



May 24, 2010

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**Imperiled Species  
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**Kipp Frohlich**  
Section Leader  
(850) 922-4330  
(850) 922-4338 fax

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Thank you for agreeing to serve on the Local Rule Review Committee (LRRC) for Flagler County. The Florida Fish and Wildlife Conservation Committee (FWC) is required to initiate the LRRC process before proposing new or amended rules that would regulate the speed and operation of motorboats for the purpose of manatee protection. The letter we sent on March 8, 2010, to notify Flagler County of our intent to consider rule making (copy attached) provides additional information about the LRRC process and other background information.

As stated in the letter, the FWC is reviewing Flagler County to determine if new manatee protection zones are needed. Based on our preliminary staff review, we believe some new zones may be warranted. These potential zones and a discussion of the rationale for them are detailed in the attached document (*Flagler County Manatee Protection Rule Review Data Discussion and Preliminary Identification of Areas for LRRC Review*). It is important to stress that the potential zones are not final staff recommendations. Before we finalize the staff recommendations, we want to fully evaluate the perspectives and issues raised during the LRRC process. We therefore request that the LRRC review the potential zones identified by staff and provide recommendations as to what zones, if any, should be proposed. If the LRRC identifies any other zones it feels are needed or suggested modifications to the FWC potential zones, we would like to know about these as well.

We have provided County staff with the documents mentioned above as well as the geographic information system (GIS) data that can be displayed, queried, and analyzed in ArcGIS®. A summary and description of the documents and data is included in the appendices of the attached document.

In closing, I want to again thank you for agreeing to serve on the Flagler County LRRC. The FWC greatly appreciates the work that you will perform. I can assure you that FWC staff and the Commissioners will give very careful and deliberate consideration to the recommendations that the LRRC provides. We look forward to working with you.

Sincerely,

R. Kipp Frohlich, Section Leader  
Imperiled Species Management Section

Attachments

# **Flagler County Manatee Protection Rule Review Data Discussion and Preliminary Identification of Areas for LRRC Review**

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**Prepared by FWC staff for use by the  
Flagler County Local Rule Review Committee (LRRC)  
in fulfillment of Florida Statute 379.2431(2)(f)7**

**May 2010**

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## Introduction

This document summarizes and discusses the primary data and analyses used during the Florida Fish and Wildlife Conservation Commission's (FWC) preliminary review of the need for manatee protection boat speed zones in Flagler County. The document identifies and discusses five potential zones FWC staff believes **may** be warranted based on the data review and three other areas where FWC staff requests input from the LRRC. At this time staff has not made a final determination as to whether any of these potential zones should be presented to the FWC Commissioners for consideration. Prior to making a final determination, staff will fully evaluate the local perspective as provided by the LRRC. The FWC requests that the LRRC review these potential zones and provide recommendations as to what zones, if any, it believes should be established. This document should not be construed to limit what information the LRRC may consider or what zones it can recommend. The LRRC report may contain any recommendations the LRRC deems worthy and the FWC response to the LRRC report will address all recommendations.

## Overview of Data Analysis

### 1. Notes on data analysis and data sources

- a. For purposes of analyzing and summarizing data, the county was divided into five primary regions. These regions were: Marineland and Long Creek; Palm Coast to the Dunes Hammock Bridge; Fox Cut; Fox Cut to the State Road 100 Bridge; and, south of the State Road 100 Bridge to the Flagler-Volusia County line. A map of these regions is included as **Figure 1**.
- b. For purposes of creating maps to display data, the county was divided into two regions: the North Region extends from the St. Johns County line to the Dunes Hammock Bridge; the South Region extends from the Dunes Hammock Bridge to the Volusia County line.
- c. The primary data sources used in this review are discussed in the following sections. Other data that were also considered in the review are not discussed in this document, such as manatee telemetry data. These data and other information are included in the list of supporting data.
- d. A 2003 publication discussing manatee use patterns along the Atlantic Coast based on telemetry data has been provided to the county. This document should be used as an aid to understand the telemetry data.

### 2. Notes on Manatee Aerial Survey Data

- a. Manatee distributional aerial survey (AS) data for Flagler County were collected twice a month for a two year period from November 2005 through September 2007 by FWC Fish and Wildlife Research Institute (FWRI) staff.
- b. A total of 47 survey flights were flown.
- c. Each flight surveyed approximately 8.7 km<sup>2</sup> of coastal waters in the county.
- d. This dataset does 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.

### **3. Notes on Manatee Mortality Data**

- a. Manatee mortality data have been collected since 1974. Data through December 2009 were used for this review.
- b. 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.
- c. When possible, the FWRI Marine Mammal Pathobiology Lab (MMPL) records whether watercraft-related deaths were “acute,” meaning the animal had extensive injuries and the collision most likely occurred relatively close to the location of the carcass recovery, or “chronic,” meaning the animal sustained less extensive injuries and may have been able to travel some distance before succumbing to the injuries. A determination of acute versus chronic cannot always be made and this information has consistently been noted on necropsy reports only in recent years. Where this information is available, it has been noted in the discussions in the following sections.

### **4. Notes on Boat Aerial Survey Data**

- a. The primary boating data used for this review were collected by MOTE Marine Laboratory (MML) from August 2007 through February 2009 using aerial surveys. A written report discussing this data was compiled by MML and provided to FWRI in June 2009. An electronic version (PDF format) of this report has been provided to Flagler County staff.
- b. MML flew 20 surveys. The data were collected in four survey quarters: Winter (Dec. – Feb.), Spring (Mar. – May), Summer (June – Aug.), and Fall (Sept. – Nov.). Each quarter contained five flights consisting of two weekday flights and three weekend flights.
- c. The boat data used in this analysis was a subset of the overall dataset. Vessels that were classified as operating under human-power or sail power [“SPEED” = 1 OR “SPEED”=2] were not included in the analysis. This power boat data set included a total of 732 boats in Flagler County.
- d. The Flagler County power boat data was further subdivided to include vessels that were classified as plowing, cruising or planing [“SPEED” >= 4]. This “Fast Boats” subset included a total of 277 boats, or approximately 38% of the dataset.

### **5. Manatee-Boat coincidence**

- a. The manatee and boat aerial survey point data were processed in ArcGIS using the kernel density command with a cell size of 25 meters and a search radius of 325 meters. Coincidence values were calculated by multiplying the per survey manatee cover by the per survey boating cover.

- b. Coincidence is the area of potential spatial overlap between the two datasets, with the higher numbers and warmer colors representing a higher potential for manatee-boat interactions.
- c. Six coincidence covers were created, one using the Flagler power boats dataset described above and one using only boats from the “fast” boats. An all boat coincidence and a “fast” boat coincidence cover were created for the warmer month period (Apr. - Oct.) and the colder month period (Nov.-Mar.).

## 6. Countywide Data Summary

### Manatee Aerial Survey Data

- The data document a strong seasonal disparity in the number of manatees seen, with an overall density of 0.327 in the warmer months (Apr.-Oct.) and 0.046 in the colder months (Nov.-Mar.), which means documented manatee use was approximately 7.8 times higher during the warmer months. **Table 1** summarizes the aerial survey data by zone and season.

### Mortality Data

- 75 carcasses have been recovered in the coastal portion of the county since 1974, with 59 (79%) recovered during the warmer months and 16 (21%) recovered during the colder months. (The warmer months account for 58% of the year while the colder months account for 42%.) The “Perinatal (<=150 cm)” category had the most deaths (36). “Human Related: Watercraft collision” was the next highest category with 14, nine (9) of which have occurred since 2002. **Table 2** summarizes the mortality data by month and cause of death.
- The first watercraft-related carcass was recovered in the county in 1990. Since that date, watercraft-related carcass recoveries have been increasing in coastal Flagler County. During the 1990-1999 period, five (5) manatee deaths were identified as watercraft-related, while from 2000-2009, nine (9) watercraft-related manatee deaths were recorded in the county’s coastal waters.
- Of the 14 watercraft-related deaths recorded in the county’s coastal waters, 12 (86%) were recovered during the warmer months and two (14%) were recovered during the colder months. Two watercraft-related deaths are the most ever recovered in the county in one year (in 2007, 2006, and 2003).
- Five (5) of the six (6) watercraft-related carcasses recovered in the coastal part of the county since 2004 were identified as acute deaths and one (1) as a chronic death. None of the reports for deaths in Flagler County prior to 2004 includes an assessment of acute versus chronic.

### Coincidence Data

- The mean countywide “All Boats” coincidence value (“Coin”) was 0.476 while the mean overall “Fast Boats” coincidence value (“Fast Coin”) was 0.206. The ratio of Fast Coin to Coin (0.433 in this case) gives an indication of how much of the overall coincidence was the result of boats traveling at higher speeds. **Table 3** summarizes the coincidence analysis results by zone and season.
- The mean countywide coincidence values for the warmer months (Coin = 0.662; Fast Coin = 0.327) were several times greater than the corresponding values for the colder months (0.103 and 0.058, respectively). This suggests the overall boating risk to manatees is substantially higher during the warmer months.

### Seasonality of the Data

- Because of the seasonal trend displayed in the datasets, the data have been analyzed and presented based on traditional warm (April through October) and cold (November through March) season ranges. FWC staff chose this seasonal break to remain consistent with other state manatee protection zones; however, alternative seasonal windows may be appropriate.

## **7. Areas identified by FWC staff where protection zones may be warranted**

Site-specific areas identified by FWC staff as potentially warranting manatee protection zones are discussed in the zone by zone discussions below. Figures showing the locations of the site-specific areas are also included for each region.

## **FWC Preliminary Rule Proposals**

### **1. Marineland & Matanzas River**

#### Data Discussion

##### *Manatee Aerial Survey Data*

- The mean density of manatees seen per survey per square kilometer was 0.104. The density documented during the warmer months (0.150) was approximately 4 times greater than that seen during the colder months (0.038).

##### *Mortality Data*

- Five manatee carcasses have been recovered in this zone, none of which were attributed to watercraft-related injuries. The carcass recovered in 1992 (MNE9221) was attributed to another form of human related injuries, but the origin of the injuries was undetermined. Of the remaining four carcasses, two were attributed to natural causes and two were too decomposed to conclusively attribute to a cause of death.

##### *Coincidence Data*

- Coin for this region was 0.363 and Fast Coin was 0.142. The ratio of Fast Coin to Coin was 0.391, indicating that fast boats accounted for a relatively large portion of the manatee-boat coincidence in this area. The Coin value for the warmer months (0.396) was approximately 3 times the value for the colder months (0.118).

#### Areas identified by FWC staff where protection zones may be warranted

- The FWC has received requests to review the portion of the Matanzas River in the Intracoastal Waterway adjacent to Marineland for potential manatee protection boating speed zones. Three manatee carcasses have been recovered in the vicinity of Marineland, none of which was the result of watercraft-related injuries. The area around Marineland had a heightened level of warm season Fast Coin (1.109), but upon further examination, this was because of one group of 16 manatees travelling through the area. FWC staff has not identified this as an area where a zone may be warranted, but we are requesting input from the LRRC.

## 2. Palm Coast

### Data Discussion

#### *Manatee Aerial Survey Data*

- The mean density of manatees seen per survey per square kilometer was 0.121. The density documented during the warmer months (0.152) was approximately 2 times greater than that seen during the colder months (0.075).

#### *Mortality Data*

- Thirty manatee carcasses have been recovered in this zone. Most (23) of the 30 recovered manatee carcasses were classified as perinatal deaths, signifying that this area may be used by manatees as a calving or nursing area.
- Three (3) of the carcass recoveries were attributed to watercraft-related injuries. These three carcasses were recovered in 1990, 1995, and 1998. None of the reports for these deaths includes an assessment of acute versus chronic.

#### *Coincidence Data*

- Coin for this region was 0.215 and Fast Coin was 0.064. The ratio of Fast Coin to Coin was 0.298 indicating that fast boats accounted for a moderate portion of the manatee-boat coincidence in this area. The Coin value for the warmer months (0.232) was approximately 2.5 times the value for the colder months (0.090).

### Areas identified by FWC staff where protection zones may be warranted

- FWC staff initially considered the area in the Intracoastal Waterway north of the Palm Coast residential canals where the waterway widens with the Matanzas River flats to the west. This area has heightened warm season coincidence (0.916) and Fast Coin (0.657). Three manatee carcasses have been recovered in the immediate vicinity, one of which was a watercraft related mortality (MJAV9028) recovered in May 1990. Four groups of manatees were observed in this area; all groups were one or two animals each. FWC staff has not identified this as an area where a zone may be warranted, but we are requesting input from the LRRC.
- B1: An area extending from the northern shoreline of the central Palm Coast residential canal to approximately 300 feet south of the Dunes Hammock Bridge. This area has heightened warm season coincidence (1.459) and Fast Coin (0.466). The area's ratio of Fast Coin to coincidence (0.32) indicates "fast" boats are a moderate component of the overall manatee-boat coincidence in this area. The number of perinatal carcasses recorded in the Palm Coast canal residential system and the fact mother-calf pairs have been seen in this area suggest this area may be an important calving or nursing area.

*Potential Zone:* Add a warm season (April through October) Slow Speed Minimum Wake zone starting just north of the central Palm Coast residential canal extending to approximately 300 feet south of the Dunes Hammock Bridge (total linear distance: 1.5 miles).

## 3. Fox Cut

### Data Discussion

#### *Manatee Aerial Survey Data*

- The mean density of manatees seen per survey per square kilometer was 0.250. The density documented during the warmer months (0.407) was approximately 22 times greater than that seen during the colder months (0.018).



#### *Mortality Data*

- One (1) manatee carcass has been recovered in this area. The carcass was recovered in 2003 and was classified as a perinatal.

#### *Coincidence Data*

- Coin for this region was 0.886 and Fast Coin was 0.447. The ratio of Fast Coin to Coin was 0.506 indicating that fast boats accounted for a relatively large portion of the manatee-boat coincidence in this area. The Coin value for the warmer months (1.714) was approximately 42 times the value for the colder months (0.041).

#### Areas identified by FWC staff where protection zones may be warranted

- FWC staff has not identified this as an area where a zone may be warranted, but we are requesting input from the LRRC.

### **4. Smith Creek North of S.R. 100**

#### Data Discussion

##### *Manatee Aerial Survey Data*

- The mean density of manatees seen per survey per square kilometer was 0.469. The density documented during the warmer months (0.764) was approximately 22 times greater than that seen during the colder months (0.035).

##### *Mortality Data*

- Seventeen manatee carcasses have been recovered in this area. Most (10) of the 17 recovered manatee carcasses were classified as perinatal deaths, signifying that this area may be used by manatees as a calving or nursing area.
- One (1) of the carcass recoveries was attributed to watercraft-related injuries. This carcass was recovered in 2006 and was classified as an acute death, indicating that the interaction with the vessel likely occurred nearby.
- Of the remaining six (6) carcasses, two were determined to have died from natural causes and the cause of death was undetermined for the remaining four.

##### *Coincidence Data*

- Coin for this region was 0.915 and Fast Coin was 0.402. The ratio of Fast Coin to Coin was 0.439 indicating that fast boats accounted for a relatively large portion of the manatee-boat coincidence in this area. The Coin value for the warmer months (1.326) was approximately 9 times the value for the colder months (0.153).

#### Areas identified by FWC staff where protection zones may be warranted

- D1: Smith Creek extending from the southern shore of Lehigh Canal northward to just north of the Silver Lake Marina. This area displays heightened warm season Coin (1.797) and “Fast Coin (0.694). The area’s ratio of Fast Coin to Coin (0.39) indicates “fast” boats are a large component of the overall manatee-boat coincidence in this area. Four manatee carcasses have been recovered in the immediate vicinity. One was a watercraft-related mortality recovered in 2006 (MNE0632); it was classified as an “acute” death. Of the remaining 3 deaths, two were perinatal and one was undetermined.

*Potential Zone:* Add a warm season (April through October) Slow Speed Minimum

Wake zone starting just north of the Silver Lake Marina extending to the south lip of LeHigh Canal (total linear distance: 1.2 miles).

- D2: Smith Creek extending from approximately 300 feet south of the State Route 100 bridge to the southern shore of the Lehigh Canal. This area displays relatively high warm

season Coin (1.055) and Fast Coin (0.580). The area's ratio of Fast Coin to Coin (0.55) indicates "fast" boats are a very large component of the overall manatee-boat coincidence in this area. Ten manatee carcasses have been recovered in the immediate vicinity, most of which (7) were perinatal deaths. No watercraft related carcasses have been recovered in this area.

*Potential Zone:* Add a warm season (April through October) Slow Speed Minimum Wake zone starting at the south lip of LeHigh Canal extending to approximately 300 feet south of the State Route 100 bridge (total linear distance: 1.5 miles).

## 5. Smith Creek South of S.R. 100

### Data Discussion

#### *Manatee Aerial Survey Data*

- The mean density of manatees seen per survey per square kilometer was 0.400. The density documented during the warmer months (0.646) was approximately 17 times greater than that seen during the colder months (0.039).

#### *Mortality Data*

- Fifteen (15) manatee carcasses have been recovered in this area. Most (10) of the 15 recovered manatee carcasses were classified as watercraft-related deaths.
- The first watercraft-related carcass was recovered in 1993 and the most recent was recovered in 2009. The most watercraft related deaths to occur in one year in this area is two (2003 and 2007).
- Of the five (5) watercraft-related carcasses that have been recovered since 2004, four (4) were designated as acute, indicating that the animals likely sustained the injuries nearby; the other was listed as chronic. None of the reports for deaths prior to 2004 includes an assessment of acute versus chronic.
- The remaining five carcasses consist of two perinatal deaths, two adult manatees dying from natural causes, and one whose cause of death was undetermined.

#### *Coincidence Data*

- Coin for this region was 0.607 and Fast Coin was 0.314. The ratio of the Fast Coin to Coin was 0.517 indicating that fast boats accounted for a relatively large portion of the manatee-boat coincidence in this area. The Coin value for the warmer months (0.946) was approximately 18 times the value for the colder months (0.051).

### Areas identified by FWC staff where protection zones may be warranted

- E1: An area extending approximately 1.8 miles north from the Gamble Rodgers Memorial State Recreation Area boat launch canal in Smith Creek, inclusive of all associated canals. This area displays relatively high warm season Coin (1.052) and Fast Coin (0.875). The area's ratio of Fast Coin to Coin (0.83) indicates that the majority of boats are travelling at plowing speed or faster and that these "fast" boats are an extremely large component of the overall manatee-boat coincidence in this area. Twelve manatee carcasses have been recovered in the immediate vicinity, the majority of which (9) were watercraft-related deaths. Eight of the watercraft-related carcasses were recovered during the warm season months. Of the nine watercraft related deaths, seven have occurred since 2000. Three (3) of the watercraft-related carcasses were designated as acute deaths and one as chronic.

*Potential Zone:* Add a warm season (April through October) Slow Speed Minimum Wake zone starting at the Gamble Rodgers Memorial State Recreation Area boat launch extending approximately 1.8 miles north in Smith Creek.

- E2: An area extending from the Volusia County line north to the Gamble Rodgers Memorial State Recreation Area. This area is currently regulated by state manatee protection speed zones under the Volusia County Rule (68C-22.012, Florida Administrative Code). The waterway is currently regulated as a Slow Speed zone outside of the channel and 30 mph in the channel during daylight hours and 25 mph in the channel during nighttime hours. This area displays relatively high warm season Coin (0.937) and Fast Coin (0.707). The area's ratio of Fast Coin to Coin (0.75) indicates that the majority of boats are travelling at plowing speed or faster and that these "fast" boats are an extremely large component of the overall manatee-boat coincidence in this area. No manatee carcasses have been recovered in the immediate vicinity.

*Potential Zone:* Change the existing zone to a warm season (April through October) Slow Speed Minimum Wake zone and remove the component of the existing zones that are in effect during the cold season (total linear distance: 0.7 miles). Also, amend the Volusia County rule to remove the portion of the existing zone that is located within Flagler County.

## Appendix A: List of Data Layers & Descriptions

### Base Data Layers

1. Shoreline – a rasterized shoreline of coastal Flagler and St. Johns Counties with land = 1 and water = 2. Layer based upon FWC’s statewide shoreline accurate to a scale of 1:12,000 and compared to Aerial Photography
2. WaterMask – a reclassification of the Shoreline raster with land = “NoData” and water = 1.
3. VolusiaRule\_68C\_22\_012FAC – a polygon feature class displaying the Volusia and Associated County Rules 68C-22.012 that extend into Flagler County.
4. ManateeTelemetry\_SireniaPTT\_1988\_1997\_LClass3 – a subset of USGS Sirenia Project satellite telemetry data including all telemetry hits occurring within Flagler County
5. ManateeDeaths\_2009\_12 – a point feature class displaying the locations of manatee carcass recoveries and the cause of death associated with the carcass
6. ManateeAerialSurveyPoints\_2005\_2007\_FWC – Manatee Distribution Points collected by Florida Fish & Wildlife Research Institute via aerial survey from 2005-2007 covering St. Johns and Flagler Counties
7. ManateeAerialSurveyPath\_2005\_2007\_FWC – a line shapefile representing the flight route flown by Florida Fish & Wildlife Research Institute during the manatee distribution survey of St. Johns and Flagler Counties
8. ManateeAerialSurveyPath\_500mPolyBuffer – an expansion of the flight route path by 500 meters, representing the visibility of the aerial survey observers.
9. Flagler\_Roads – a line shapefile representing the major roads in Flagler County
10. Flagler\_CountyBounds\_Poly – a polygon shapefile representing the Flagler County Boundary
11. Flagler\_CityLimits\_LandOnly – a polygon shapefile representing the municipalities in Flagler County
12. BoatSurvey\_2007\_2009\_MOTE – a point feature class that recorded the locations and activities of boat traffic in Flagler and St. Johns County. This data was collected by Mote Marine Lab in aerial surveys flown from 2007 through 2009.
13. ATONs\_Flag\_2002\_04: Locations of aids to navigation (i.e., channel markers) in Flagler County as of 2002-04

### Final Data Layers

1. BoatSurvey\_Density\_Summer\_perSurvey - Raster cover derived from the April through October (“warm season”) 2007-09 boat aerial survey data using the kernel density command in ArcGIS (Population field = Total; 325 meter search radius) and then dividing the cell values by the number of surveys (12) flown
2. BoatSurvey\_Density\_Winter\_perSurvey - Raster cover derived from the November through March (“cold season”) 2007-09 boat aerial survey data using the kernel density command in ArcGIS (Population field = Total; 325 meter search radius) and then dividing the cell values by the number of surveys (8) flown

3. BoatSurvey\_FastDensity\_Summer\_perSurvey - Raster cover derived from the April through October (“warm season”) and identifying boats travelling at plowing speed or faster [“SPEED” >=4] using the 2007-09 boat aerial survey data using the kernel density command in ArcGIS (Population field = Total; 325 meter search radius) and then dividing the cell values by the number of surveys (12) flown
4. BoatSurvey\_FastDensity\_Winter\_perSurvey - Raster cover derived from the November through March (“cold season”) and identifying boats travelling at plowing speed or faster [“SPEED” >=4] using the 2007-09 boat aerial survey data and using the kernel density command in ArcGIS (Population field = Total; 325 meter search radius) and then dividing the cell values by the number of surveys (8) flown
5. ManateeAerialSurveyDensity\_Summer\_perSurvey - Raster cover derived from the April through October (“warm season”) 2005-07 aerial survey data using the kernel density command in ArcGIS (Population field = Total; 325 meter search radius) and then dividing the cell values by the number of surveys (28) flown
6. ManateeAerialSurveyDensity\_Winter\_perSurvey - Raster cover derived from the November through March (“cold season”) 2005-07 aerial survey data using the kernel density command in ArcGIS (Population field = Total; 325 meter search radius) and then dividing the cell values by the number of surveys (19) flown
7. Coincidence\_AllBoats\_Summer - Raster cover of April through October (“warm season”) manatee-boat coincidence created by multiplying the per survey manatee raster for April through October by the per survey boat raster for April through October
8. Coincidence\_AllBoats\_Winter - Raster cover of November through March (“cold season”) manatee-boat coincidence created by multiplying the per survey manatee raster for November through March by the per survey boat raster for November through March
9. Coincidence\_FastBoats\_Summer - Raster cover of April through October (“warm season”) manatee- “fast” boat coincidence created by multiplying the per survey manatee raster for April through October by the per survey “fast” boat raster for April through October
10. Coincidence\_FastBoats\_Winter - Raster cover of November through March (“cold season”) manatee- “fast” boat coincidence created by multiplying the per survey manatee raster for November through March by the per survey “fast” boat raster for November through March
11. Flagler\_2010\_Prelim\_Rule\_Proposals – a polygon shapefile outlining the general location of areas where FWC staff believe manatee protection zones may be warranted

## **Appendix B: Data Summary Tables**

### **List of Tables**

Table 1: Manatee aerial survey data summary by region and season

Table 2: Manatee mortality (1974-Dec.2009) characterized by month and cause of death

Table 3: Manatee-boat coincidence & “fast” coincidence summary by region and season

Table 1

## Flagler County Manatee Aerial Survey Data: Summary of 2005-2007 Data

| Aerial Survey Season:             | April - October         |                |                         |                          | November - March        |                |                         |                          | All Months              |                |                         |                          |
|-----------------------------------|-------------------------|----------------|-------------------------|--------------------------|-------------------------|----------------|-------------------------|--------------------------|-------------------------|----------------|-------------------------|--------------------------|
| Aerial Survey Period:             | 2005-2007               |                |                         |                          | 2005-2007               |                |                         |                          | 2005-2007               |                |                         |                          |
| Number of Flights:                | 28                      |                |                         |                          | 19                      |                |                         |                          | 47                      |                |                         |                          |
| Location                          | Manatees<br>seen<br>[1] | Density<br>[2] | Percent<br>Total<br>[3] | Percent<br>Survey<br>[4] | Manatees<br>seen<br>[1] | Density<br>[2] | Percent<br>Total<br>[3] | Percent<br>Survey<br>[4] | Manatees<br>seen<br>[1] | Density<br>[2] | Percent<br>Total<br>[3] | Percent<br>Survey<br>[4] |
| <b>Coastal Flagler County [5]</b> | <b>213</b>              | <b>0.327</b>   | <b>100.00%</b>          | <b>82.14%</b>            | <b>21</b>               | <b>0.046</b>   | <b>100.00%</b>          | <b>31.58%</b>            | <b>234</b>              | <b>0.213</b>   | <b>100.00%</b>          | <b>61.70%</b>            |
| <b>North County</b>               | <b>65</b>               | <b>0.151</b>   | <b>30.52%</b>           | <b>57.14%</b>            | <b>14</b>               | <b>0.054</b>   | <b>66.67%</b>           | <b>21.05%</b>            | <b>79</b>               | <b>0.111</b>   | <b>33.76%</b>           | <b>44.68%</b>            |
| Marineland & Matanzas River       | 33                      | 0.150          | 15.49%                  | 32.14%                   | 4                       | 0.038          | 19.05%                  | 10.53%                   | 37                      | 0.104          | 15.81%                  | 23.40%                   |
| Palm Coast                        | 32                      | 0.152          | 15.02%                  | 46.43%                   | 10                      | 0.075          | 47.62%                  | 21.05%                   | 42                      | 0.121          | 17.95%                  | 36.17%                   |
| <b>South County</b>               | <b>148</b>              | <b>0.641</b>   | <b>69.48%</b>           | <b>75.00%</b>            | <b>7</b>                | <b>0.033</b>   | <b>33.33%</b>           | <b>26.32%</b>            | <b>155</b>              | <b>0.395</b>   | <b>66.24%</b>           | <b>57.45%</b>            |
| Fox Cut                           | 30                      | 0.407          | 14.08%                  | 42.86%                   | 1                       | 0.018          | 4.76%                   | 5.26%                    | 31                      | 0.250          | 13.25%                  | 27.66%                   |
| Smith Creek N of SR100 Bridge     | 68                      | 0.764          | 31.92%                  | 67.86%                   | 4                       | 0.035          | 19.05%                  | 15.79%                   | 72                      | 0.469          | 30.77%                  | 46.81%                   |
| Smith Creek S of SR100 Bridge     | 50                      | 0.646          | 23.47%                  | 32.14%                   | 2                       | 0.039          | 9.52%                   | 10.53%                   | 52                      | 0.400          | 22.22%                  | 23.40%                   |

[1] Manatees Seen: Number of manatees seen during Aerial Surveys Collected by FWRI 2005-2007 [47 flights]

[2] Density: Mean number of manatees seen per survey per sq. km as calculated by the kernel density function in ArcGIS

[3] Percent Total: Percentage of all the manatees seen in the entire county that were seen in the region

[4] Percent Surveys: Percentage of all surveys during which at least one manatee was seen in the area

[5] Does not include 2 manatees seen in the Atlantic Ocean, 35 manatees seen in Volusia County, 155 manatees seen in St. Johns County, or 2 manatees seen in Duval County in 2005-2007 surveys

Table 2

**Coastal Flagler County Carcass Recoveries from 1974 through December 2009**  
**Primary Cause of Death by Month**

| Month              | Human Related: Other | Human Related: Watercraft collision | Natural: Cold Stress (beginning in 1986) | Natural: Other (includes red tide) | Perinatal (<= 150 cm) | Undetermined: Other | Undetermined: Too decomposed | Grand Total |
|--------------------|----------------------|-------------------------------------|--|------------------------------------|-----------------------|---------------------|------------------------------|-------------|
| January            | 0                    | 1                                   | 3  | 0                                  | 0                     | 1                   | 0                            | 5           |
| February           | 0                    | 0                                   | 0  | 2                                  | 0                     | 0                   | 2                            | 4           |
| March              | 0                    | 0                                   | 1  | 0                                  | 1                     | 0                   | 0                            | 2           |
| April              | 0                    | 0                                   | 0  | 2                                  | 4                     | 0                   | 1                            | 7           |
| May                | 0                    | 6                                   | 0  | 1                                  | 10                    | 0                   | 1                            | 18          |
| June               | 0                    | 2                                   | 0  | 1                                  | 3                     | 0                   | 1                            | 7           |
| July               | 0                    | 3                                   | 0  | 0                                  | 6                     | 1                   | 2                            | 12          |
| August             | 0                    | 0                                   | 0  | 0                                  | 7                     | 0                   | 0                            | 7           |
| September          | 0                    | 1                                   | 0  | 1                                  | 3                     | 0                   | 1                            | 6           |
| October            | 0                    | 0                                   | 0  | 0                                  | 1                     | 0                   | 1                            | 2           |
| November           | 0                    | 1                                   | 1  | 0                                  | 1                     | 0                   | 0                            | 3           |
| December           | 1                    | 0                                   | 1  | 0                                  | 0                     | 0                   | 0                            | 2           |
| <b>Grand Total</b> | <b>1</b>             | <b>14</b>                           | <b>6</b>                                 | <b>7</b>                           | <b>36</b>             | <b>2</b>            | <b>9</b>                     | <b>75</b>   |



Table 3

## Flagler County Manatee-Boat Coincidence Analysis: Number of Manatees seen and Manatee-Boat Coincidence by Area &amp; Season

| Aerial Survey Period:                  | April - October   |                           |              |                       | November - March  |                           |              |                       | All Months        |                           |              |                       |
|--|-------------------|---------------------------|--------------|-----------------------|-------------------|---------------------------|--------------|-----------------------|-------------------|---------------------------|--------------|-----------------------|
| Number of Manatee Surveys (2005-2007): | 28                |                           |              |                       | 19                |                           |              |                       | 47                |                           |              |                       |
| Location                               | Total Seen<br>[1] | Manatee<br>Density<br>[2] | Coin<br>[3]  | "Fast"<br>Coin<br>[4] | Total Seen<br>[1] | Manatee<br>Density<br>[2] | Coin<br>[3]  | "Fast"<br>Coin<br>[4] | Total Seen<br>[1] | Manatee<br>Density<br>[2] | Coin<br>[3]  | "Fast"<br>Coin<br>[4] |
| <b>Coastal Flagler County [5]</b>      | <b>213</b>        | <b>0.327</b>              | <b>0.662</b> | <b>0.327</b>          | <b>21</b>         | <b>0.046</b>              | <b>0.103</b> | <b>0.058</b>          | <b>234</b>        | <b>0.213</b>              | <b>0.476</b> | <b>0.206</b>          |
| <b>North County</b>                    | <b>65</b>         | <b>0.151</b>              | <b>0.324</b> | <b>0.155</b>          | <b>14</b>         | <b>0.054</b>              | <b>0.111</b> | <b>0.058</b>          | <b>79</b>         | <b>0.111</b>              | <b>0.300</b> | <b>0.109</b>          |
| Marineland & Matanzas River            | 33                | 0.150                     | 0.396        | 0.224                 | 4                 | 0.038                     | 0.118        | 0.069                 | 37                | 0.104                     | 0.363        | 0.142                 |
| Palm Coast                             | 32                | 0.152                     | 0.232        | 0.063                 | 10                | 0.075                     | 0.102        | 0.044                 | 42                | 0.121                     | 0.215        | 0.064                 |
| <b>South County</b>                    | <b>148</b>        | <b>0.641</b>              | <b>1.264</b> | <b>0.634</b>          | <b>7</b>          | <b>0.033</b>              | <b>0.090</b> | <b>0.057</b>          | <b>155</b>        | <b>0.395</b>              | <b>0.790</b> | <b>0.378</b>          |
| Fox Cut                                | 30                | 0.407                     | 1.714        | 0.803                 | 1                 | 0.018                     | 0.041        | 0.041                 | 31                | 0.250                     | 0.886        | 0.447                 |
| Smith Creek N of SR100 Bridge          | 68                | 0.764                     | 1.326        | 0.592                 | 4                 | 0.035                     | 0.153        | 0.088                 | 72                | 0.469                     | 0.915        | 0.402                 |
| Smith Creek S of SR100 Bridge          | 50                | 0.646                     | 0.946        | 0.582                 | 2                 | 0.039                     | 0.051        | 0.033                 | 52                | 0.400                     | 0.607        | 0.314                 |

[1] Manatees Seen: Number of manatees seen during Aerial Surveys Collected by FWRI 2005-2007 [47 flights]

[2] Density: Mean number of manatees seen per survey per sq. km as calculated by the kernel density function in ArcGIS

[3] Coin: Manatee-Boat Coincidence value using the 2007 boat data (i.e., per survey manatee density x per survey boat density)

[4] "Fast" Coin: Mean manatee-boat coincidence value using the 2007 boat data but only including boats with observed speeds of "planing," "cruising," or "plowing"

[5] Does not include 2 manatees seen in the Atlantic Ocean, 35 manatees seen in Volusia County, 155 manatees seen in St. Johns County, or 2 manatees seen in Duval County in 2005-2007 surveys

## Appendix C: Data Map Presentations

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Figure 16: Manatee-Boat Coincidence Data, Cold Season; Southern Flagler County

Figure 17: Manatee-“Fast” Boat Coincidence Data, Cold Season; Southern Flagler County

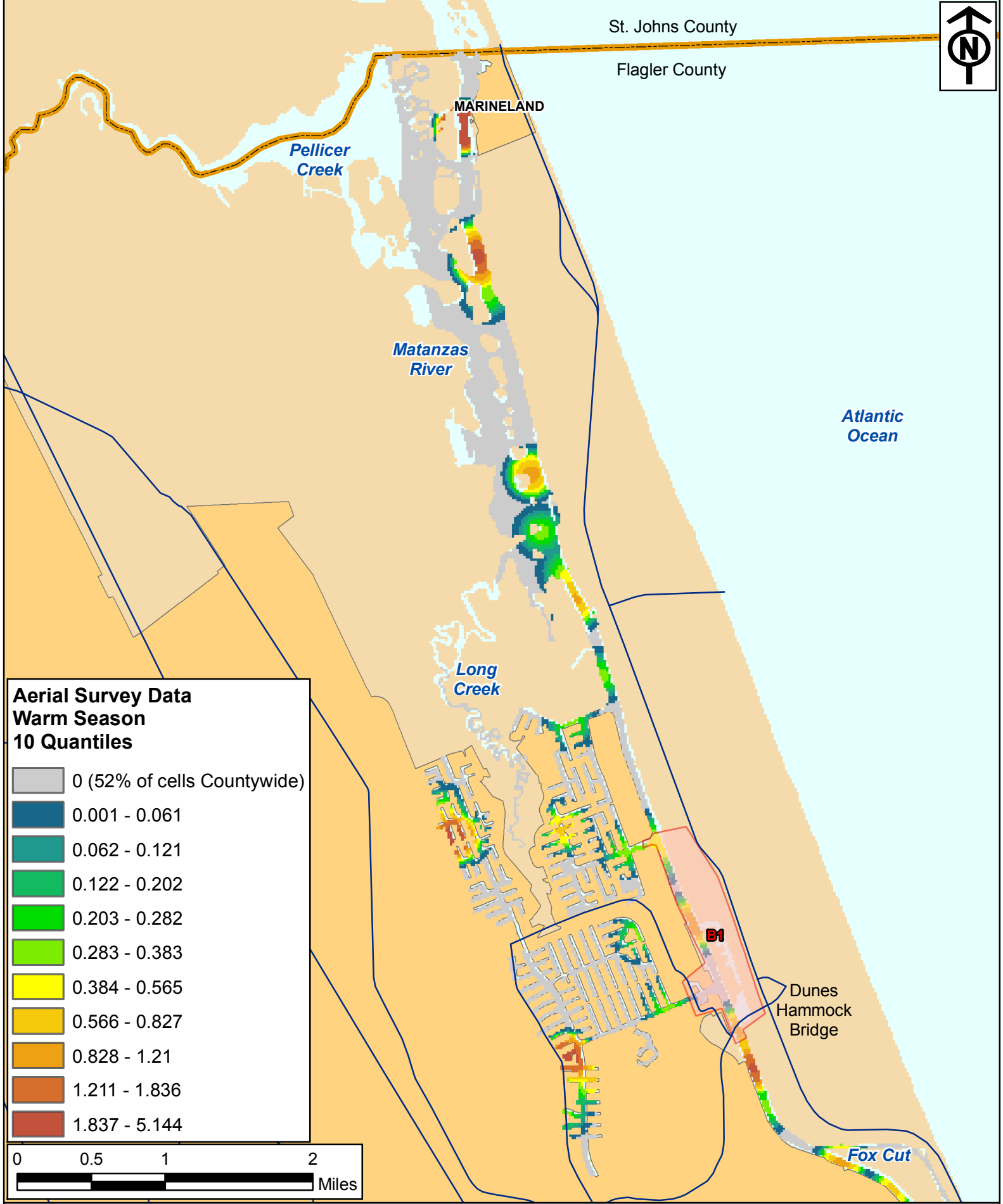


**Legend**  
North Region  
South Region

0 1 2 4  
Miles

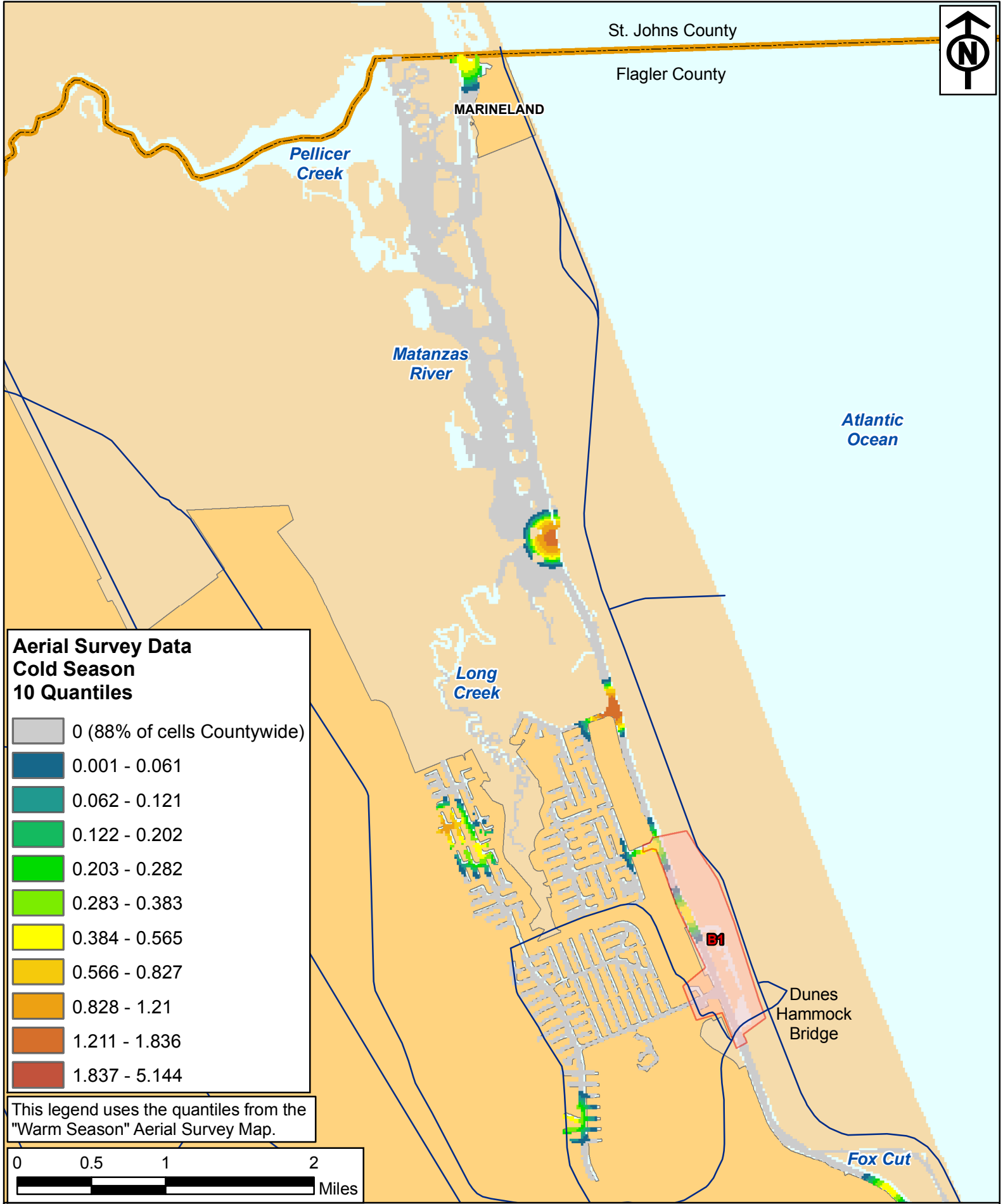
**Figure 1: Data Summary Areas**

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



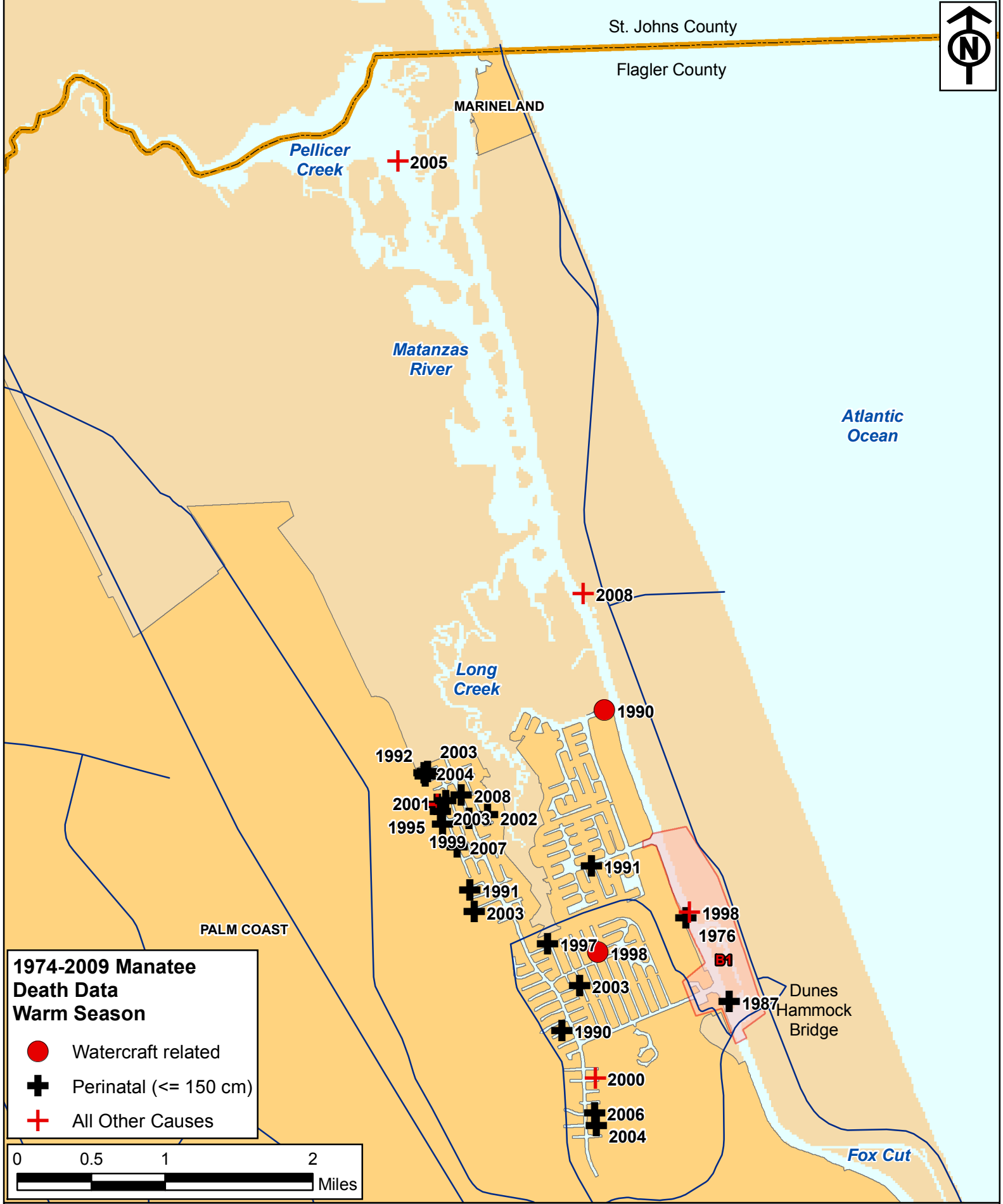
**Figure 2: 2005-07 Manatee Aerial Survey Data, Warm Season  
(Kernel Density; 325 m Radius)  
Northern Flagler County: St. Johns County line to  
Dunes Hammock Bridge**

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



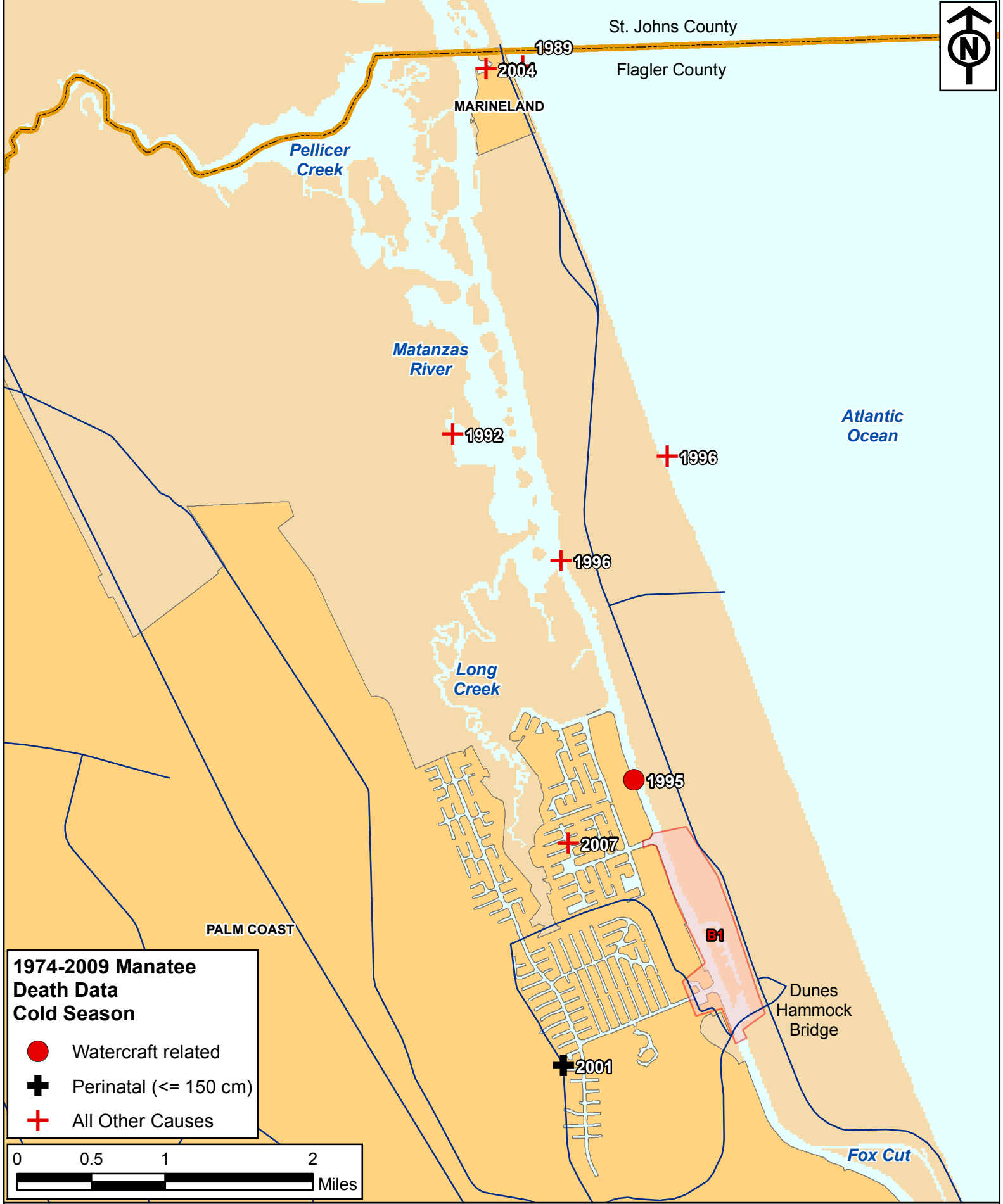
**Figure 3: 2005-07 Manatee Aerial Survey Data, Cold Season (Kernel Density; 325 m Radius) Northern Flagler County: St. Johns County line to Dunes Hammock Bridge**

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**Figure 4: Manatee Death Data (1974- December 2009) Warm Season**  
**Northern Flagler County: St. Johns County line to Dunes Hammock Bridge**

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 Division of Habitat & Species Conservation  
 Imperiled Species Management Section  
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 Tallahassee, Florida 32399-1600  
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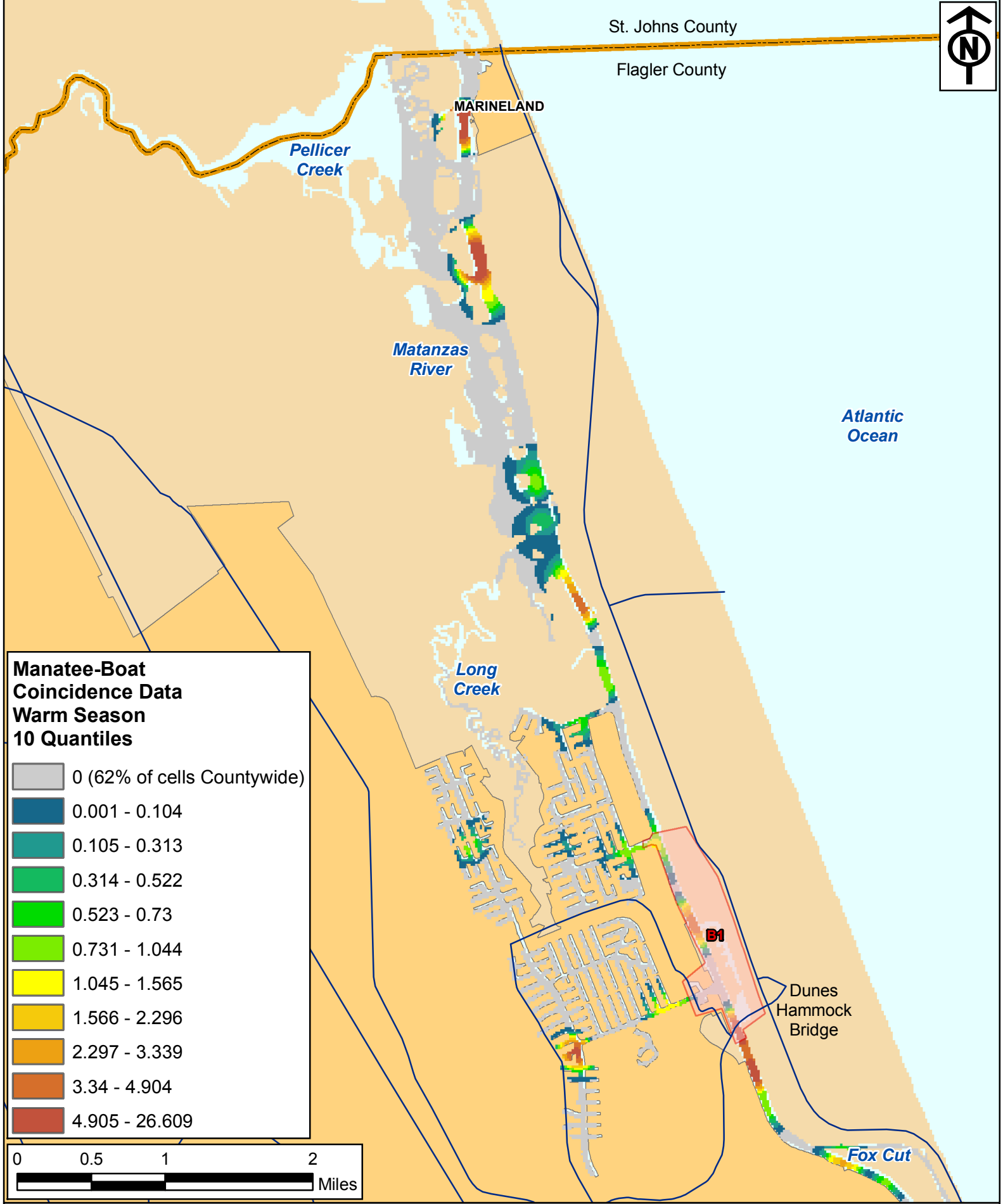
**1974-2009 Manatee Death Data Cold Season**

- Watercraft related
- + Perinatal (<= 150 cm)
- + All Other Causes

0 0.5 1 2 Miles

**Figure 5: Manatee Death Data (1974- December 2009) Cold Season**  
**Northern Flagler County: St. Johns County line to Dunes Hammock Bridge**

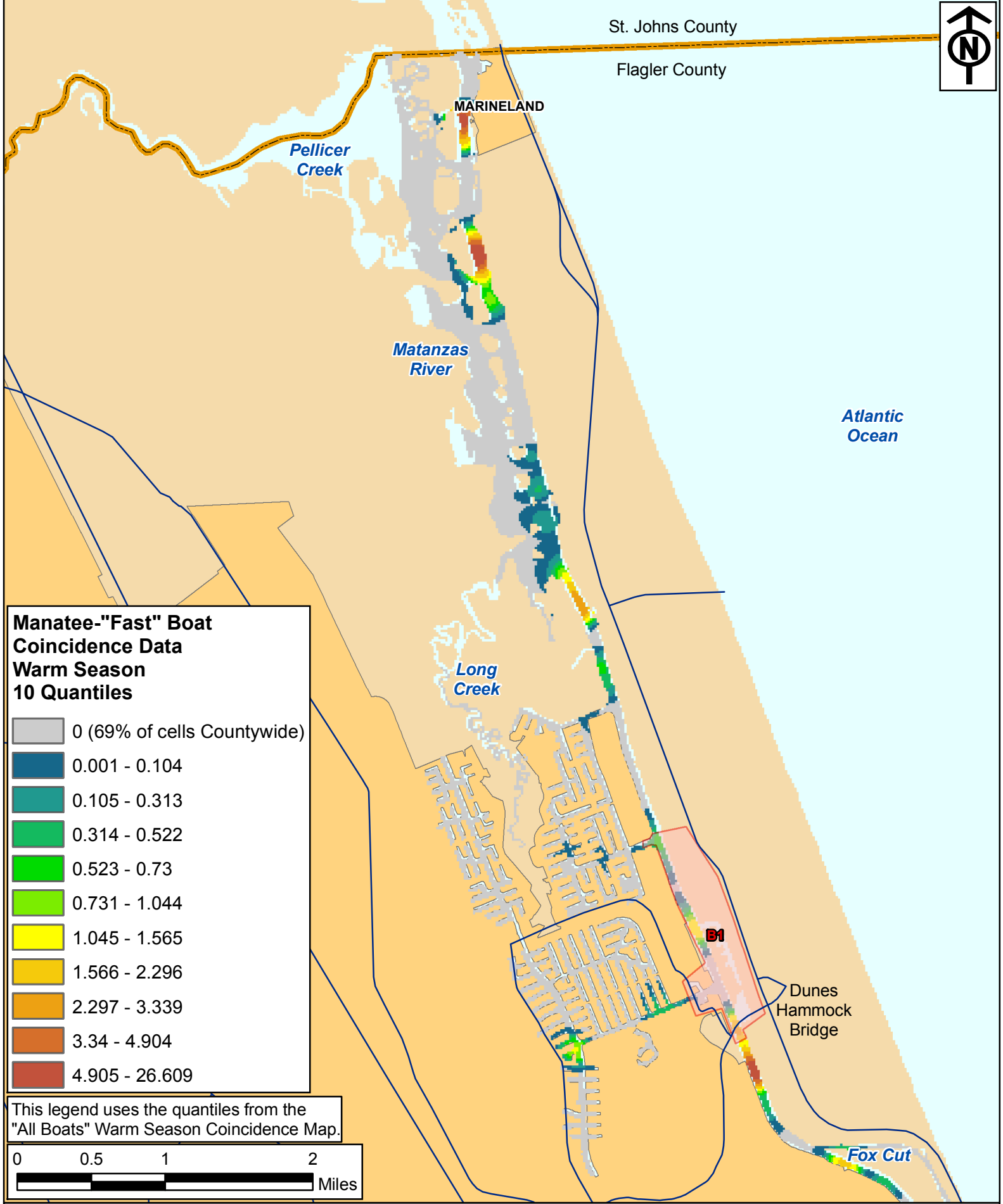
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**Figure 6: Manatee-Boat Coincidence Data  
Warm Season  
Northern Flagler County: St. Johns County line to  
Dunes Hammock Bridge**

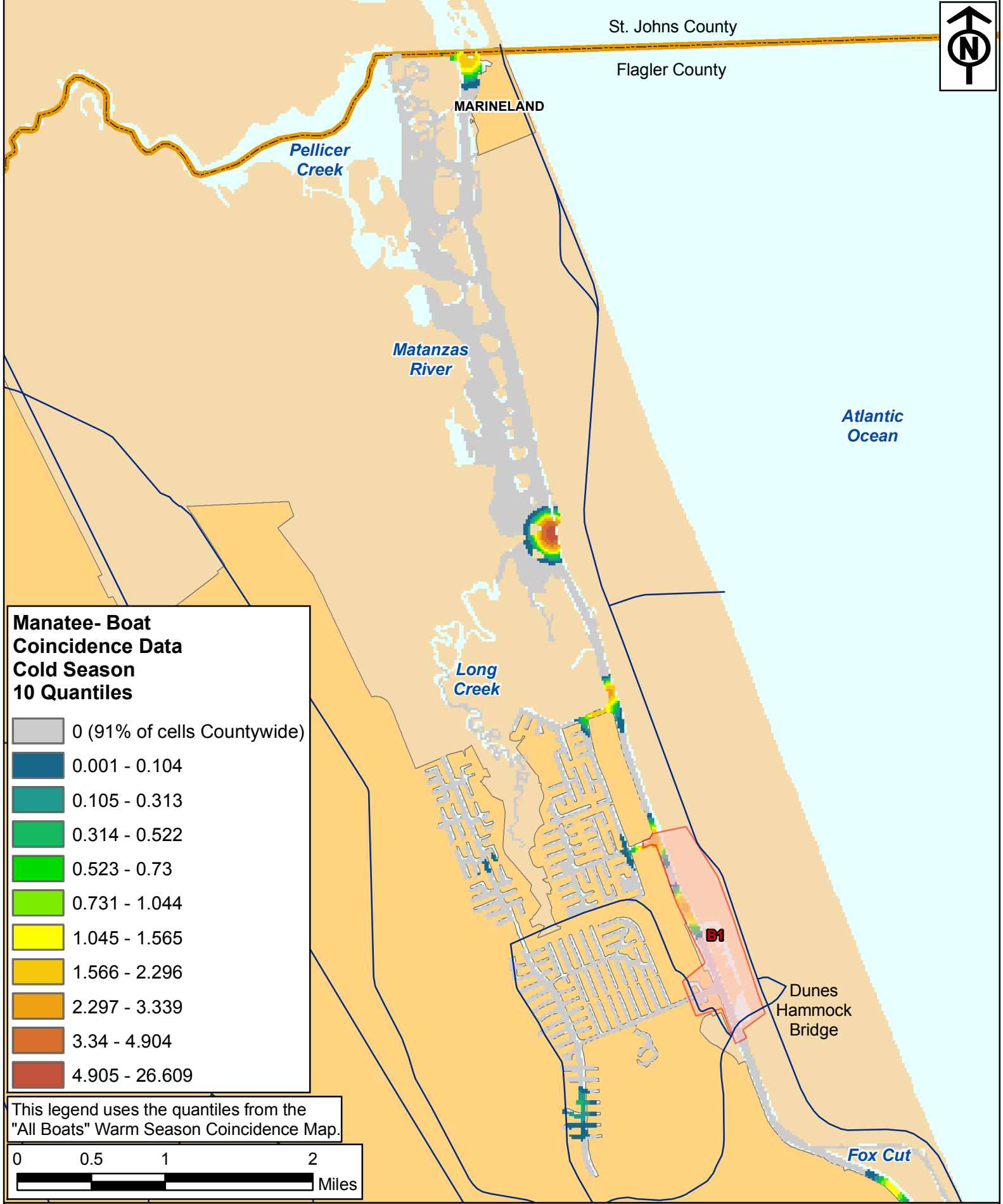
Florida Fish & Wildlife Conservation Commission  
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 Imperiled Species Management Section  
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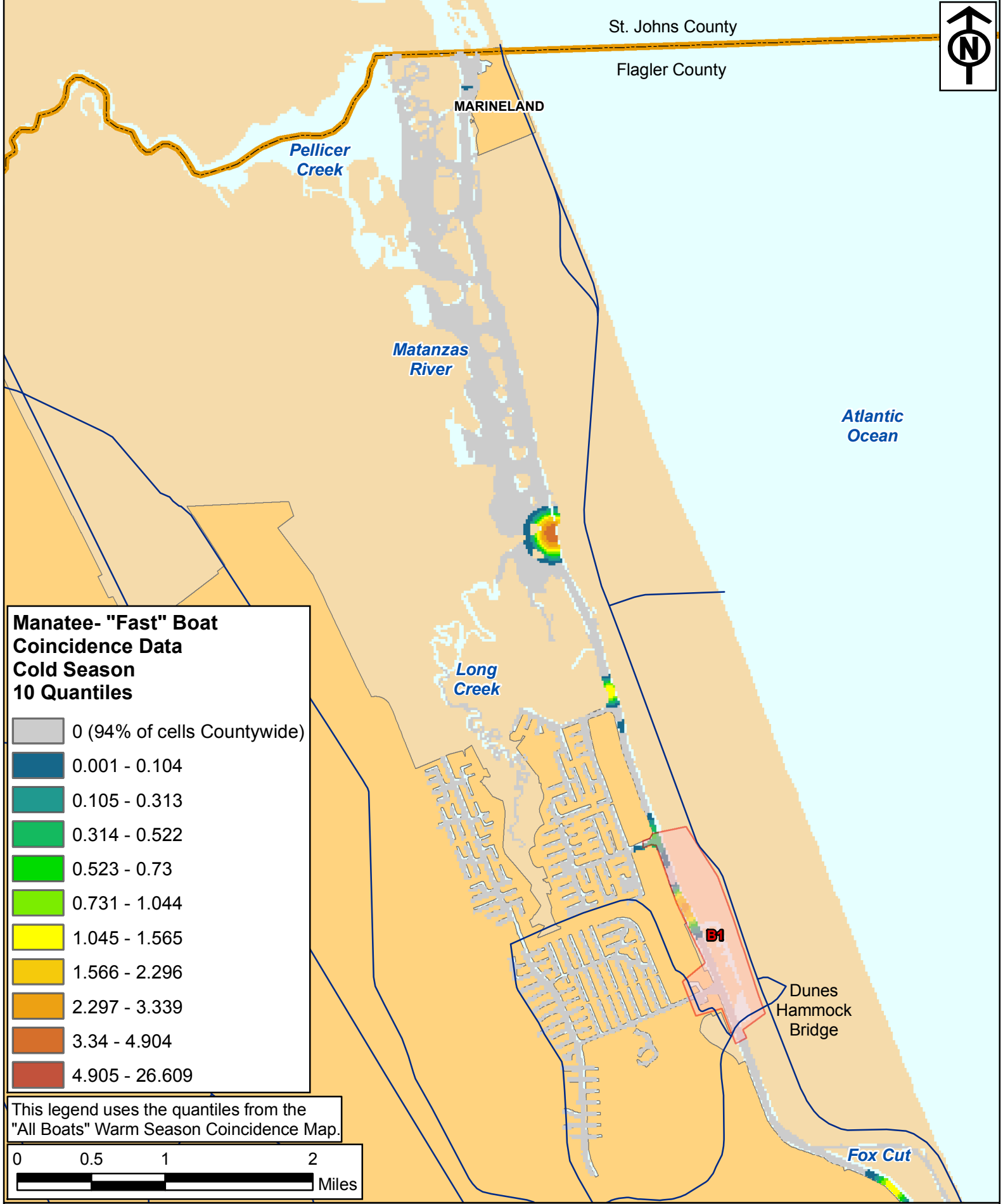
**Figure 7: Manatee-"Fast" Boat Coincidence Data  
Warm Season  
Northern Flagler County: St. Johns County line to  
Dunes Hammock Bridge**

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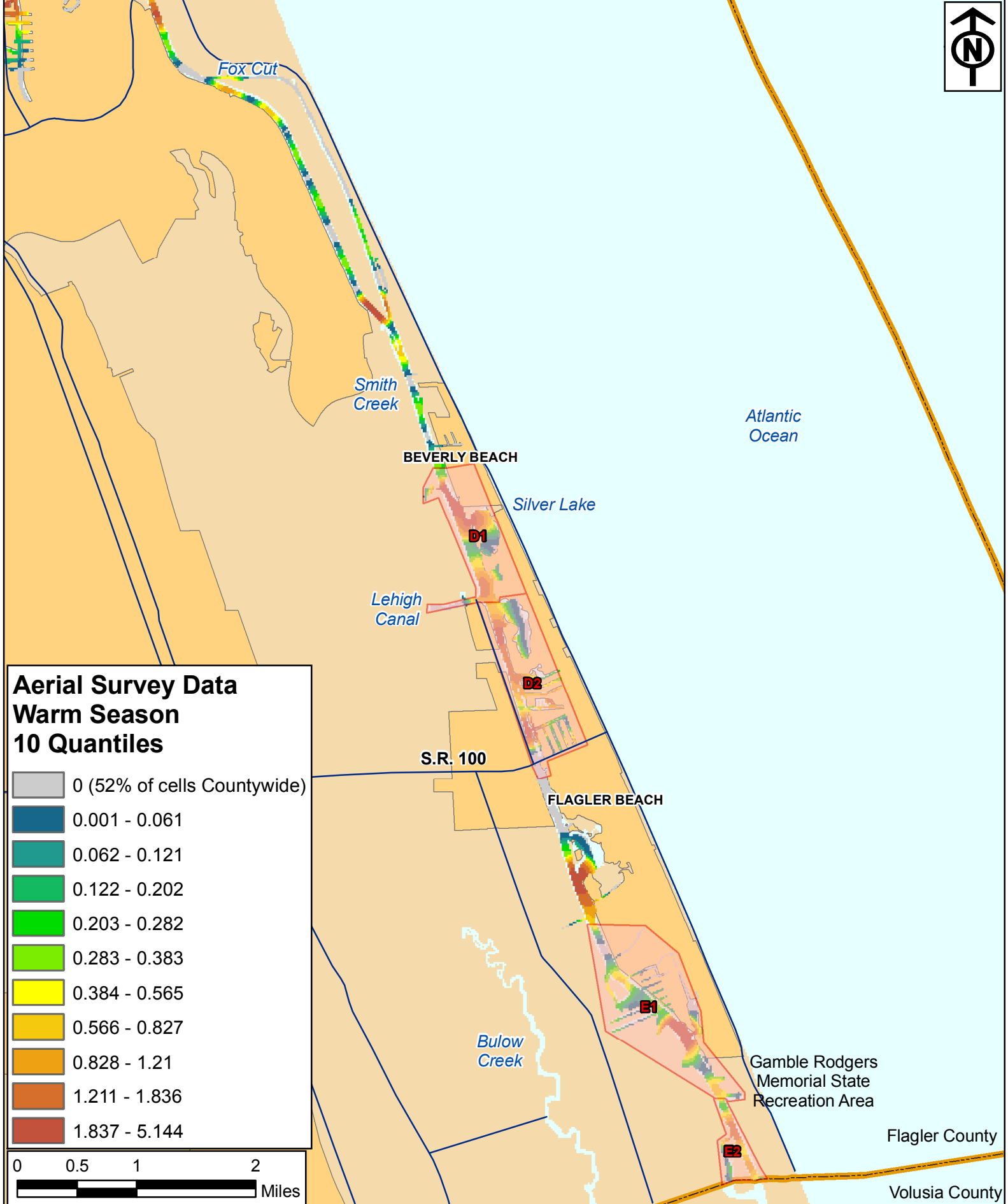
**Figure 8: Manatee- Boat Coincidence Data Cold Season Northern Flagler County: St. Johns County line to Dunes Hammock Bridge**

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 Imperiled Species Management Section  
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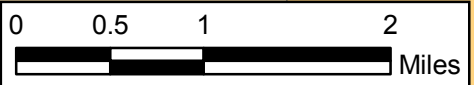
**Figure 9: Manatee- "Fast" Boat Coincidence Data Cold Season Northern Flagler County: St. Johns County line to Dunes Hammock Bridge**

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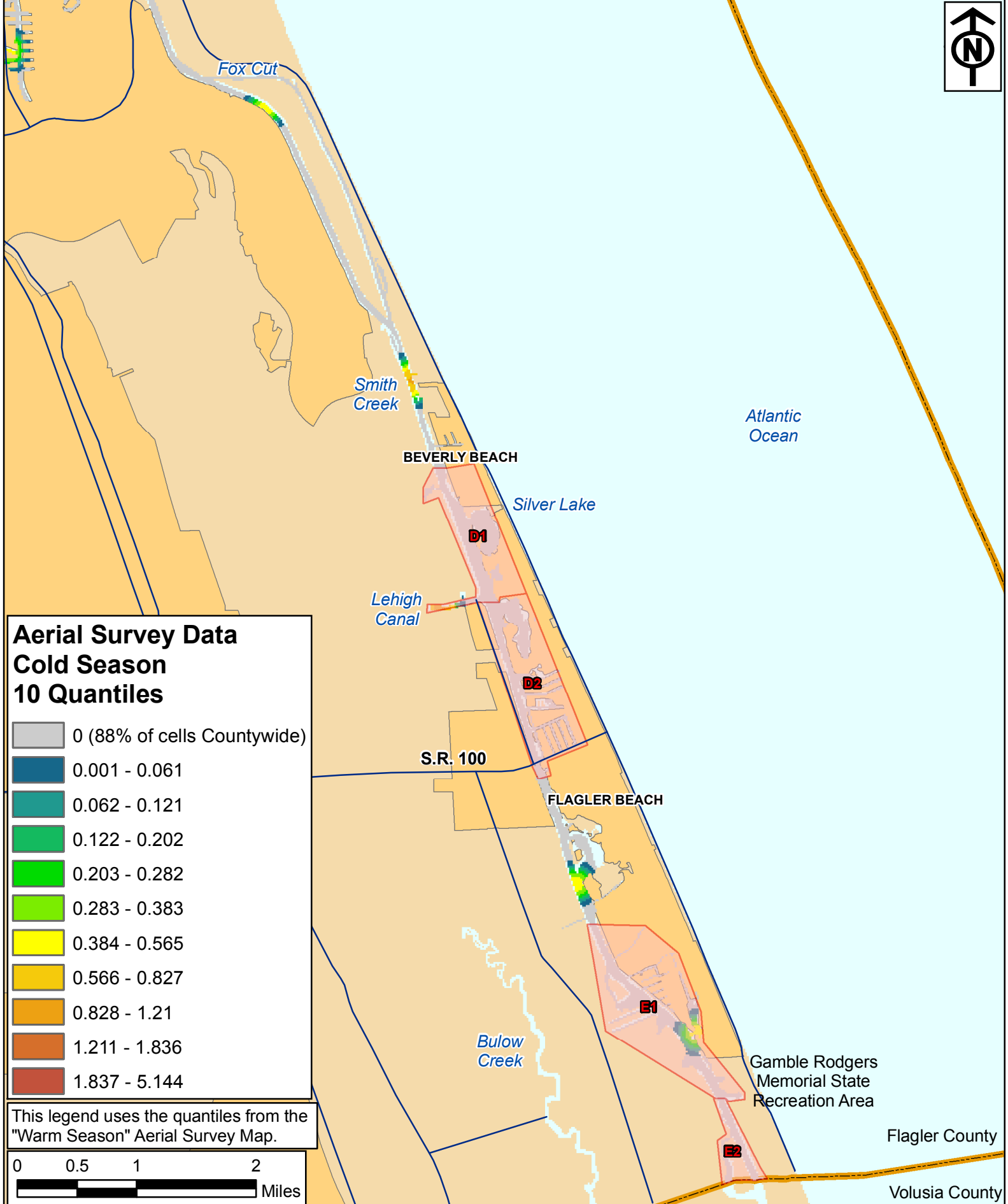
**Aerial Survey Data  
Warm Season  
10 Quantiles**

- 0 (52% of cells Countywide)
- 0.001 - 0.061
- 0.062 - 0.121
- 0.122 - 0.202
- 0.203 - 0.282
- 0.283 - 0.383
- 0.384 - 0.565
- 0.566 - 0.827
- 0.828 - 1.21
- 1.211 - 1.836
- 1.837 - 5.144



**Figure 10: Manatee- Aerial Survey Data, Warm Season (Kernel Density; 325 m Radius)  
Southern Flagler County: Dunes Hammock Bridge to Volusia County line**

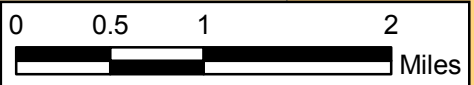
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**Aerial Survey Data  
Cold Season  
10 Quantiles**

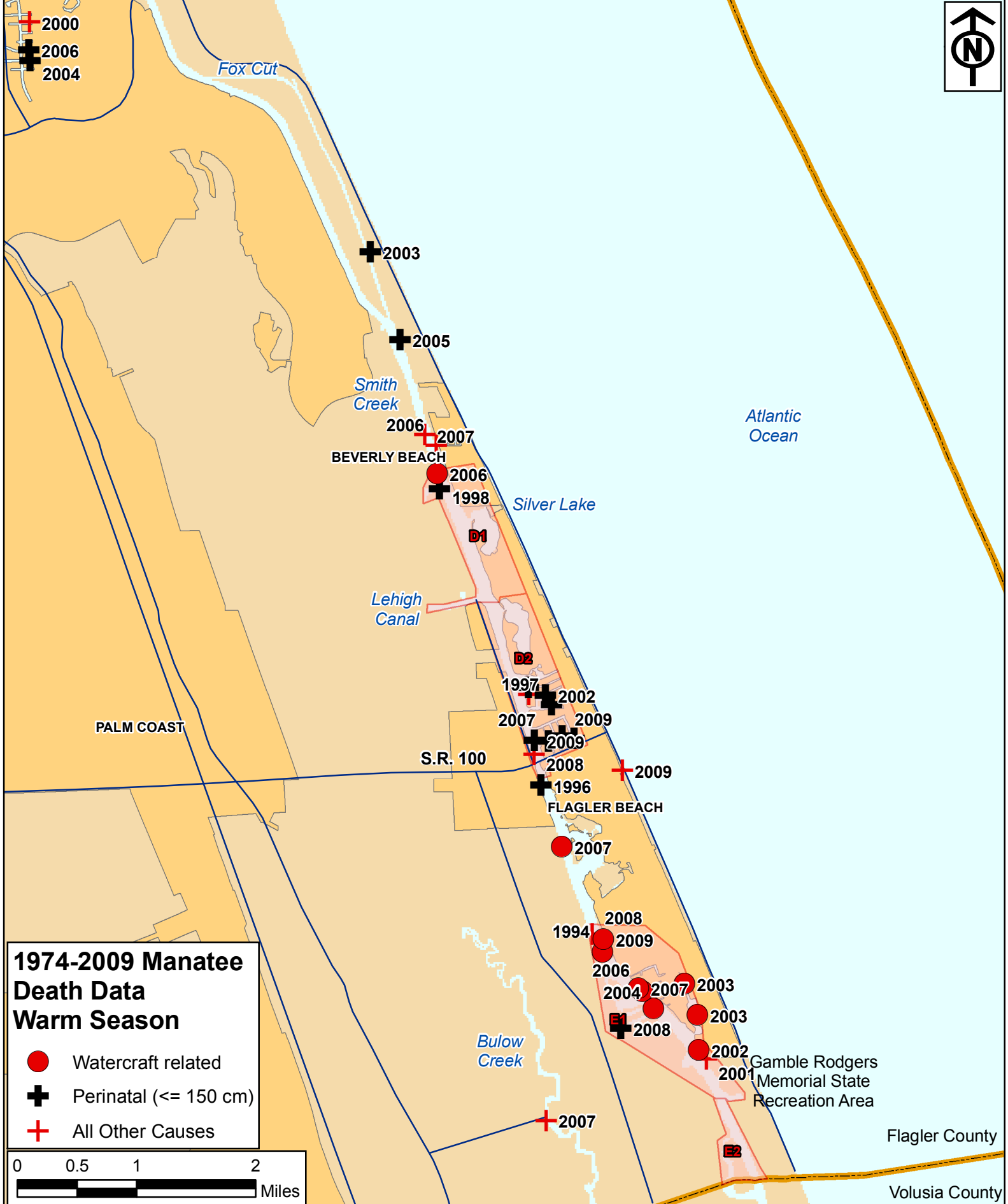
- 0 (88% of cells Countywide)
- 0.001 - 0.061
- 0.062 - 0.121
- 0.122 - 0.202
- 0.203 - 0.282
- 0.283 - 0.383
- 0.384 - 0.565
- 0.566 - 0.827
- 0.828 - 1.21
- 1.211 - 1.836
- 1.837 - 5.144

This legend uses the quantiles from the "Warm Season" Aerial Survey Map.



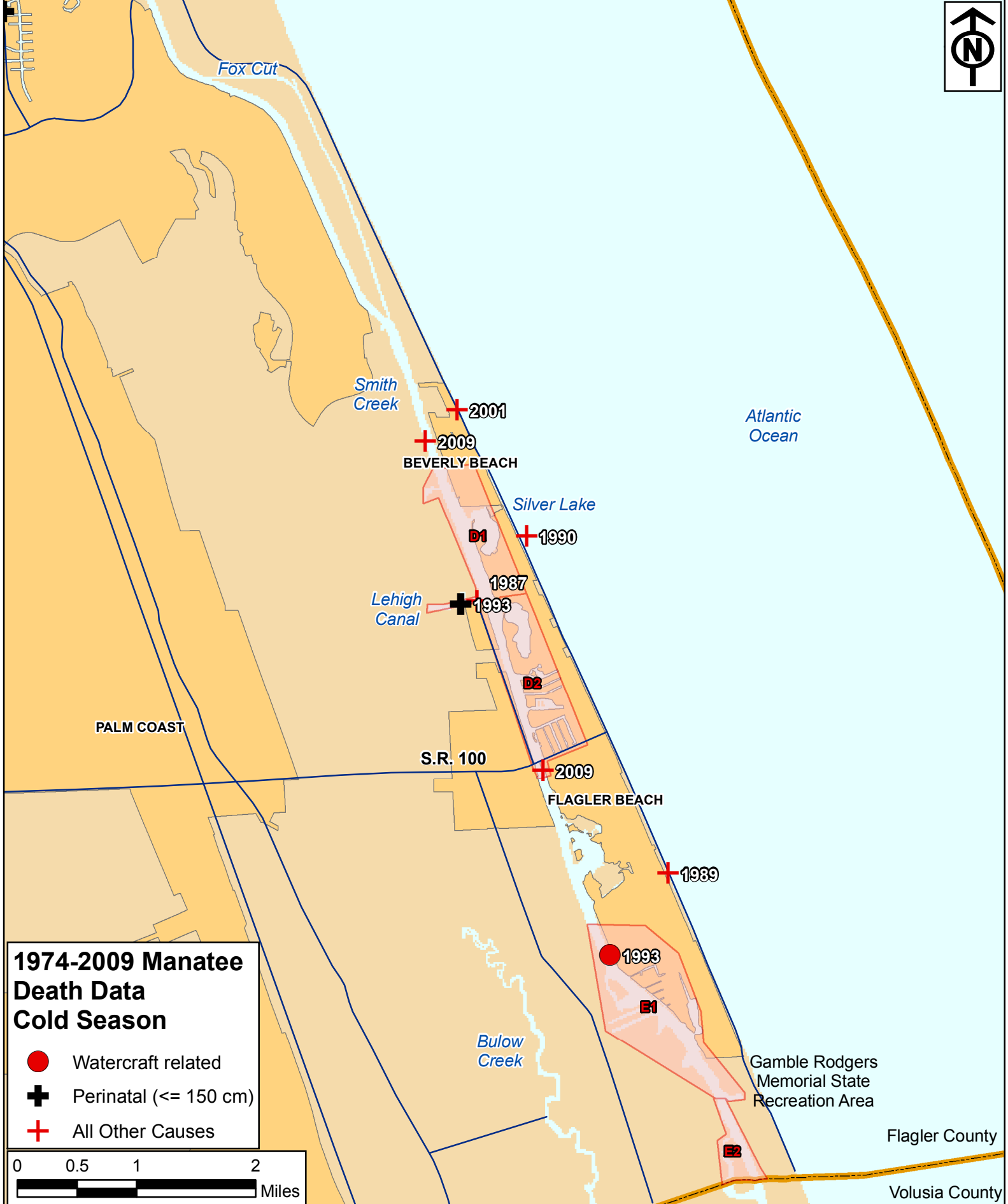
**Figure 11: 2005-07 Manatee Aerial Survey Data, Cold Season  
(Kernel Density; 325 m Radius)  
Southern Flagler County: Dunes Hammock Bridge to  
Volusia County line**

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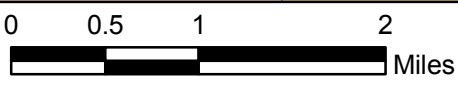
**Figure 12: Manatee Death Data (1974- December 2009) Warm Season**  
**Southern Flagler County: Dunes Hammock Bridge to Volusia County line**

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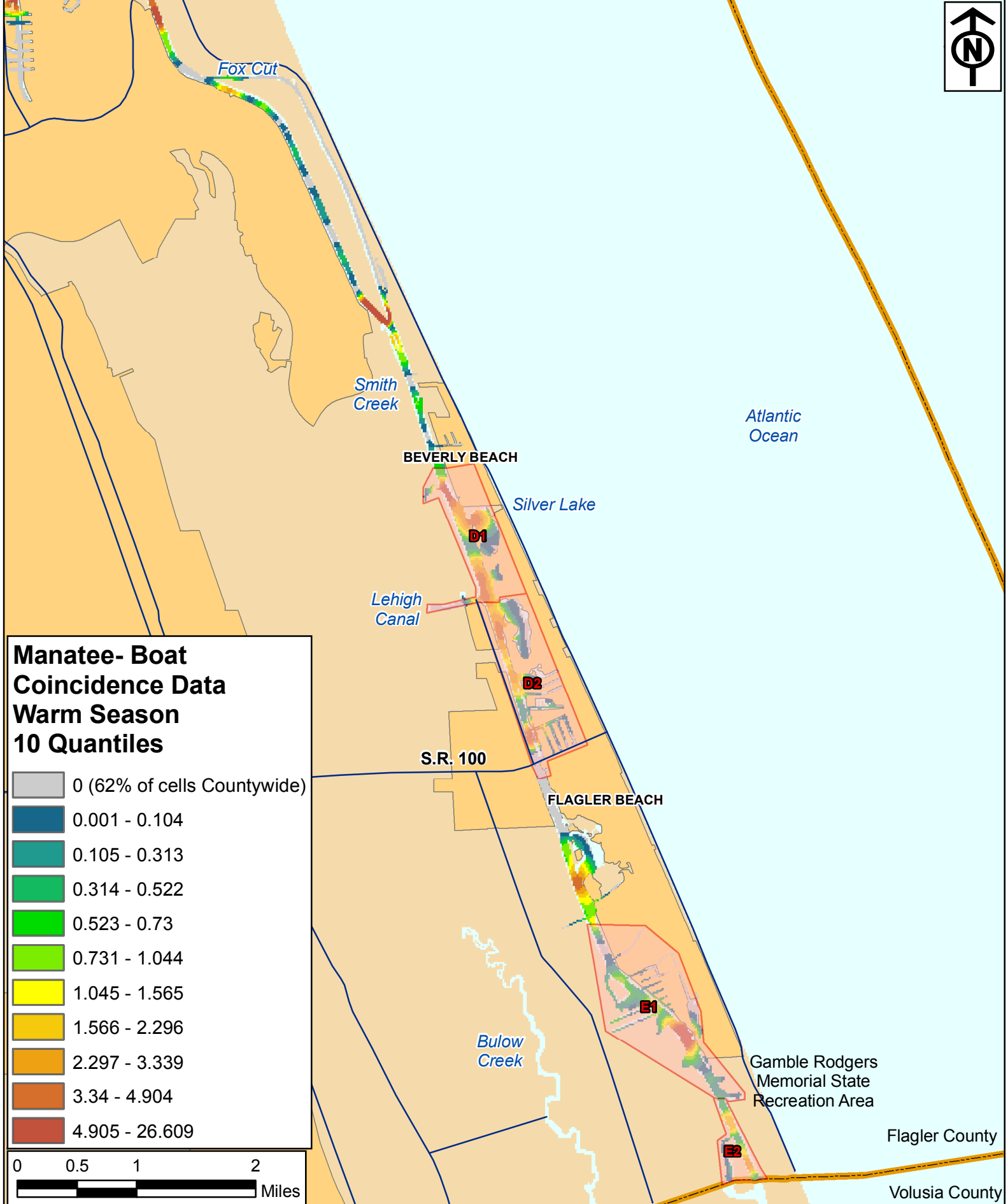
**1974-2009 Manatee  
Death Data  
Cold Season**

- Watercraft related
- + Perinatal (<= 150 cm)
- + All Other Causes



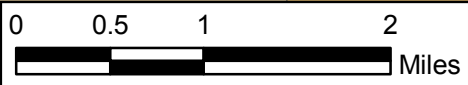
**Figure 13: Manatee Death Data (1974- December 2009)  
Cold Season  
Southern Flagler County: Dunes Hammock Bridge to  
Volusia County line**

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**Manatee- Boat  
Coincidence Data  
Warm Season  
10 Quantiles**

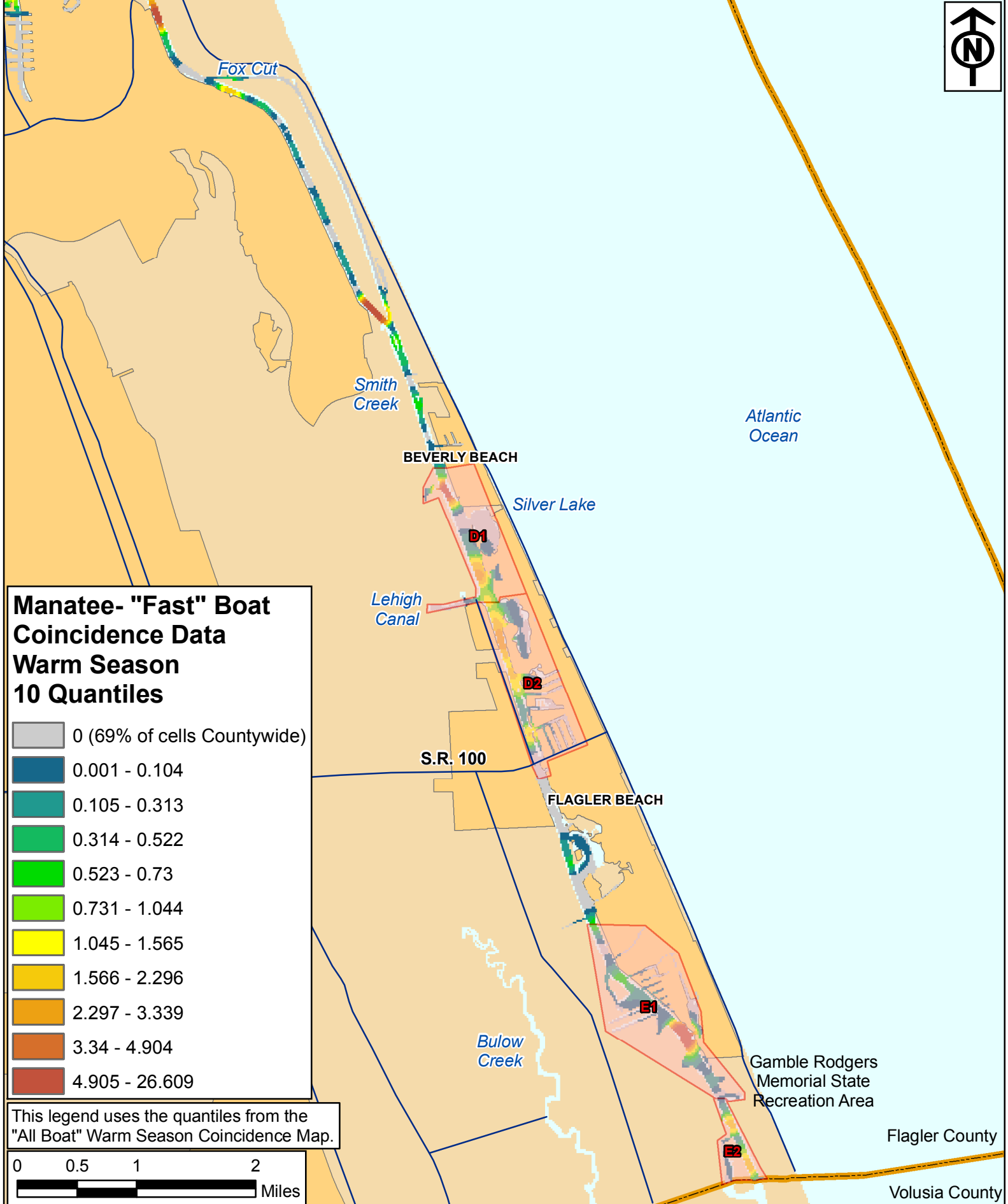
- 0 (62% of cells Countywide)
- 0.001 - 0.104
- 0.105 - 0.313
- 0.314 - 0.522
- 0.523 - 0.73
- 0.731 - 1.044
- 1.045 - 1.565
- 1.566 - 2.296
- 2.297 - 3.339
- 3.34 - 4.904
- 4.905 - 26.609



**Figure 14: Manatee- Boat Coincidence  
Warm Season  
Southern Flagler County: Dunes Hammock Bridge to  
Volusia County line**

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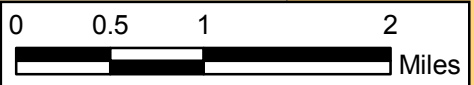




**Manatee- "Fast" Boat  
Coincidence Data  
Warm Season  
10 Quantiles**

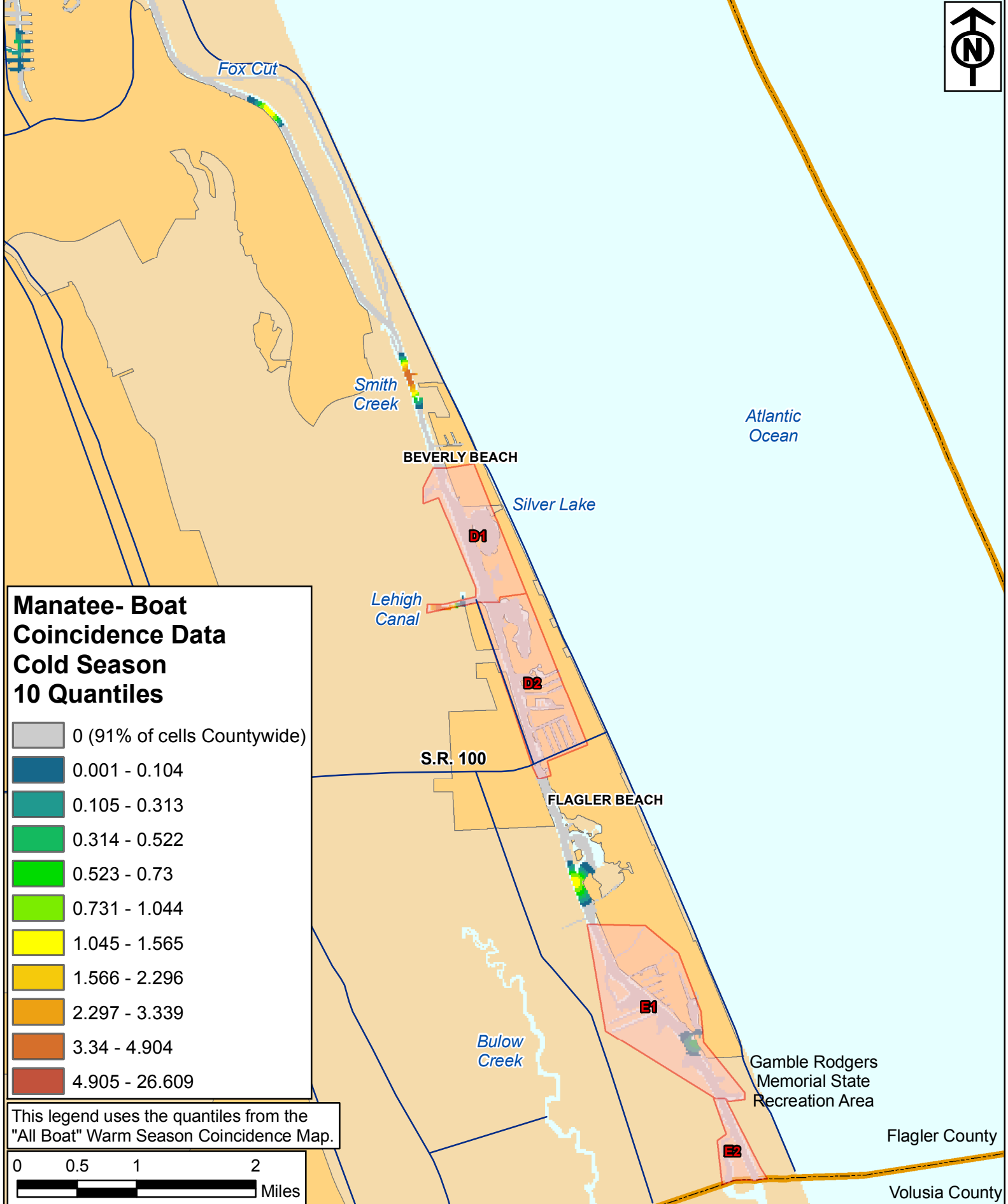
- 0 (69% of cells Countywide)
- 0.001 - 0.104
- 0.105 - 0.313
- 0.314 - 0.522
- 0.523 - 0.73
- 0.731 - 1.044
- 1.045 - 1.565
- 1.566 - 2.296
- 2.297 - 3.339
- 3.34 - 4.904
- 4.905 - 26.609

This legend uses the quantiles from the "All Boat" Warm Season Coincidence Map.



**Figure 15: Manatee- "Fast" Boat Coincidence Data  
Warm Season  
Southern Flagler County: Dunes Hammock Bridge to  
Volusia County line**

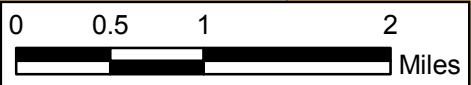
Florida Fish & Wildlife Conservation Commission  
Division of Habitat & Species Conservation  
Imperiled Species Management Section  
620 South Meridian Street, Mail Station 6A  
Tallahassee, Florida 32399-1600  
Tel: 850-922-4330 Fax: 850-922-4338



**Manatee- Boat  
Coincidence Data  
Cold Season  
10 Quantiles**

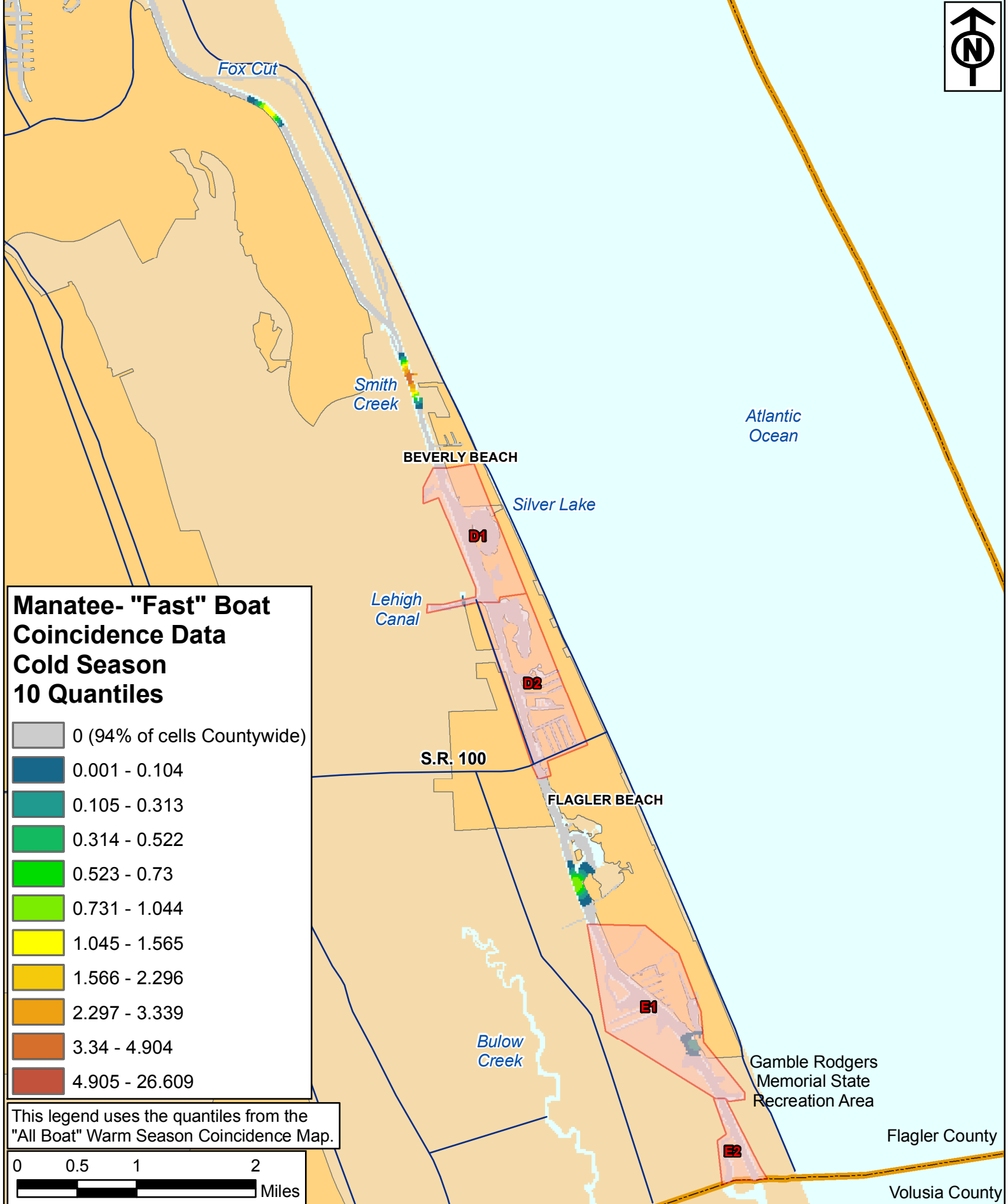
- 0 (91% of cells Countywide)
- 0.001 - 0.104
- 0.105 - 0.313
- 0.314 - 0.522
- 0.523 - 0.73
- 0.731 - 1.044
- 1.045 - 1.565
- 1.566 - 2.296
- 2.297 - 3.339
- 3.34 - 4.904
- 4.905 - 26.609

This legend uses the quantiles from the "All Boat" Warm Season Coincidence Map.



**Figure 16: Manatee- Boat Coincidence Data  
Cold Season  
Southern Flagler County: Dunes Hammock Bridge to  
Volusia County line**

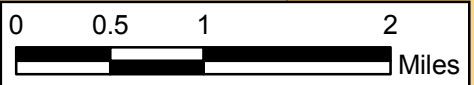
Florida Fish & Wildlife Conservation Commission  
Division of Habitat & Species Conservation  
Imperiled Species Management Section  
620 South Meridian Street, Mail Station 6A  
Tallahassee, Florida 32399-1600  
Tel: 850-922-4330 Fax: 850-922-4338



**Manatee- "Fast" Boat  
Coincidence Data  
Cold Season  
10 Quantiles**

- 0 (94% of cells Countywide)
- 0.001 - 0.104
- 0.105 - 0.313
- 0.314 - 0.522
- 0.523 - 0.73
- 0.731 - 1.044
- 1.045 - 1.565
- 1.566 - 2.296
- 2.297 - 3.339
- 3.34 - 4.904
- 4.905 - 26.609

This legend uses the quantiles from the "All Boat" Warm Season Coincidence Map.



**Figure 17: Manatee- "Fast" Boat Coincidence Data  
Cold Season  
Southern Flagler County: Dunes Hammock Bridge to  
Volusia County line**

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