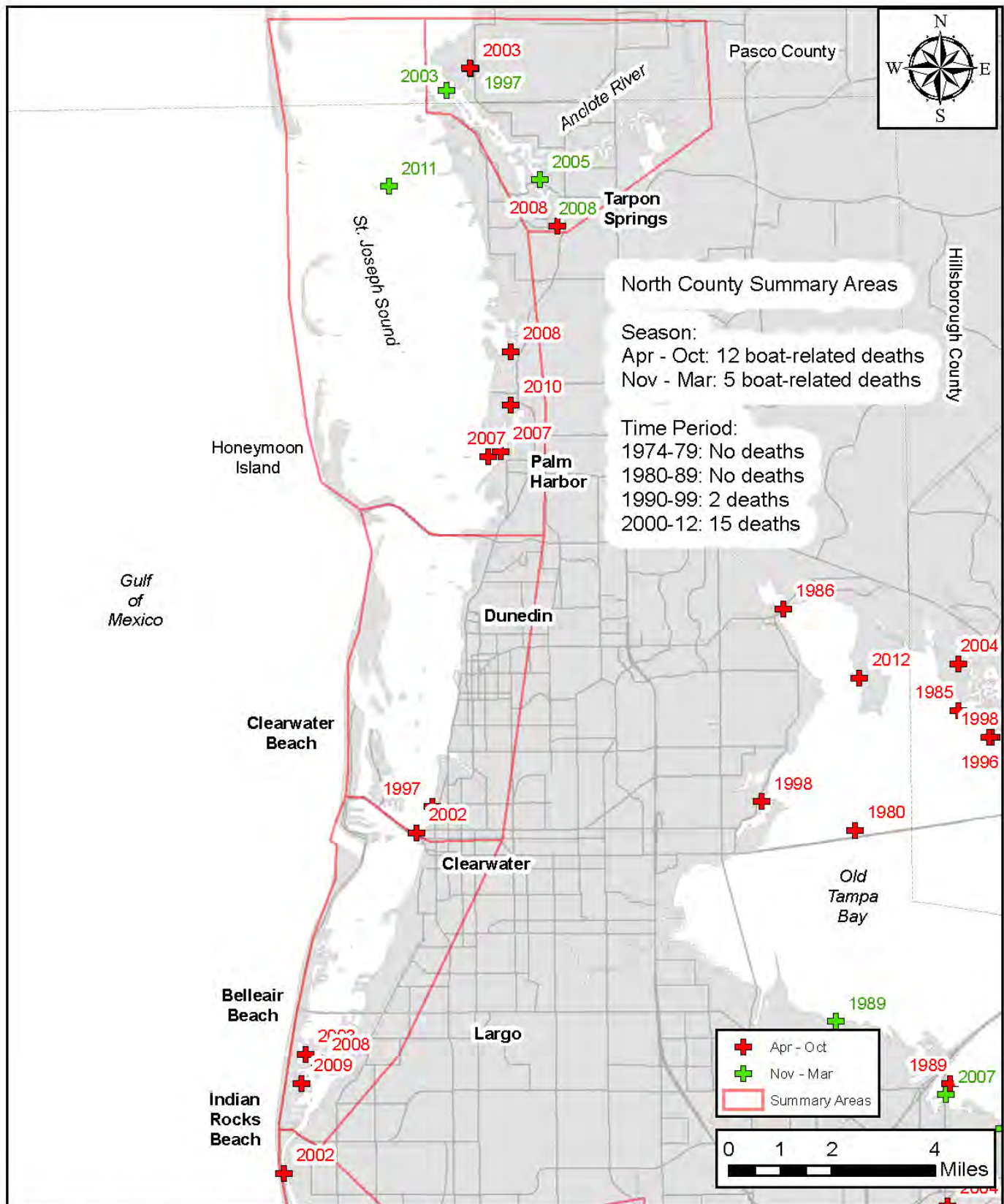
Figure 11



"Fast Boats" Manatee-Boat Spatial Overlap (2008-10 Manatees; 2008-09 Boats)
Cold Season (Nov - Mar)
Western Pinellas County (North)

Florida Fish & Wildlife Conservation Commission
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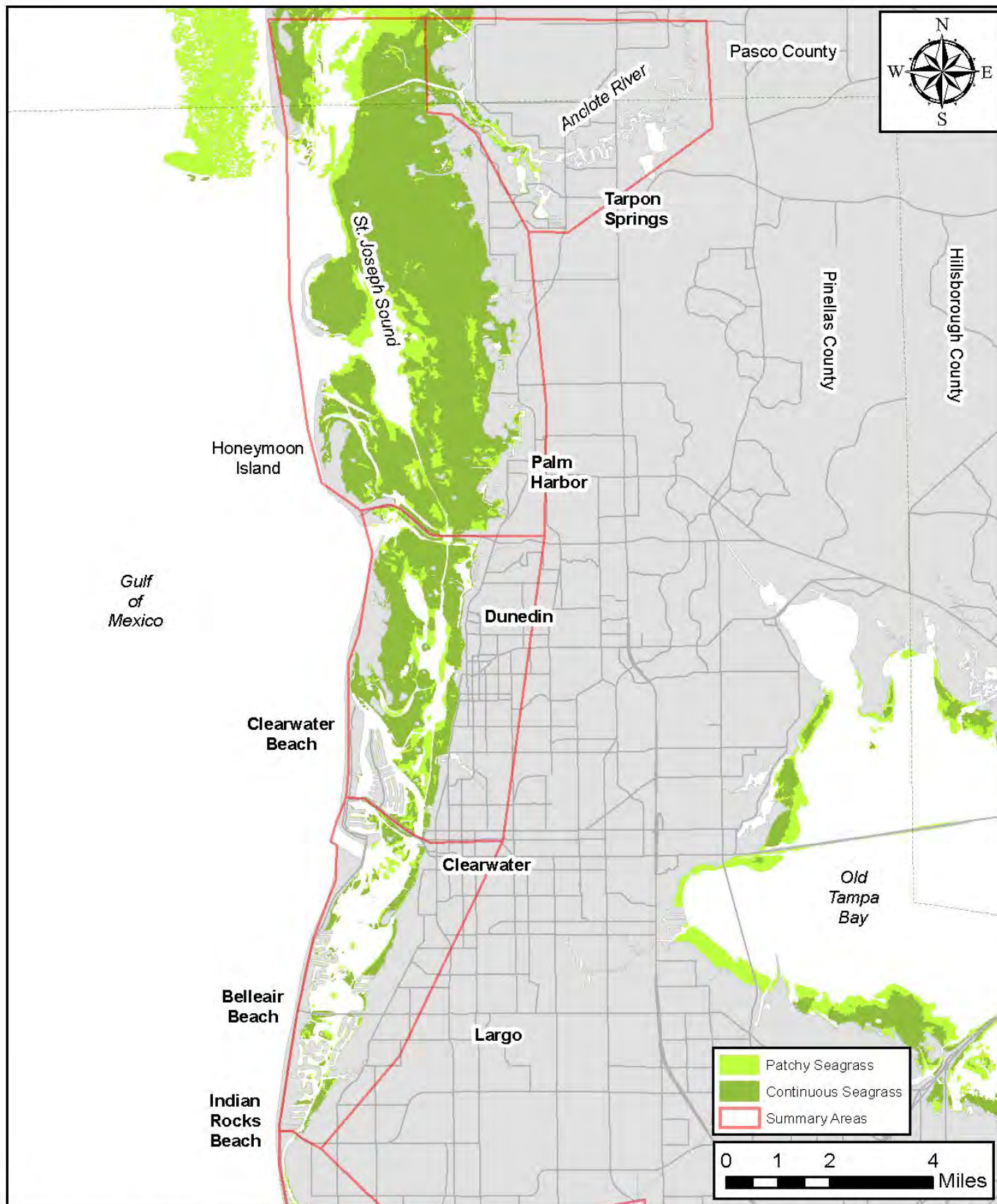
Figure 12



Boat-related Manatee Mortality by Season and Time Period (1974 - 2012)
 Western Pinellas County (North)
 (Data for 2012 are preliminary)

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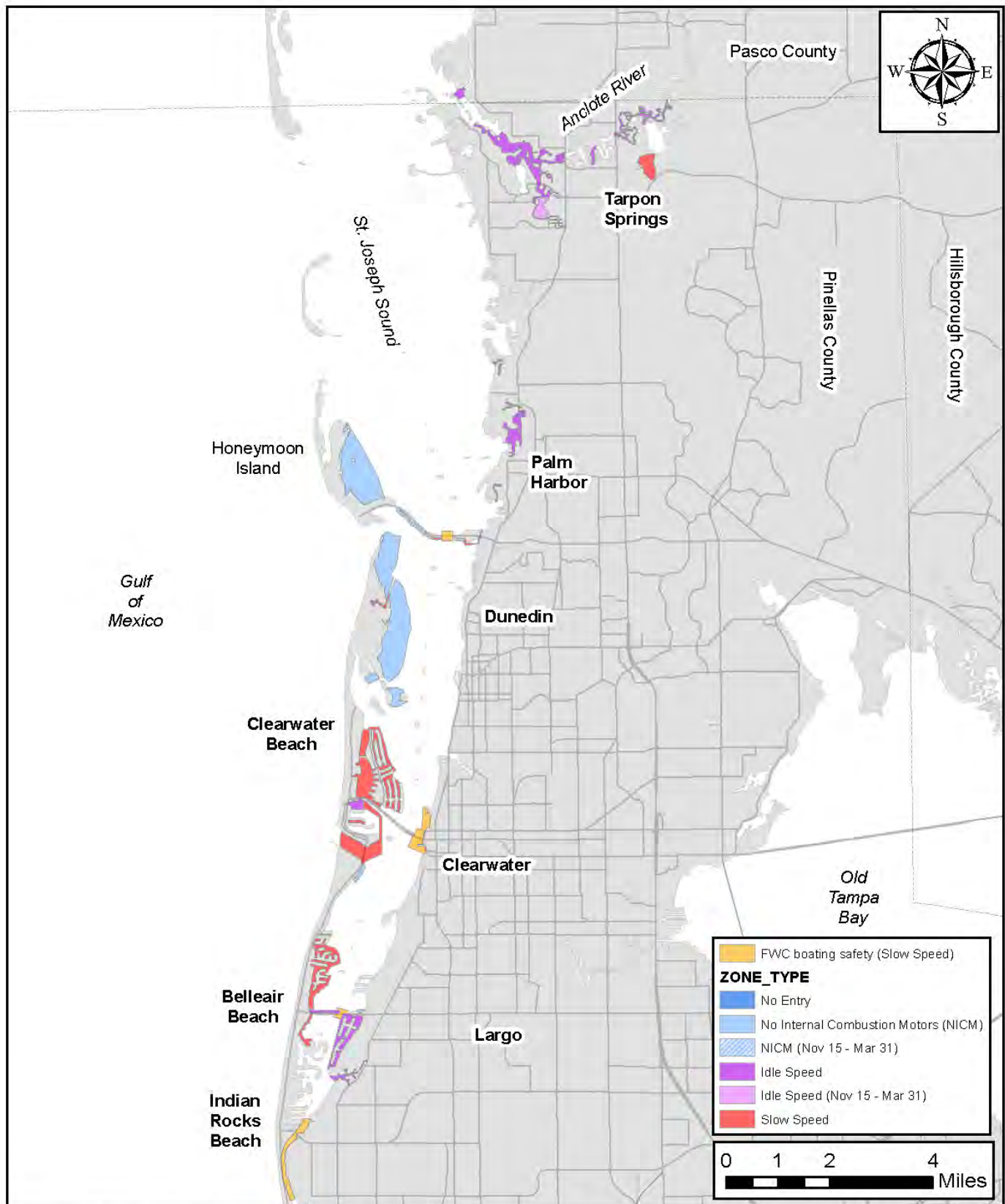
Figure 13



Seagrass (Pinellas: 2012; Pasco: 2007)
 Western Pinellas County (North)
 (Source: Southwest Florida Water Management District)

Florida Fish & Wildlife Conservation Commission
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Figure 14



Existing local and state boating regulations (November 2013)
Western Pinellas County Only (North)

Florida Fish & Wildlife Conservation Commission
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Imperiled Species Management Section
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Figure 15

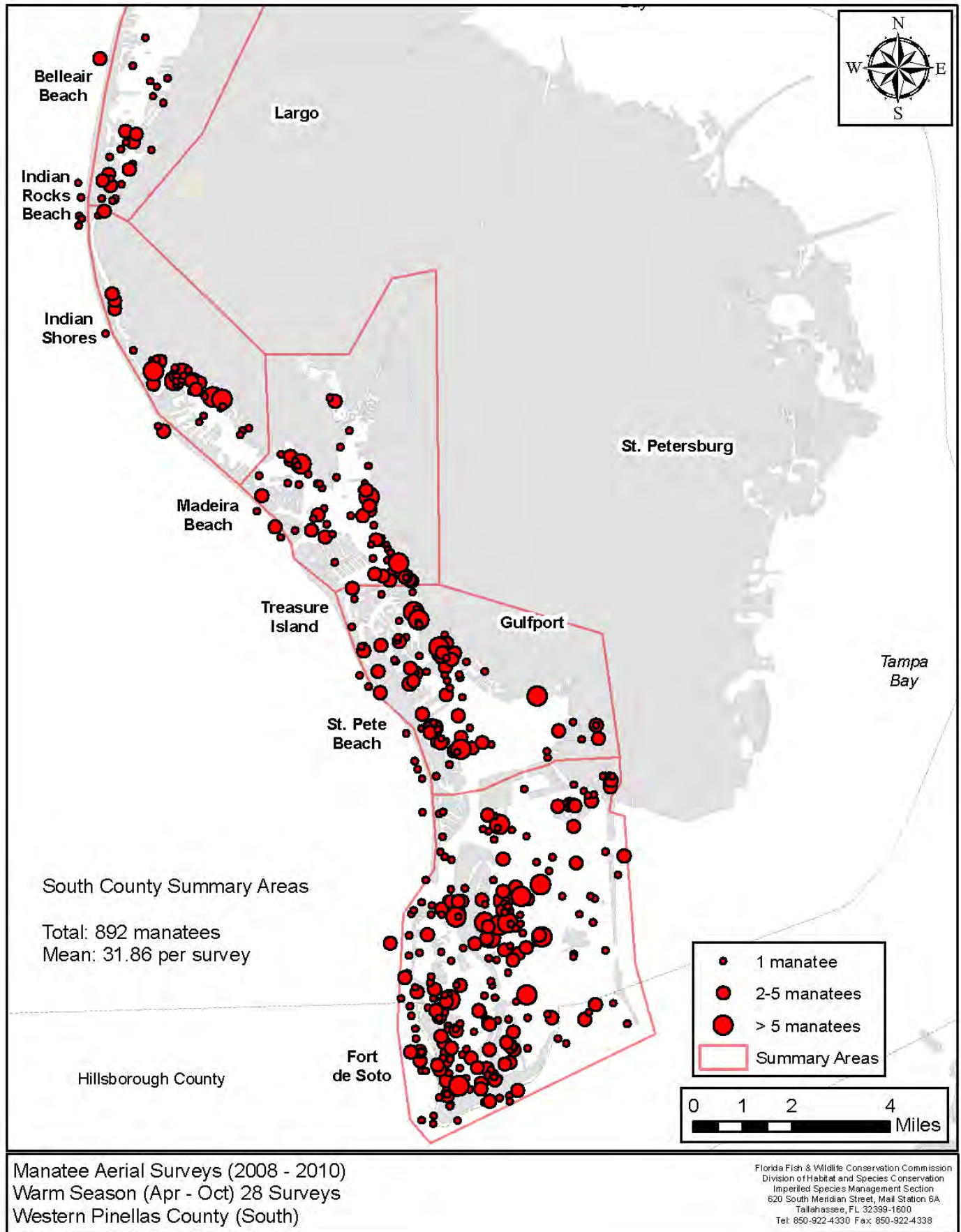


Figure 16

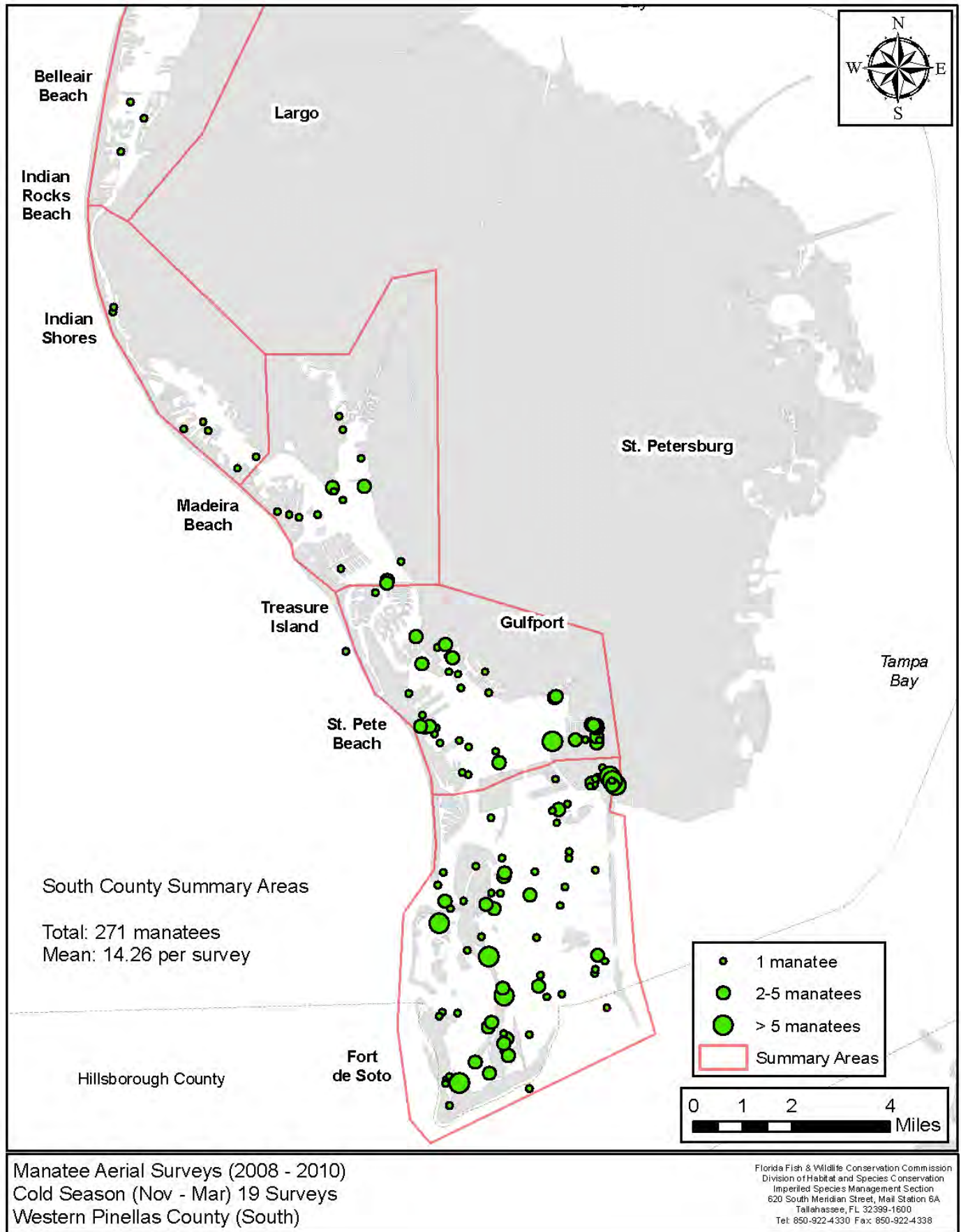


Figure 17

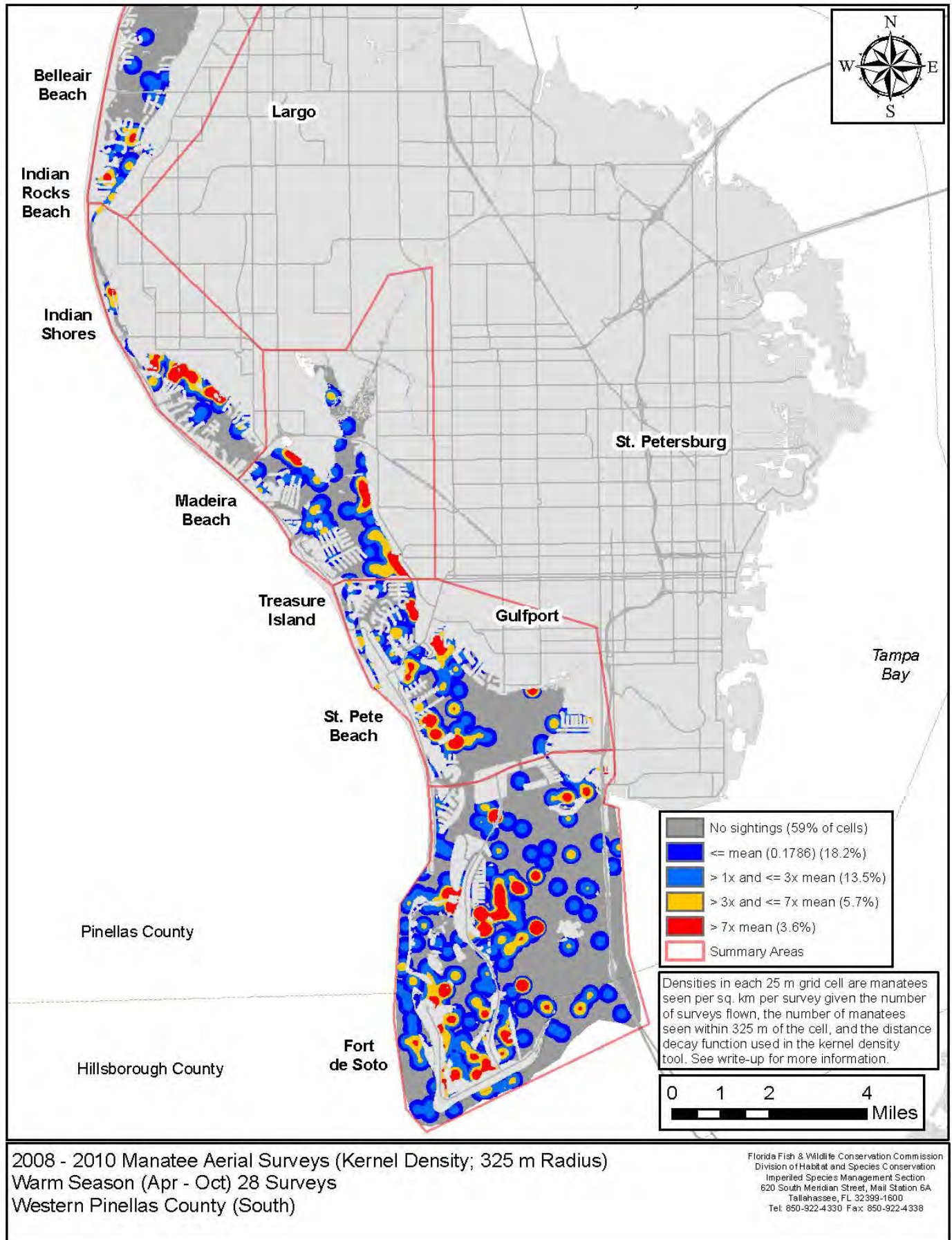


Figure 18

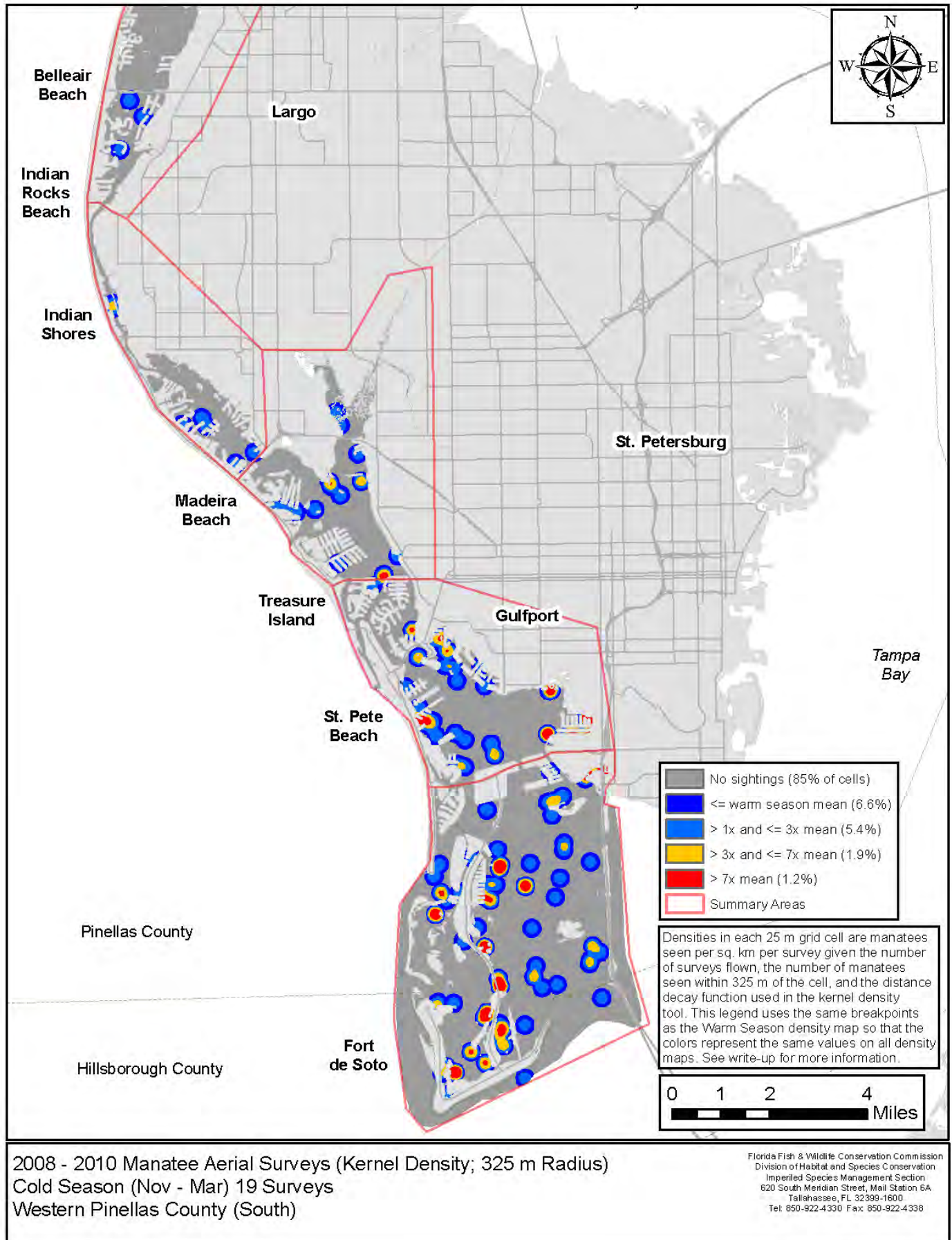


Figure 19

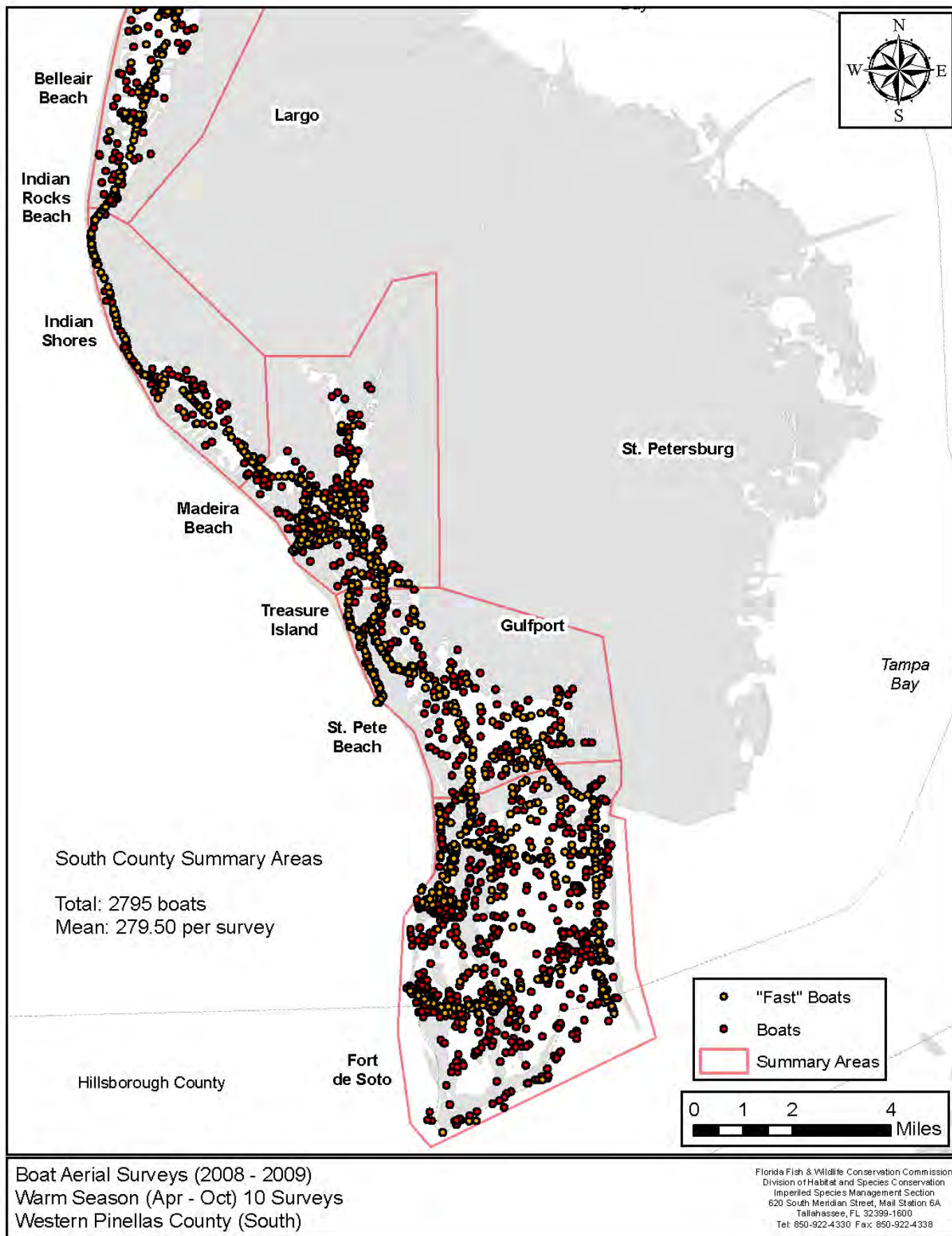


Figure 20

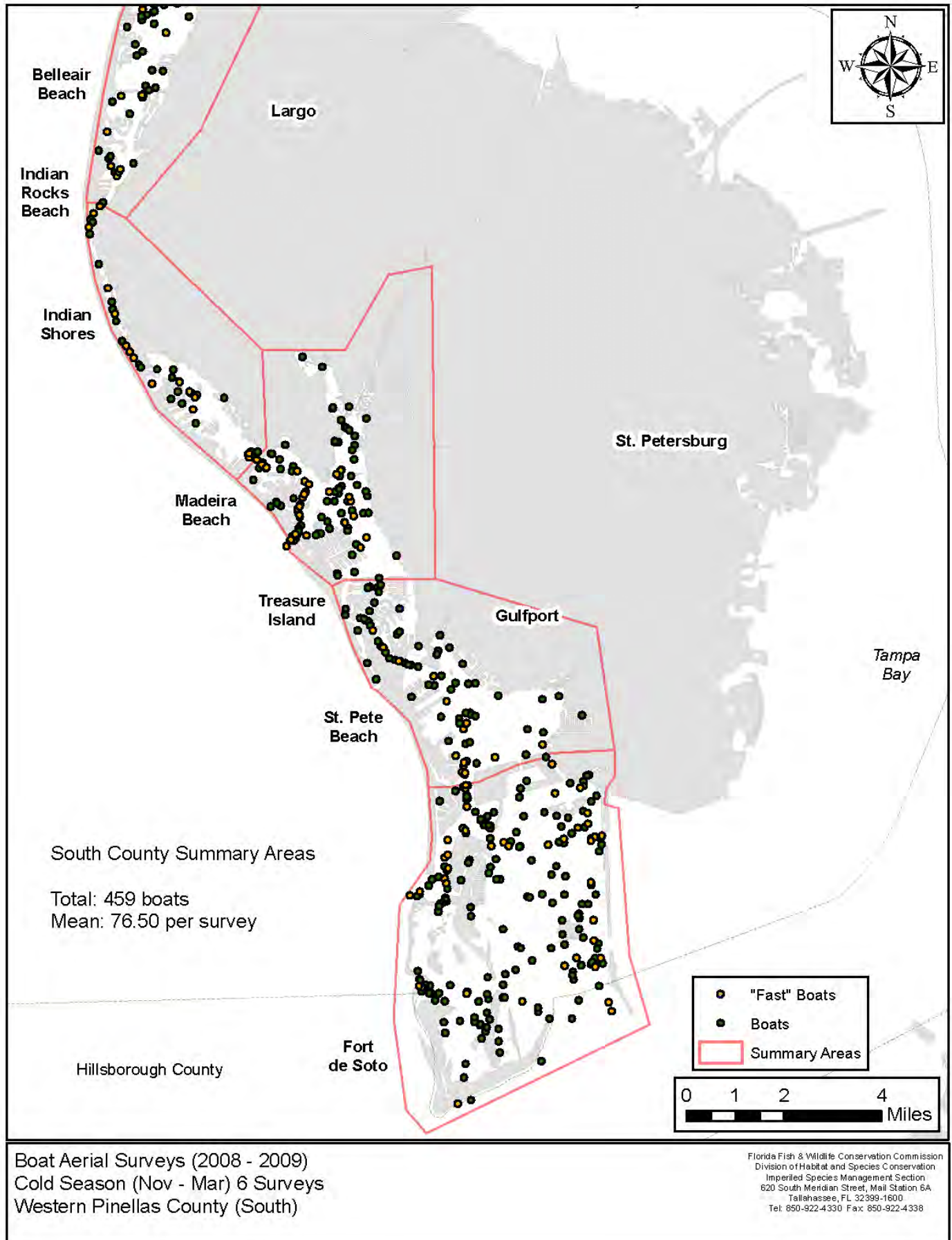
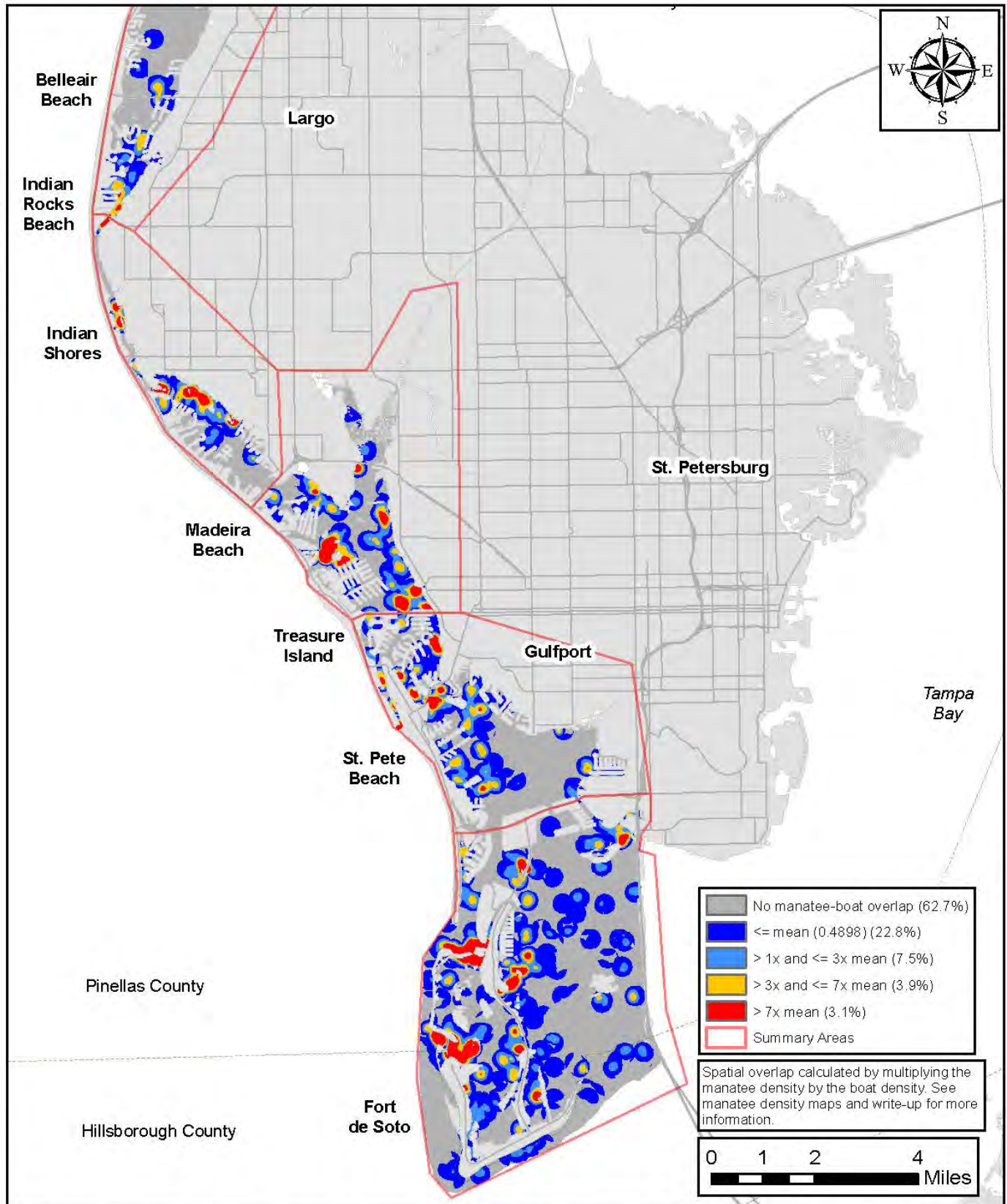


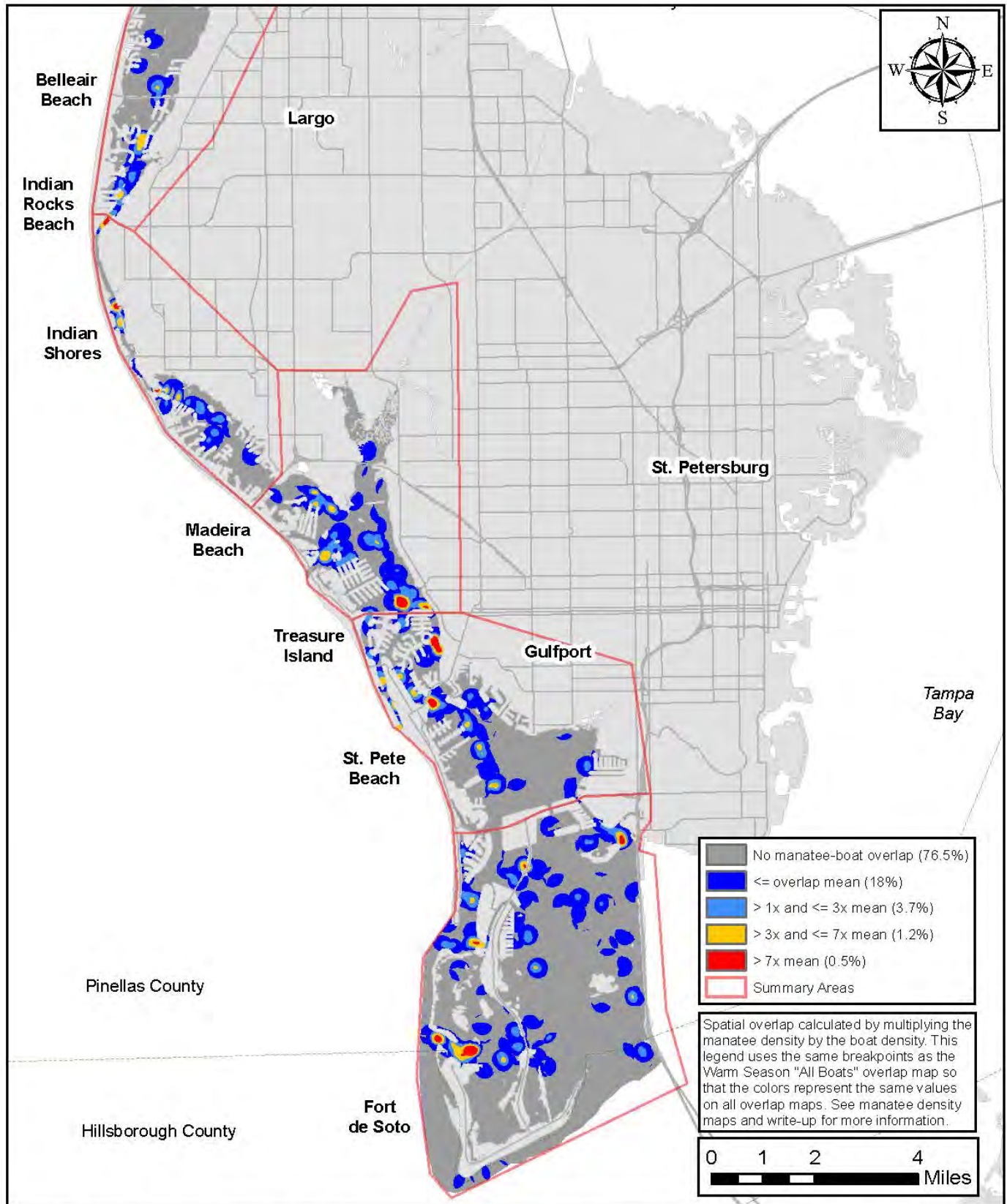
Figure 21



"All Boats" Manatee-Boat Spatial Overlap (2008-10 Manatees; 2008-09 Boats)
 Warm Season (Apr - Oct)
 Western Pinellas County (South)

Florida Fish & Wildlife Conservation Commission
 Division of Habitat and Species Conservation
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Figure 22



"Fast Boats" Manatee-Boat Spatial Overlap (2008-10 Manatees; 2008-09 Boats)
 Warm Season (Apr - Oct)
 Western Pinellas County (South)

Florida Fish & Wildlife Conservation Commission
 Division of Habitat and Species Conservation
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Figure 23

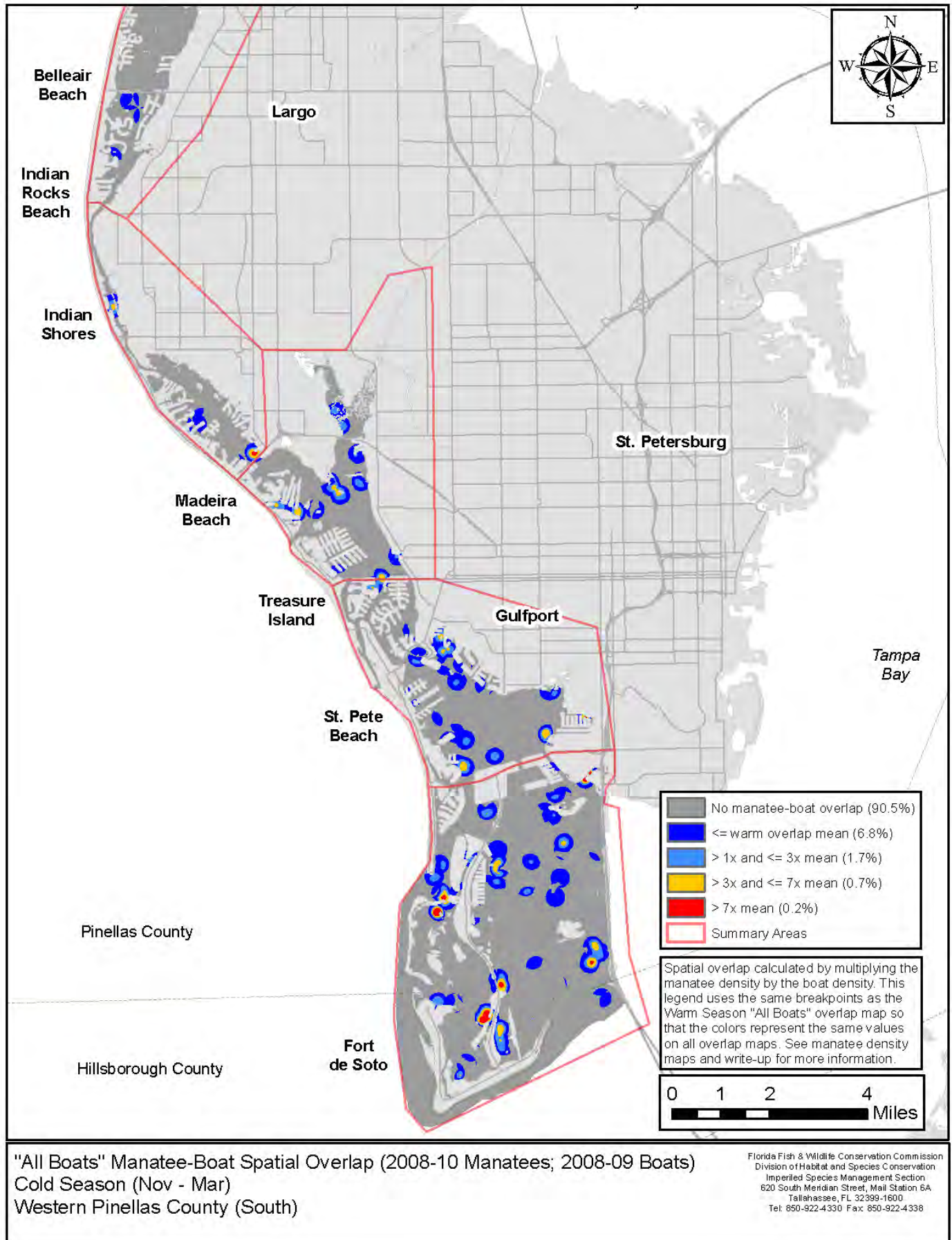


Figure 24

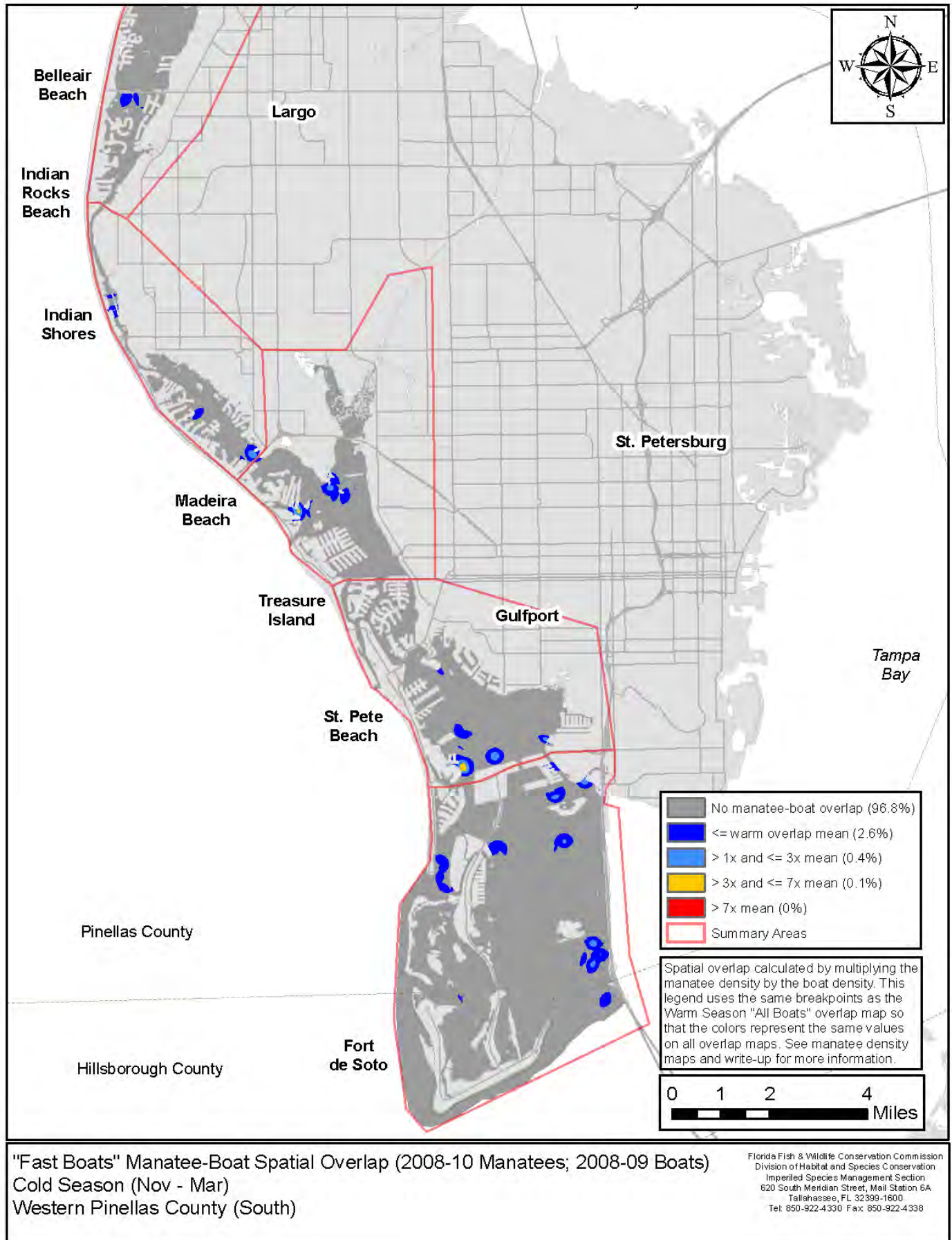


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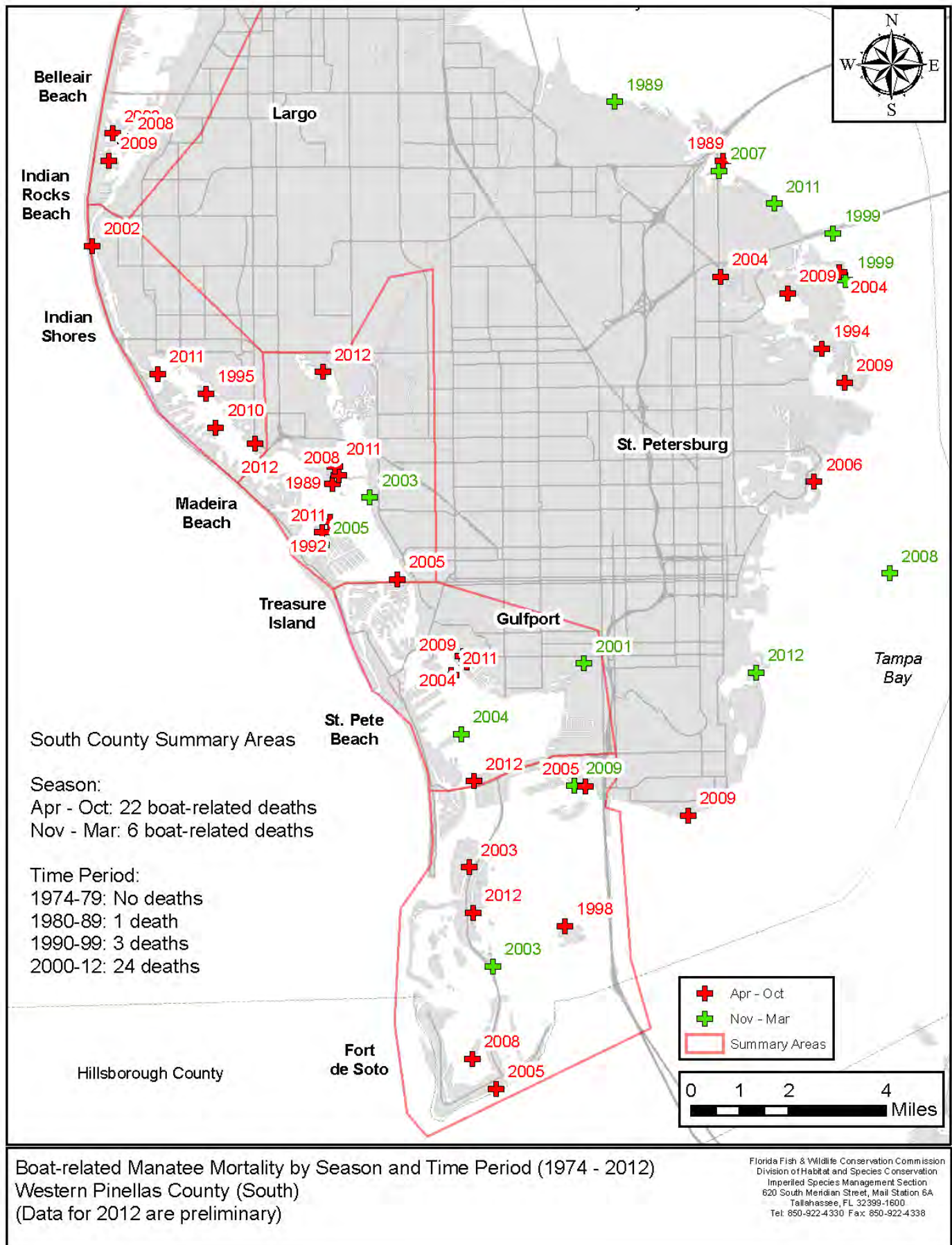
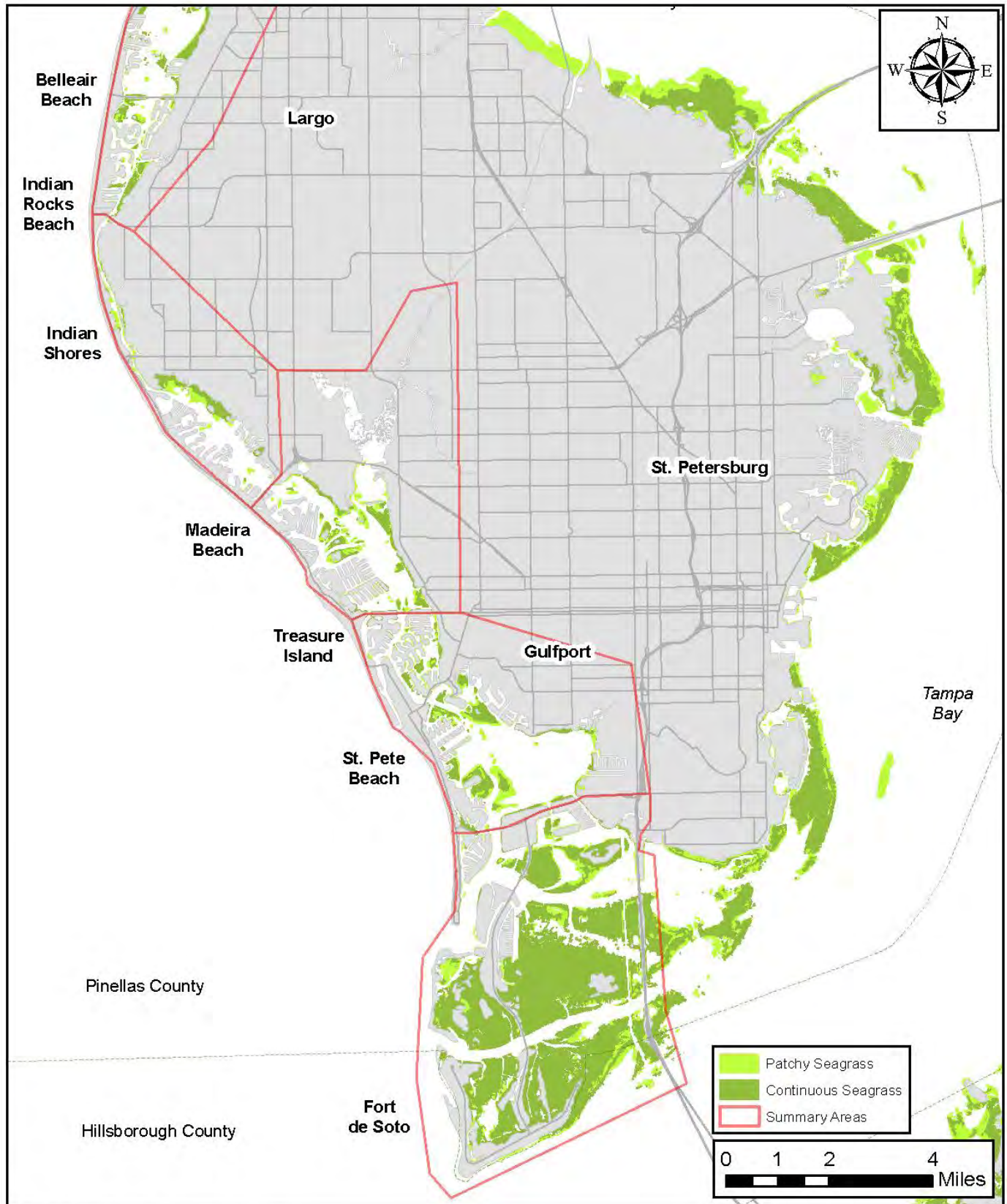


Figure 26



Seagrass (2012)
 Western Pinellas County (South)
 (Source: Southwest Florida Water Management District)

Florida Fish & Wildlife Conservation Commission
 Division of Habitat and Species Conservation
 Imperiled Species Management Section
 620 South Meridian Street, Mail Station 6A
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Figure 27

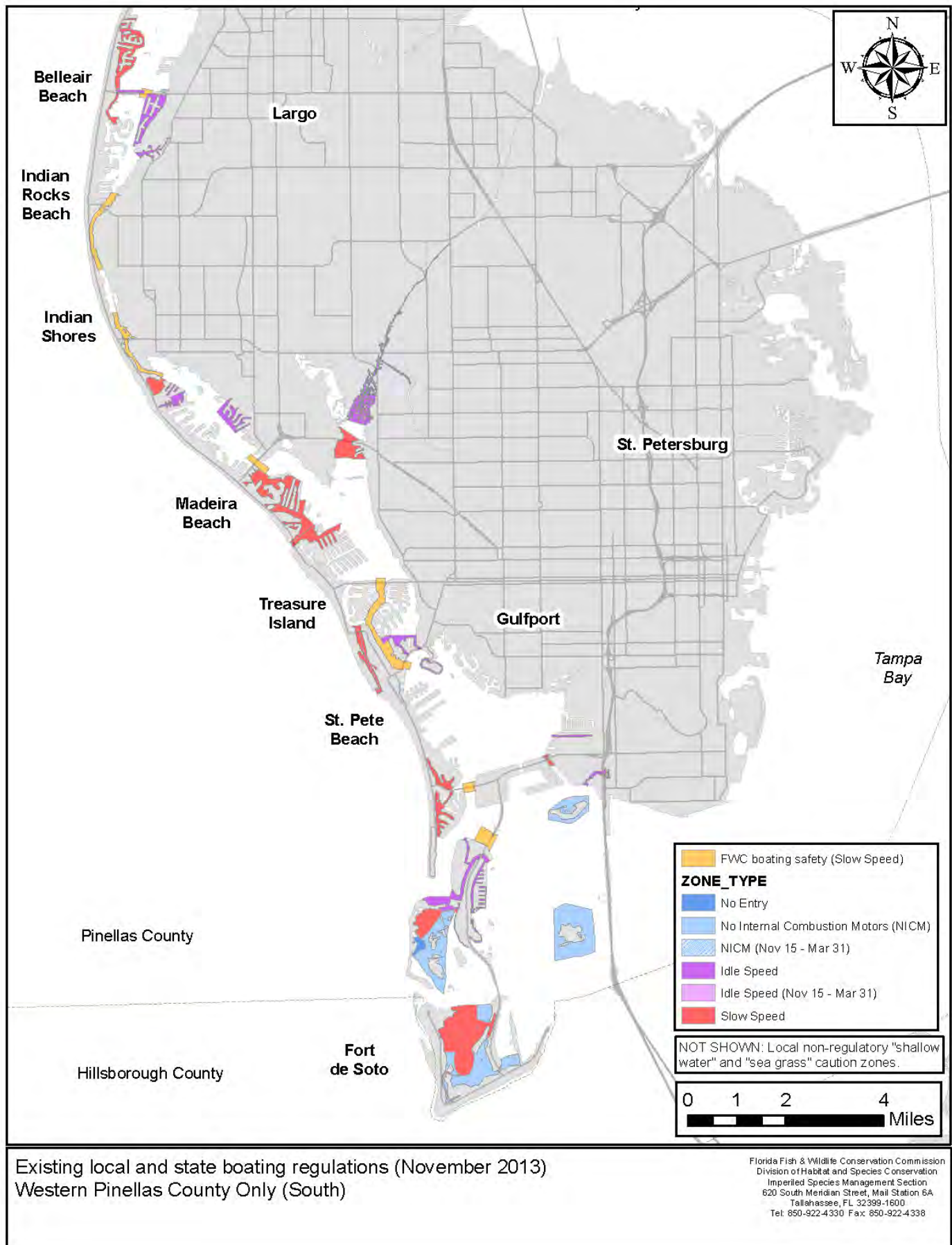


Figure 28