June 29, 2010

Committee Members
Broward County Local Rule Review Committee

Thank you for agreeing to serve on the Local Rule Review Committee (LRRC) for Broward 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 15, 2010, to notify Broward 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 the existing Broward County rule to determine if any modifications should be made. Based on our preliminary staff review and issues raised by others, a number of potential rule changes have been identified. The potential rule changes and a discussion of the rationale for them are detailed in the attached document (Data Discussion and Preliminary Identification of Areas for LRRC Review). It is important to stress that the potential changes 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 identified potential rule changes and provide recommendations as to what changes, if any, should be proposed. If the LRRC identifies any other changes it feels are needed, we would like to know about these as well.

We have provided County staff with the documents mentioned above as well as other documents that may be of interest. A list and description of the documents is included in Appendix A of the attached document. Geographic information system (GIS) data used in the analyses are also listed in Appendix A. The GIS data, which can be displayed, queried, and analyzed in ArcGIS®, are available if desired.

In closing, I want to again thank you for agreeing to serve on the Broward 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
Broward County Manatee Protection Rule Review  
Data Discussion and Preliminary Identification of Areas for LRRC Review  

Prepared by FWC staff for use by the Broward County Local Rule Review Committee (LRRC)  
June 2010

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 Broward County manatee protection rule. The document identifies and discusses 12 potential rule changes that may be warranted based on the data review and other factors. At this time staff has not made a final determination as to whether any of these potential rule changes 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 changes and provide recommendations as to what changes, if any, it believes should be made. This document should not be construed to limit what information the LRRC may consider or what rule changes 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.

A. 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 four primary zones, with three of the four primary zones further subdivided into two or more smaller sub-zones (Figure 1). The primary zones were: North County (north of East Las Olas Blvd, including the Hillsboro Canal, Pompano Canal, and Middle River); Port Everglades (Intracoastal Waterway (ICW) area between East Las Olas Blvd and the Dania Cutoff Canal); South County (south of the Dania Cutoff Canal); and, Inland Areas (inland waterways generally west of Port Everglades, including New River, Dania Cutoff Canal, and the C-10 Canal).
   b. For purposes of creating maps to display data, the county was divided into four regions: the North Region extends from the Palm Beach County line to the vicinity of Commercial Blvd; the North-Central Region runs from the vicinity of Commercial Blvd to just north of the Dania Cutoff Canal; the South Region extends from the vicinity of SE 17th Street to the Miami-Dade County line; and, the Inland Region covers the inland waterways generally west of Port Everglades.
   c. Because manatee use of Broward County is highly seasonal, data were mapped and 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 in the review, such as manatee telemetry data. These data and other information are included in the list of supporting data (Appendix A).
   e. Manatee aerial survey (AS) data for Broward County have been collected during several different periods in the last 20-30 years. Although all available data were reviewed, detailed analyses used only data from the 1988-92 and 2004-09 periods. The 1988-92 data were the primary AS data available when the countywide rule was first developed in the early 1990s, while the 2004-09 data represent current use and distribution.
   f. Manatee mortality data have been collected since 1974. Data through December 2009 were used for this review.
   g. The primary boating data used for this review were collected by Mote Marine Laboratory (MML) in 2004-05 using aerial surveys. The written final report prepared by MML and provided to the FWC in June 2005 has been provided to County staff.
   h. Data on seagrass were collected by Broward County staff in 2006-07. The data represent where seagrass was present based on field measurements. Positions are approximate, and additional areas of seagrass are believed to exist but have not yet been verified.

2. Notes on manatee aerial survey data and comparisons between 1988-92 and 2004-09
   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 temporarily 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. Data for the 1988-92 period were collected during two separate survey efforts: 1988-90 and 1991-92. The combined period includes data from 60 surveys.

c. The 1988-90 data include a total of 48 surveys, flown between January 1988 and March 1990. The survey area covered the ICW area but not Hillsboro Canal, the Pompano Canal area, Middle River, or inland areas.

d. The 1991-92 data include a total of 12 surveys, flown between November 1991 and September 1992. The survey area covered the ICW area and the inland areas but not Hillsboro Canal, the Pompano Canal area, or Middle River.

e. Data for the 2004-09 period were collected during two separate survey efforts: 2004-07 and 2007-09. The combined period includes data from 93 surveys.

f. The 2004-07 data include a total of 48 surveys, flown between January 2004 and April 2007. The survey area covered the ICW area, Hillsboro Canal, Middle River, and inland areas, but not the Pompano Canal area. The South Fork of the Middle River was not surveyed consistently because of the limited ability to see manatees due to overhanging vegetation and related issues.

g. The 2007-09 data include a total of 45 surveys, flown between November 2007 and December 2009. Most of the surveys were flown during the cold season. The survey area covered the ICW area, Hillsboro Canal, the Pompano Canal area, Middle River, and inland areas; however, the Pompano Canal area, Middle River, and C-10 Canal were not included in many of the surveys. As with the 2004-07 surveys, the South Fork of the Middle River was not surveyed consistently because of the limited ability to see manatees due to overhanging vegetation and related issues.

h. Because the areas surveyed within Broward County during the various survey efforts were not identical, the sighting densities and percent totals reported in Table 1 were not all based on the exact same areas. Also, eight manatees seen in nearshore waters of the Atlantic Ocean were not included in the analyses.

3. Notes on manatee mortality data
   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.

4. Notes on boat aerial survey data
   a. The 2004-05 boat data include a total of 17 surveys, flown between May 2004 and January 2005. Two surveys were flown on each survey date (except for one day when only one survey was flown), one in the morning and one in the afternoon, with the surveys split evenly between weekdays and weekends. The survey area covered the ICW area (but only as far south as Hallandale Beach Blvd), the Pompano Canal area, Middle River, and inland areas, but not most of Hillsboro Canal or the C-10 Canal. Surveys of the inland areas were often abbreviated due to flight restrictions imposed by the Ft. Lauderdale airport. A total of 3452 boats were recorded, including 42 in the extreme southern portion of Palm Beach County.

   b. The boat data used in the manatee-boat coincidence analysis (see below) was a subset of the overall dataset. Not included in the analysis were the following categories of boats: Type = Other and Size < 16 feet (predominately unpowered canoes and kayaks); and, Type = Sailboat and Size < 16 feet (predominately unpowered sailboats). There were 128 boats in these excluded groups. The reduced subset (“All Boats”) included a total of 3342 boats.

   c. The “All Boats” dataset was further subdivided to create a “Fast Boats” dataset, which included only boats with Speed = Planing, Cruising, or Plowing. The Fast Boats dataset included a total of 889 boats, or 27% of the All Boats dataset.

5. Notes on 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. Because no boat aerial survey data were collected prior to 2004, we only calculated coincidence values using the 2004-09 manatee data. Because of this, no comparisons of coincidence can be made between 2004-09 and 1988-92, as was done for the manatee data.

c. Two coincidence covers were created for each season, one using the All Boats dataset (“Coin”) and one using just the Fast Boats dataset (“Fast Coin”), as described above. The ratio of Fast Coin to Coin gives an indication of how much of the overall coincidence was the result of boats traveling at higher speeds.

6. Areas where a rule change may be warranted
Site-specific areas identified as potentially warranting a rule change are discussed in the zone by zone discussions below, with issues not tied to a specific site discussed after the zone by zone discussions. Figures showing the locations of the site-specific areas are also included for each region.

B. Countywide Data Summary

1. Comparison of manatee aerial survey data from 2004-09 vs. 1988-92
a. The mean density of manatees seen per km² per survey (“manatee density”) increased during both the cold season and warm season between 1988-92 and 2004-09, with a much more substantial increase during the cold season. The manatee density during the cold season increased from 3.90 to 10.48, while it increased from 0.45 to 0.60 during the warm season. Table 1 summarizes the aerial survey data by zone and season.

b. Considering the relative proportion of manatees seen in each zone, there were some changes between 1988-92 and 2004-09. The most noticeable change for the cold season was an increase in the proportion of manatees using the inland power plant area (5% for 1988-92; 53% for 2004-09) and a corresponding decrease in the proportion using the Port Everglades power plant (76% for 1988-92; 29% for 2004-09). Changes for the warm season were more subtle, with the most noticeable change being an increase in the proportion of manatees using the North County zone (11% for 1988-92; 34% for 2004-09). Changes in use and distribution are discussed in greater detail in the zone by zone discussions below.

2. Manatee mortality
a. 203 carcasses were recovered in the county through 2009, with 68 (33%) recovered during the warm season and 135 (67%) recovered during the cold season. (The warm season account for 58% of the year while the cold season account for 42%.) The “Boat-related” category had the most deaths (70). “Undetermined/Unrecovered” and “perinatal” deaths were the next two highest categories, with 56 and 39 deaths, respectively. Table 2 summarizes the mortality data by zone and season.

b. Of the 70 boat-related deaths recorded in the county, 47 (67%) were recovered during the cold season and 23 (33%) were recovered during the warm season. Half of the boat-related deaths (35) were recovered in January or February. Six boat-related deaths (in 2006) are the most ever recovered in the county in one year, followed by five (in 1987, 1999, and again in 2003). Table 3 summarizes the mortality data by year and category.

3. Manatee-boat coincidence
a. The mean overall “All Boats” coincidence value (“Coin”) and the mean overall “Fast Boats” coincidence value (“Fast Coin”) were each 4-5 times greater for the cold season (Coin = 4.34; Fast Coin = 1.45) than the corresponding values for the warm season (Coin = 1.04; Fast Coin = 0.28). Table 4 summarizes the coincidence analysis results by zone and season.

b. The overall ratio of Fast Coin to Coin was greater during the cold season (0.33) than it was during the warm season (0.27), which is a bit surprising given the existing manatee protection zones are more restrictive in many places during the cold season.

c. These data suggest the overall boating risk to manatees is substantially higher during the cold season and that fast boats also represent a higher proportion of the risk during this time.

C. North County

1. Comparison of manatee aerial survey data from 2004-09 vs. 1988-92 (Table 1; Figures 2-5 & Figures 14-17)
   a. The manatee density increased during both the cold season and warm season between 1988-92 and 2004-09, with both mean densities increasing by a factor of close to three. The manatee density during the cold season increased from 0.71 to 1.90, while it increased from 0.15 to 0.47 during the warm season. The relative
proportion of manatees seen in this zone during the warm season was noticeably higher in 2004-09 (34%, up from 11%), while the proportions stayed about the same for the cold season. Some of the difference can be explained by the fact the Middle River was surveyed in 2004-09 but not in 1988-92.

b. Regarding the relative distribution of manatee sightings within this zone, areas that had high relative densities in 1988-92 continued to have high relative densities in 2004-09; however, more of the area had high-end densities in 2004-09, particularly during the cold season in the portion of the zone north of NE 14th Street. The area in and around Hillsboro Inlet had the highest densities in this zone during both periods.

2. Manatee mortality (Table 2: Figure 6 & Figure 18)
   a. 38 carcasses were recovered in this zone, with eight of these attributed to boats (five of which occurred since 2000). Six of the boat-related deaths were recorded during the cold season and two during the warm season.

3. Manatee-boat coincidence (Table 4: Figures 7-10 & Figures 19-22)
   a. Cold season: Coin for this zone was 5.23 and FastCoin was 1.95. The FastCoin value was close to 35% above the mean FastCoin value for the whole county. The North County to Hillsboro Inlet area and continuing south to Atlantic Blvd had some of the highest FastCoin values. Much of the higher FastCoin values occurred in areas that are currently regulated at Idle Speed or Slow Speed for boating safety and/or manatee protection purposes.
   b. Warm season: Coin for this zone was 1.26 and FastCoin was 0.29. The FastCoin value was only slightly greater than the mean FastCoin value for the whole county.

4. Other information
   a. Figure 11 & Figure 23 show the locations of seagrass in 2006-07.
   b. Figure 12 & Figure 24 show the existing FWC manatee protection zones and boating safety zones.

5. Areas where a rule change may be warranted (Figure 13 & Figure 25)
   a. C1: Hillsboro Canal. This area had moderate to high manatee density during both the cold season and the warm season. Boat data was not collected for most of the canal so manatee-boat coincidence could not be calculated. Most of the canal is a year-round 50-foot Slow Speed shoreline buffer with the area beyond the buffer unregulated. The middle of the canal is the boundary between Broward County and Palm Beach County. The northern portion of the canal is regulated by the Palm Beach County rule as a year-round 50-foot Slow Speed shoreline buffer. FWC has received requests from law enforcement to make the entire canal a shore-to-shore Slow Speed zone.

   Potential Rule Change (year-round): Change the 50-foot Slow Speed shoreline buffer to a shore-to-shore Slow Speed zone. This change could not be fully implemented unless the Palm Beach County rule was also changed.

   b. C2: Hillsboro Inlet Area. This area (from marker “68A” to just south of NE 14th Street) had high manatee density and FastCoin during both the cold season and the warm season but is only regulated at Slow Speed during the cold season. This area is regulated year-round for boating safety.

   Potential Rule Change (warm season): Change the existing cold season Slow Speed zone to a year-round zone. This change would not have any effect on-water because of the existing boating safety zones. This change would be consistent with the resolution passed by the city of Lighthouse Point (see Area C3, below) except that the City requested Idle Speed.

   c. C3: Intracoastal Waterway (ICW) from Palm Beach County line to Marker “68A”. This area had high manatee density and FastCoin during the cold season. Most of this area is regulated at Slow Speed on weekends only during the cold season (25 MPH with a 50-foot Slow Speed buffer during other times). The area between markers “68” and “68A” (approximately 4600 feet) is also regulated as a year-round Idle Speed boating safety zone. The city of Lighthouse Point passed a resolution in June 2010 requesting that the entire ICW within its jurisdiction be changed to a year-round Idle Speed zone; the northern city limit is approximately 3100 feet north of marker “68”.

- 4 -
Potential Rule Change (cold season): Change the existing cold season weekend only Slow Speed zone to all days during the cold season. For the cold season (but not the warm season), this change would be consistent with the resolution passed by the city of Lighthouse Point except that the City requested Idle Speed.

d. C4: ICW from NE 14th Street to Atlantic (or possibly Commercial) Blvd. This area had high manatee density and moderate FastCoin during the cold season. This area is regulated at Slow Speed on weekends only during the cold season (25 MPH with a 50-foot Slow Speed buffer during other times). FWC has received requests from the public to make the area between NE 14th Street and Atlantic Blvd a year-round Idle Speed or Slow Speed zone.

Potential Rule Change (cold season): Change the existing cold season weekend only Slow Speed zone to all days during the cold season.

e. C5: ICW from Palm Beach County line to Burnham Point. This area includes the area covered by C3 and C4 plus additional area to the south (but not the Hillsboro Inlet zone). This area, which had moderate manatee density and FastCoin during the warm season, is regulated at 25 MPH with a 50-foot Slow Speed buffer during the warm season. There are multiple boating safety zones in this area as well as an underlying 30 MPH zone with a 15-inch wake limitation that was established by a Special Act of the Florida Legislature. This latter zone is not currently posted because the existing boating safety and manatee protection zones completely overlap it with more restrictive zones.

Potential Rule Change (warm season): Remove the entire warm season manatee protection zone or possibly change it to a shore-to-shore 25 MPH zone (i.e., remove only the 50-foot Slow Speed buffers). Removal of the zone completely would mean the areas outside of the other existing zones would be governed by the Special Act zones. Removal of the shoreline buffer is not expected to have any significant negative effects because boat lifts, docks, and other shore-based structures already limit high speed boat operation in many parts of this area. Removal of the buffer would make zone marking much easier because the regulatory markers would need to contain much less text.

f. C6: Entrance to Pompano Canal / Cypress Creek. The area east of US 1 and west of the ICW is currently unregulated but sandwiched between the year-round Slow Speed zone on Pompano Canal / Cypress Creek and the seasonally-differentiated zone on the ICW. This area was likely excluded from the existing zones to allow higher speeds for water sports. The ICW area immediately to the east had moderate to high manatee density and moderate FastCoin during both seasons.

Potential Rule Change (cold season): Include this area in the zone that covers the ICW immediately to the east. The ICW is currently regulated at Slow Speed on weekends only during the cold season (25 MPH with a 50-foot Slow Speed buffer during other times) but is identified in Areas C4 and C5 for a potential change.

D. Port Everglades

1. Comparison of manatee aerial survey data from 2004-09 vs. 1988-92 (Table 1; Figures 14-17)

a. The manatee density increased during the cold season between 1988-92 and 2004-09 but decreased during the warm season. The manatee density during the cold season increased from 13.70 to 16.70 but decreased from 0.39 to 0.26 during the warm season. The relative proportion of manatees seen in this zone during the cold season was substantially lower in 2004-09 (29%, down from 79%) even though the manatee density was higher. This appears to be largely a result of increased use of the inland power plant area during the cold season. The relative proportion of manatees seen in this zone during the warm season was also lower in 2004-09 (8%, down from 19%) but the change was far less than the cold season change.

b. The relative distribution of manatee sightings within this zone did not change noticeably between 1988-92 and 2004-09.
2. Summary of manatee mortality (Table 2; Figure 18)
   a. 67 carcasses were recovered in this zone, with 40 of these attributed to boats (17 of which occurred since 2000). Twenty-eight (28) of the boat-related deaths were recorded during the cold season and 2 during the warm season.

3. Summary of manatee-boat coincidence (Table 4; Figures 19-22)
   a. Cold season: Coin for this zone was 6.20 and FastCoin was 2.11. The FastCoin value was close to 46% above the mean FastCoin value for the whole county. The area adjacent to the power plant and the area west of Burnham Point had some of the highest FastCoin values. Almost all of the higher FastCoin values occurred in areas that are currently regulated at Idle Speed or Slow Speed for boating safety and/or manatee protection purposes.
   b. Warm season: Coin for this zone was 0.77 and FastCoin was 0.33. The FastCoin value was close to 18% above the mean FastCoin value for the whole county.

4. Other information
   a. Figure 23 shows the locations of seagrass in 2006-07.
   b. Figure 24 shows the existing FWC manatee protection zones and boating safety zones.

5. Areas where a rule change may be warranted (Figure 25)
   a. D1: Port Everglades Power Plant Discharge Canal. This area had high manatee density during both the cold season and the warm season. Most of the canal is a year-round No Entry zone but the east-west portion of the canal that connects to the ICW is regulated at Idle Speed during the cold season and at Slow Speed during the warm season. FWC has received requests from law enforcement and others to expand the existing No Entry zone to include the east-west portion of the canal.

Potential Rule Change (warm season): Expand the No Entry zone to include the east-west portion of the canal.

E. South County

1. Comparison of manatee aerial survey data from 2004-09 vs. 1988-92 (Table 1; Figures 26-29)
   a. The manatee density decreased during both the warm season and cold season between 1988-92 and 2004-09, with both mean densities decreasing by close to 25%. The manatee density during the cold season decreased from 0.84 to 0.60, while it decreased from 0.40 to 0.30 during the warm season. The relative proportion of manatees seen in this zone also decreased noticeably during the both seasons (from 4% to 1% during the cold season and from 16% to 8% during the warm season).
   b. The relative distribution of manatee sightings within this zone did not change noticeably between 1988-92 and 2004-09.

2. Summary of manatee mortality (Table 2; Figure 30)
   a. Five carcasses were recovered in this zone, with two of these attributed to boats (neither of which occurred since 2000). Both of the boat-related deaths were recorded during the warm season.

3. Summary of manatee-boat coincidence (Table 4; Figures 31-34)
   a. Cold season: Coin for this zone was 1.36 and FastCoin was 0.66. The FastCoin value was about 50% below the mean FastCoin value for the whole county. The areas where FastCoin was the highest were immediately south of the Dania Cutoff Canal and in the vicinity of Sheridan Street. Much of the higher FastCoin values occurred in areas that are currently regulated at Idle Speed or Slow Speed for boating safety and/or manatee protection purposes.
   b. Warm season: Coin for this zone was 1.44 and FastCoin was 0.56. The FastCoin value was two times greater than the mean FastCoin value for the whole county.

4. Other information
   a. Figure 35 shows the locations of seagrass in 2006-07.
   b. Figure 36 shows the existing FWC manatee protection zones and boating safety zones.
5. Areas where a rule change may be warranted (Figure 37)
   a. E1: West of ICW, South of Dania Beach Blvd. This existing cold season Slow Speed zone had high manatee density and FastCoin during the warm season. The area is 25 MPH with a 50-foot Slow Speed shoreline buffer during the warm season. It is one of only a few locations that has substantial seagrass.

   Potential Rule Change (warm season): Change the existing cold season Slow Speed zone to a year-round zone.

   b. E2: ICW from just south of Dania Beach Blvd. to the Miami-Dade County line. This area had moderate to low manatee density but moderate to high FastCoin during the warm season. As with Area C5, this area is regulated at 25 MPH with a 50-foot Slow Speed buffer during the warm season. There are multiple boating safety zones in this area as well as an underlying 30 MPH zone with a 15-inch wake limitation that was established by a Special Act of the Florida Legislature. This latter zone is not currently posted because the existing boating safety and manatee protection zones completely overlap it with more restrictive zones. The city of Hollywood has requested the ICW between Hollywood Blvd and Hallandale Beach Blvd be regulated at Idle Speed and the city of Hallandale Beach has requested that the ICW within its jurisdictions be changed to a year-round Slow Speed zone.

   Potential Rule Change (warm season or possibly year-round): Remove the entire warm season manatee protection zone or possibly change it to a shore-to-shore 25 MPH zone (i.e., remove only the 50-foot Slow Speed buffers). Removal of the zone completely would mean the areas outside of the other existing zones would be governed by the Special Act zones. Removal of the shoreline buffer is not expected to have any significant negative effects because boat lifts, docks, and other shore-based structures already limit high speed boat operation in many parts of this area. Removal of the buffer would make zone marking much easier because the regulatory markers would need to contain much less text.

F. Inland Areas

1. Comparison of manatee aerial survey data from 2004-09 vs. 1988-92 (Table 1; Figures 38-41)
   a. The manatee density increased during both the cold season and warm season between 1988-92 and 2004-09. The manatee density during the cold season increased from 1.70 to 28.65, while it increased from 0.94 to 1.32 during the warm season. The relative proportion of manatees seen in this zone during the cold season was noticeably higher in 2004-09 (34%, up from 11%), while the proportions stayed about the same for the warm season. The relative proportion of manatees seen in this zone during the cold season was substantially higher in 2004-09 (62%, up from 11%). This appears to be largely a result of increased use of the inland power plant area during the cold season. The relative proportion of manatees seen in this zone during the warm season remained essentially unchanged.

   b. Regarding the relative distribution of manatee sightings within this zone, areas that had high relative densities in 1988-92 continued to have high relative densities in 2004-09; however, more of the area had high-end densities in 2004-09, particularly during the cold season throughout the New River and new River Canal and in parts of the Dania Cutoff Canal and C-10 Canal.

2. Summary of manatee mortality (Table 2; Figure 42)
   a. 86 carcasses were recovered in this zone, with 17 of these attributed to boats (eight of which occurred since 2000). Ten of the boat-related deaths were recorded during the cold season and seven during the warm season.

3. Summary of manatee-boat coincidence (Table 4; Figures 43-46)
   a. Cold season: Coin for this zone was 2.71 and FastCoin was 0.33. The low FastCoin value is not surprising because almost all inland waters are currently regulated at Slow Speed for boating safety and/or manatee protection purposes.

   b. Warm season: Coin for this zone was 0.62 and FastCoin was 0.05.

4. Other information
   a. No seagrass was identified in the inland areas so no figure is provided.

   b. Figure 47 shows the existing FWC manatee protection zones and boating safety zones.
5. Areas where a rule change may be warranted (Figure 48)
   a. F1: Ft. Lauderdale Inland Power Plant cooling ponds. Although the cooling ponds are used by manatees year-round, the manatee density during the warm season is moderate to low (as compared to extremely high during the cold season). The area’s importance to manatees is primarily as a warm water aggregation site but this is not an issue during the warm season. The cooling ponds are not accessible to the general public and given the low to moderate manatee use, retaining the No Entry zone during the warm season may not be necessary.

Potential Rule Change (warm season): Change the existing year-round No Entry zone in the discharge ponds to be in effect only during the cold season.

G. Other Rule Issues

1. Preamble language in § (1) of the rule
   Since the rule was adopted in 1993, there have been numerous amendments to the Florida Manatee Sanctuary Act [§ 379.2431(2), FS] and to Rule 68C-22.001, FAC. The Act provides the authority for the FWC to establish manatee protection rules and Rule 68C-22.001 provides additional guidelines and requirements related to the rule making process. Because of these changes, the existing Broward County rule does not track the language currently contained in the Act or Rule 68C-22.001.

Potential Rule Change (G1): Amend the rule to make the language consistent with the current Act and rule language. The revised language would closely mirror the language used in the Sarasota County rule (68C-22.026), which was amended in June 2010 for the same reasons.

2. Add holidays to the zones that are only in effect on weekends
   The existing weekend-only zones do not include holidays. In other rules that differentiate between weekends and holidays, including boating safety zones in Broward County, holidays are included in the weekend zones. The reason for this is boating traffic on holidays is typically the similar to or greater than weekend traffic.

Potential Rule Change (G2): Revise the weekend-only zones to include holidays

3. Clean-up and confirmation of zone descriptions
   All zone descriptions need to be reviewed to confirm or update the latitude and longitude coordinates and to otherwise check for accuracy (e.g., confirm or update references to channel markers, etc.). Descriptions should be reviewed to see if they can be written more clearly and succinctly – to make them more understandable to the public. References to plat books and/or Township and Range coordinates should be removed unless absolutely necessary because these are arcane to most people; references to landmarks and/or specific latitude and longitude coordinates would be much better. Also, because a person’s ability to accurately locate a specific coordinate requires the person to know what reference datum was used, it may be worthwhile for § (1) of the rule to state what datum was used (e.g., UTM, NAD27).

Potential Rule Change (G3): Amend the rule to clean-up zone descriptions where needed.
<table>
<thead>
<tr>
<th>Location [1]</th>
<th>North County</th>
<th>North County to Hillsboro Inlet [a]</th>
<th>NE 14th to East Las Olas</th>
<th>Pompano Canal / Cypress Creek [b]</th>
<th>Middle River [c]</th>
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<th>East Las Olas to Port</th>
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<th>South County</th>
<th>Dania to South County</th>
<th>Inland Areas</th>
<th>New River</th>
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<th>C-10 Canal</th>
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<td>94%</td>
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[1] The areas surveyed during the different periods were not identical
[2] Density: Mean number of manatees seen per survey per sq. km
[3] Percent Total: Proportion of the mean number of manatees seen per survey countywide that were seen in each area
[4] Percent Surveys: Percentage of all surveys during which at least one manatee was seen in the area
[a] Most of Hillsboro Canal not surveyed in 1988-92
[c] Middle River not surveyed in 1988-92. South Fork of the Middle River not covered during many of the surveys because of limited ability to see manatees due to overhanging vegetation, etc.
### Table 2: Broward County Manatee Mortality by Zone and Season (through December 2009)

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[a] Includes 7 carcasses recovered in the Atlantic Ocean

[*] Death Codes: 1 = Watercraft; 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

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Table 3: Broward County Manatee Mortality by Year and Category (through December 2009)

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<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
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<td>1</td>
<td>0</td>
<td>0</td>
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<td>2</td>
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<td>4</td>
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<td>1</td>
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<td>1</td>
<td>0</td>
<td>4</td>
<td>3</td>
<td>4</td>
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<td>Total</td>
<td>70</td>
<td>7</td>
<td>9</td>
<td>39</td>
<td>12</td>
<td>10</td>
<td>56</td>
<td>133</td>
<td>203</td>
</tr>
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</table>

D_Codes: 1 = Watercraft-related; 2 = Structure; 3 = Other Human; 4 = Perinatal; 5 = Cold Stress; 6 = Other Natural; 7-9 = Undetermined or Verified/Not Recovered
Table 4: Broward County Manatee Density, "Fast" Boat Density, and Manatee-Boat Coincidence by Area and Season

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>North County to Hillsboro Inlet [a]</td>
<td>0.13</td>
<td>1.20</td>
<td>1.26</td>
<td>0.29</td>
<td>0.61</td>
<td>1.38</td>
<td>5.23</td>
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<tr>
<td>NE 14th to East Las Olas</td>
<td>0.13</td>
<td>1.83</td>
<td>0.94</td>
<td>0.39</td>
<td>0.60</td>
<td>1.79</td>
<td>3.05</td>
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<td>Pompano Canal / Cypress Creek [b]</td>
<td>0.01</td>
<td>0.20</td>
<td>0.14</td>
<td>0.04</td>
<td>0.01</td>
<td>0.58</td>
<td>0.10</td>
<td>0.05</td>
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<tr>
<td>Middle River [c]</td>
<td>0.11</td>
<td>0.55</td>
<td>0.22</td>
<td>0.09</td>
<td>0.22</td>
<td>0.30</td>
<td>0.50</td>
<td>0.06</td>
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<td>Port Everglades</td>
<td>0.10</td>
<td>3.09</td>
<td>0.77</td>
<td>0.33</td>
<td>3.96</td>
<td>3.09</td>
<td>6.20</td>
<td>2.11</td>
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<tr>
<td>East Las Olas to Port</td>
<td>0.05</td>
<td>2.86</td>
<td>0.95</td>
<td>0.42</td>
<td>0.23</td>
<td>3.14</td>
<td>3.30</td>
<td>1.32</td>
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<tr>
<td>Power Plant / John Lloyd SP</td>
<td>0.22</td>
<td>3.81</td>
<td>0.32</td>
<td>0.10</td>
<td>13.06</td>
<td>2.94</td>
<td>13.26</td>
<td>4.04</td>
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<tr>
<td>South County</td>
<td>0.14</td>
<td>1.22</td>
<td>1.44</td>
<td>0.56</td>
<td>0.26</td>
<td>1.03</td>
<td>1.36</td>
<td>0.66</td>
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<tr>
<td>South County to South County [d]</td>
<td>0.14</td>
<td>1.22</td>
<td>1.44</td>
<td>0.56</td>
<td>0.26</td>
<td>1.03</td>
<td>1.36</td>
<td>0.66</td>
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<td>Inland Areas</td>
<td>0.22</td>
<td>0.28</td>
<td>0.62</td>
<td>0.05</td>
<td>9.46</td>
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<td>New River</td>
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<td>0.92</td>
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<td>0.49</td>
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<td>Dania Power Plant / New River Canal</td>
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<td>0.04</td>
<td>0.53</td>
<td>0.02</td>
<td>22.98</td>
<td>0.03</td>
<td>1.98</td>
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<td>C-10 Canal [e]</td>
<td>0.17</td>
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<td>--</td>
<td>--</td>
<td>0.72</td>
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</tr>
<tr>
<td>Broward County</td>
<td>0.15</td>
<td>1.39</td>
<td>1.04</td>
<td>0.28</td>
<td>3.38</td>
<td>1.43</td>
<td>4.34</td>
<td>1.45</td>
</tr>
</tbody>
</table>

[1] Manatee Density: Mean manatee density per survey for the 2004-09 period (ArcGIS kernel density using a 325 m search radius)
[2] Fast Boat Density: Mean boat density per survey for the 2004-05 period for only boats with observed speeds of "planing," "cruising," or "plowing" (ArcGIS kernel density using a 325 m search radius)
[3] Coin: Mean manatee-boat coincidence value (ArcGIS kernel density for manatees times the kernel density for boats)
[4] "Fast" Coin: Mean manatee-boat coincidence 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] Coin Ratio: Ratio of Fast Coin to Coin (Column [4] value divided by Column [3] value). In some cases this ratio may appear incorrect based on the Coin and Fast Coin values but this is due to the Coin and Fast Coin values only being shown to two decimal places.
[a] Hillsboro Canal west of US 1 not surveyed for boats so manatee-boat coincidence does not include this area
[b] Pompano Canal / Cypress Creek area only surveyed five times for manatees
[c] South Fork of the Middle River not covered during many of the manatee surveys
[d] Area south of Hallandale Beach Blvd not surveyed for boats so manatee-boat coincidence does not include this area
[e] C-10 Canal not surveyed for boats so manatee-boat coincidence cannot be calculated

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 tables. 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 comparison table were calculated by dividing the number of manatees seen within each area by the amount of area surveyed. Except for the Pompano Canal Area, the mean kernel density values are lower than the means reported in the aerial survey summary tables.
Figure 1: Data Summary Areas (Broward County)
Figure 2: 2004-09 Manatee Aerial Survey Data (Kernel Density; 325 m Radius)
Cold Season (November - March)
Broward County: North Region
Figure 3: 1988-92 Manatee Aerial Survey Data (Kernel Density; 325 m Radius)
Cold Season (November - March)
Broward County: North Region
Figure 4: 2004-09 Manatee Aerial Survey Data (Kernel Density; 325 m Radius)
Warm Season (April - October)
Broward County: North Region

Aerial Survey Data
10 Quantiles
- 0.000 (66% of cells countywide)
- 0.001 - 0.014
- 0.015 - 0.054
- 0.055 - 0.111
- 0.112 - 0.175
- 0.176 - 0.245
- 0.246 - 0.305
- 0.306 - 0.420
- 0.421 - 0.630
- 0.631 - 1.150
- 1.151 - 3.731

0 0.5 1 2
Miles

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Figure 5: 1988-92 Manatee Aerial Survey Data (Kernel Density; 325 m Radius)
Warm Season (April - October)
Broward County: North Region
Figure 6: Manatee Mortality (1974 - December 2009)
Broward County: North Region
(Year of occurrence noted for boat-related deaths)
Figure 7: "All Boats" Manatee-Boat Coincidence (2004-09 Manatees; 2004-05 Boats)
Cold Season (November - March)
Broward County: North Region
Figure 8: "Fast Boats" Manatee-Boat Coincidence (2004-09 Manatees; 2004-05 Boats)
Cold Season (November - March)
Broward County: North Region
Figure 9: "All Boats" Manatee-Boat Coincidence (2004-09 Manatees; 2004-05 Boats)
Warm Season (April - October)
Broward County: North Region

This legend uses the quantiles from the Cold Season "All Boats" Coincidence map. Percentages for each category for this cover are noted.

Manatee-Boat Coincidence
10 Quantiles

- 0.000 (72% of cells countywide)
- 0.001 - 0.060 (3.9%)
- 0.061 - 0.340 (4.3%)
- 0.341 - 0.825 (3.8%)
- 0.826 - 1.550 (3.7%)
- 1.551 - 2.450 (3.1%)
- 2.451 - 3.600 (1.9%)
- 3.601 - 5.300 (1.7%)
- 5.301 - 7.900 (2.0%)
- 7.901 - 14.600 (2.1%)
- 14.601 - 42.483 (1.6%)
Figure 10: "Fast Boats" Manatee-Boat Coincidence (2004-09 Manatees; 2004-05 Boats) Warm Season (April - October) Broward County: North Region
Figure 11: Seagrass (2006-07)
Broward County: North Region
(Source: Broward County)

These data represent where seagrass was present based on field measurements. Positions are approximate. Additional areas of seagrass are believed to exist but have not yet been verified.
Figure 12: Existing FWC Manatee Protection and Boating Safety Zones
Broward County: North Region
Areas Identified as Potentially Warranting a Rule Change
Broward County: North Region

**Figure 13: Areas Identified as Potentially Warranting a Rule Change**

FWC Manatee Zones (Current)

- **No Entry**
- **Idle Speed**
- **Idle Speed (cold) / Slow Speed (warm)**
- **Slow Speed**
- **Slow Speed (50-foot buffer)**
- **Slow Speed (cold) **
- **Slow Speed on Weekends (cold) **
- **25 MPH (50-ft Slow Speed buffer)**

**During all other times zone is 25 MPH with a 50-foot Slow Speed shoreline buffer**

- **C1**
- **C2**
- **C3, C5**
- **C4, C5**
- **C6**
- **Deerfield Beach**
- **Hillsboro Inlet**
- **Pompano Beach**
- **N.E. 14th Street**
- **Atlantic Blvd**
- **Cypress Creek**
- **Pompano Canal**
Figure 14: 2004-09 Manatee Aerial Survey Data (Kernel Density; 325 m Radius)
Cold Season (November - March)
Broward County: North-Central Region
Figure 15: 1988-92 Manatee Aerial Survey Data (Kernel Density; 325 m Radius)
Cold Season (November - March)
Broward County: North-Central Region
Figure 16: 2004-09 Manatee Aerial Survey Data (Kernel Density; 325 m Radius)

Warm Season (April - October)

Broward County: North-Central Region

Aerial Survey Data
10 Quantiles

- 0.000 (66% of cells countywide)
- 0.001 - 0.014
- 0.015 - 0.054
- 0.055 - 0.111
- 0.112 - 0.175
- 0.176 - 0.245
- 0.246 - 0.305
- 0.306 - 0.420
- 0.421 - 0.630
- 0.631 - 1.150
- 1.151 - 3.731

Miles
Figure 17: 1988-92 Manatee Aerial Survey Data (Kernel Density; 325 m Radius)
Warm Season (April - October)
Broward County: North-Central Region
Figure 18: Manatee Mortality (1974 - December 2009)
Broward County: North-Central Region
(Year of occurrence noted for boat-related deaths)
Figure 19: "All Boats" Manatee-Boat Coincidence (2004-09 Manatees; 2004-05 Boats)
Cold Season (November - March)
Broward County: North-Central Region
Figure 20: "Fast Boats" Manatee-Boat Coincidence (2004-09 Manatees; 2004-05 Boats)
Cold Season (November - March)
Broward County: North-Central Region

This legend uses the quantiles from the Cold Season "All Boats" Coincidence map. Percentages for each category for this cover are noted.
Figure 21: "All Boats" Manatee-Boat Coincidence (2004-09 Manatees; 2004-05 Boats)
Warm Season (April - October)
Broward County: North-Central Region
Figure 22: "Fast Boats" Manatee-Boat Coincidence (2004-09 Manatees; 2004-05 Boats)  
Warm Season (April - October) 
Broward County: North-Central Region
Figure 23: Seagrass (2006-07)
Broward County: North-Central Region
(Source: Broward County)

These data represent where seagrass was present based on field measurements. Positions are approximate. Additional areas of seagrass are believed to exist but have not yet been verified.
Figure 24: Existing FWC Manatee Protection and Boating Safety Zones
Broward County: North-Central Region

**During all other times zone is 25 MPH with a 50-foot Slow Speed shoreline buffer**

Not shown: 30 MPH / 15 inch wake in all waters of the ICW and New River Canal except where other zones apply (boating safety)
Figure 25: Areas Identified as Potentially Warranting a Rule Change
Broward County: North-Central Region

**Areas of Potential Change**

**FWC Manatee Zones (Current)**
- No Entry
- Idle Speed
- Idle Speed (cold) / Slow Speed (warm)
- Slow Speed
- Slow Speed (50-foot buffer)
- Slow Speed (cold) **
- Slow Speed on Weekends (cold) **
- 25 MPH (50-ft Slow Speed buffer)

**During all other times zone is 25 MPH with a 50-foot Slow Speed shoreline buffer**

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Figure 26: 2004-09 Manatee Aerial Survey Data (Kernel Density; 325 m Radius)
Cold Season (November - March)
Broward County: South Region

Aerial Survey Data
10 Quantiles

- 0.000 (20% of cells countywide)
- 0.001 - 0.052
- 0.053 - 0.140
- 0.141 - 0.253
- 0.254 - 0.388
- 0.389 - 0.545
- 0.546 - 0.760
- 0.761 - 1.110
- 1.111 - 1.820
- 1.821 - 3.700
- 3.701 - 171.198

Miles

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Figure 27: 1988-92 Manatee Aerial Survey Data (Kernel Density; 325 m Radius) Cold Season (November - March) Broward County: South Region
Figure 28: 2004-09 Manatee Aerial Survey Data (Kernel Density; 325 m Radius)
Warm Season (April - October)
Broward County: South Region
Figure 29: 1988-92 Manatee Aerial Survey Data (Kernel Density; 325 m Radius)
Warm Season (April - October)
Broward County: South Region
Figure 30: Manatee Mortality (1974 - December 2009)  
Broward County: South Region  
(Year of occurrence noted for boat-related deaths)
Figure 31: "All Boats" Manatee-Boat Coincidence (2004-09 Manatees; 2004-05 Boats)
Cold Season (November - March)
Broward County: South Region
Figure 32: "Fast Boats" Manatee-Boat Coincidence (2004-09 Manatees; 2004-05 Boats) Cold Season (November - March) Broward County: South Region
Figure 33: "All Boats" Manatee-Boat Coincidence (2004-09 Manatees; 2004-05 Boats)  
Warm Season (April - October)  
Broward County: South Region
Figure 34: "Fast Boats" Manatee-Boat Coincidence (2004-09 Manatees; 2004-05 Boats)
Warm Season (April - October)
Broward County: South Region

This legend uses the quantiles from the Cold Season “All Boats” Coincidence map. Percentages for each category for this cover are noted.
These data represent where seagrass was present based on field measurements. Positions are approximate. Additional areas of seagrass are believed to exist but have not yet been verified.

Figure 35: Seagrass (2006-07)
Broward County: South Region
(Source: Broward County)
Figure 36: Existing FWC Manatee Protection and Boating Safety Zones
Broward County: South Region

FWC Manatee Zones (Current)
- No Entry
- Idle Speed
- Idle Speed (cold) / Slow Speed (warm)
- Slow Speed
- Slow Speed (50-foot buffer)
- Slow Speed (cold) **
- Slow Speed on Weekends (cold) **
- 25 MPH (50-ft Slow Speed buffer)

FWC Boating Safety Zones (Current)
- Idle Speed
- Slow Speed
- Slow Speed (Weekends/Holidays)

** During all other times zone is 25 MPH with a 50-foot Slow Speed shoreline buffer

Not shown: 30 MPH / 15 inch wake in all waters of the ICW and New River Canal except where other zones apply (boating safety)
Figure 37: Areas Identified as Potentially Warranting a Rule Change
Broward County: South Region

**Areas of Potential Change**

**FWC Manatee Zones (Current)**

- No Entry
- Idle Speed
- Idle Speed (cold) / Slow Speed (warm)
- Slow Speed
- Slow Speed (50-foot buffer)
- Slow Speed (cold) **
- Slow Speed on Weekends (cold) **
- 25 MPH (50-ft Slow Speed buffer)

**During all other times zone is 25 MPH with a 50-foot Slow Speed shoreline buffer**

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Figure 38: 2004-09 Manatee Aerial Survey Data (Kernel Density; 325 m Radius)
Cold Season (November - March)
Broward County: Inland Region

Aerial Survey Data
10 Quantiles
0.000 (20% of cells countywide)
0.001 - 0.052
0.053 - 0.140
0.141 - 0.253
0.254 - 0.388
0.389 - 0.545
0.546 - 0.760
0.761 - 1.110
1.111 - 1.820
1.821 - 3.700
3.701 - 171.198

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Figure 39: 1988-92 Manatee Aerial Survey Data (Kernel Density; 325 m Radius)
Cold Season (November - March)
Broward County: Inland Region
Figure 40: 2004-09 Manatee Aerial Survey Data (Kernel Density; 325 m Radius) Warm Season (April - October) Broward County: Inland Region
Figure 41: 1988-92 Manatee Aerial Survey Data (Kernel Density; 325 m Radius)
Warm Season (April - October)
Broward County: Inland Region
Figure 42: Manatee Mortality (1974 - December 2009)
Broward County: Inland Region
(Year of occurrence noted for boat-related deaths)
Figure 43: "All Boats" Manatee-Boat Coincidence (2004-09 Manatees; 2004-05 Boats)
Cold Season (November - March)
Broward County: Inland Region
Figure 44: "Fast Boats" Manatee-Boat Coincidence (2004-09 Manatees; 2004-05 Boats)

Cold Season (November - March)

Broward County: Inland Region
Figure 45: "All Boats" Manatee-Boat Coincidence (2004-09 Manatees; 2004-05 Boats)
Warm Season (April - October)
Broward County: Inland Region
This legend uses the quantiles from the Cold Season "All Boats" Coincidence map. Percentages for each category for this cover are noted.

Figure 46: "Fast Boats" Manatee-Boat Coincidence (2004-09 Manatees; 2004-05 Boats)
Warm Season (April - October)
Broward County: Inland Region
Figure 47: Existing FWC Manatee Protection and Boating Safety Zones
Broward County: Inland Region

FWC Manatee Zones (Current)
- No Entry
- Idle Speed
- Idle Speed (cold) / Slow Speed (warm)
- Slow Speed
- Slow Speed (50-foot buffer)
- Slow Speed (cold) **
- Slow Speed on Weekends (cold) **
- 25 MPH (50-ft Slow Speed buffer)

FWC Boating Safety Zones (Current)
- Idle Speed
- Slow Speed
- Slow Speed (Weekends/Holidays)

** During all other times zone is 25 MPH with a 50-foot Slow Speed shoreline buffer

Not shown: 30 MPH / 15 inch wake in all waters of the ICW and New River Canal except where other zones apply (boating safety)
Figure 48: Areas Identified as Potentially Warranting a Rule Change
Broward County: Inland Region

**During all other times zone is 25 MPH with a 50-foot Slow Speed shoreline buffer**
Appendix A

Supporting Information and Data: Review of Broward County Manatee Protection Rule Review (June 2010)

Documents:

379.2431 (2008): Manatee Sanctuary Act
68C-22.001-002: The “Scope and Purpose” and “Definitions” rules of Chapter 68C-22, FAC
68C-22.010 (text): Current FWC manatee protection rule for Broward County (68C-22.010, FAC)
68C-22.026 (portions): Sections of the FWC manatee protection rule for Sarasota County relating to preamble language
LRRC cover letter (Broward_100629): FWC cover letter to Broward LRRC (6/29/10)
LRRC notice to county (Broward_100315): FWC letter to Broward County (3/15/10)
LRRC Prelim Area Discussion (Broward_2007): Data Discussion and Preliminary Identification of Areas for LRRC Review, prepared by FWC staff for use by the Broward County LRRC (June 2010).

Rulemaking Process (for Broward LRRC): Description of the FWC manatee protection rule development process, including the role of the LRRC in the overall process
Other: Deutsch, C.J. et al. 2003. Seasonal movements, migratory behavior, and site fidelity of West Indian manatees along the Atlantic coast of the United States. Wildlife Monographs. The Wildlife Society. This published paper discusses manatee telemetry data and what it shows about manatee use along the Atlantic coast of Florida.

GIS Data: [Coordinate system for all covers is: Albers, NAD 1983]

Aerial_Survey_2007-09: 2007-09 manatee aerial survey point data collected between November 2007 and December 2009
Aerial_Survey_Syn91-10: 1991-2010 synoptic aerial survey point data for Florida
Man0409_Cold: Raster cover derived from the November – March (“cold season”) 2004-09 aerial survey data using the kernel density command in ArcGIS (Population field = Total; 325 meter search radius) and then dividing each cell value by the number of surveys flown over the cell during the cold season
Man0409_Warm: Raster cover derived from the April – October (“warm season”) 2004-09 aerial survey data using the kernel density command in ArcGIS (Population field = Total; 325 meter search radius) and then dividing each cell value by the number of surveys flown over the cell during the warm season
Man8892_Cold: Raster cover derived from the November – March (“cold season”) 1988-92 manatee aerial survey data using the kernel density command in ArcGIS (Population field = Total; 325 meter search radius) and then dividing each cell value by the number of surveys flown over the cell during the cold season
Man8892_Warm: Raster cover derived from the April – October (“warm season”) 1988-92 aerial survey data using the kernel density command in ArcGIS (Population field = Total; 325 meter search radius) and then dividing each cell value by the number of surveys flown over the cell during the warm season
ATONS_Broward_08: Locations of aids to navigation (i.e., channel markers) in or within close proximity to Broward County as of 2008
Boat_Cold: Raster cover derived from the November – March (“cold season”) 2004-05 aerial survey data using the kernel density command in ArcGIS (325 meter search radius) and then dividing each cell value by the number of surveys flown over the cell during the cold season
BoatFast_Cold: Raster cover derived from the November – March (“cold season”) 2004-05 aerial survey data using only boats with speeds of Plowing, Cruising, or Planing. The kernel density command in ArcGIS was used (325 meter search radius) and each cell value was divided by the number of surveys flown over the cell during the cold season.
Boat_Warm: Raster cover derived from the April – October (“warm season”) 2004-05 aerial survey data using the kernel density command in ArcGIS (325 meter search radius) and then dividing each cell value by the number of surveys flown over the cell during the warm season
BoatFast_Warm: Raster cover derived from the April – October (“warm season”) 2004-05 aerial survey data using only boats with speeds of Plowing, Cruising, or Planing. The kernel density command in ArcGIS was used (325 meter search radius) and each cell value was divided by the number of surveys flown over the cell during the warm season.
Broward_Rule_BS: Existing FWC boating safety zones in Broward County
Broward_Rule_Man: Polygon shapefile of the existing FWC manatee protection zones in Broward County. Data are preliminary but are not known to contain any errors.
Broward_Rule_Prelim1006: Preliminary areas identified where a change to the Broward County rule may be warranted
Coin_Cold: Raster cover of November – March (“cold season”) manatee-boat spatial coincidence created by multiplying the 2004-09 cold season manatee raster by the 2004-05 cold season boat raster
**CoinFast_Cold**: Raster cover of November – March (“cold season”) manatee-“fast” boat spatial coincidence created by multiplying the 2004-09 cold season manatee raster by the 2004-05 cold season “fast” boat raster

**Coin_Warm**: Raster cover of April – October (“warm season”) manatee-boat spatial coincidence created by multiplying the 2004-09 warm season manatee raster by the 2004-05 warm season boat raster

**CoinFast_Warm**: Raster cover of April – October (“warm season”) manatee-“fast” boat spatial coincidence created by multiplying the 2004-09 warm season manatee raster by the 2004-05 warm season “fast” boat raster

**County_Boundaries**: County boundaries in line format

**Deaths0912**: Manatee mortality point data through December 2009

**Roads_Major**: Major roads in Broward County

**Seagrass_Broward_2006-07**: 2006-07 seagrass data collected by Broward County staff. The data represent where seagrass was present based on field measurements.

**Shoreline_2004**: Shoreline data in line format

**Summary_Areas_Broward2010**: Zones used for analyzing and summarizing data within Broward County

**Telemetry_Broward_87-98**: Telemetry tracking data collected from manatees fitted with PTT tags (Location Class 2 or 3). Only locations in or within close proximity to Broward County are included. Data are available for manatees that were tagged for varying amounts of time between 1987 and 1998. Location Class 3 are the most accurate satellite locations. Additional information about the telemetry data can be found in: Deutsch, C.J. et al. 2003. Seasonal movements, migratory behavior, and site fidelity of West Indian manatees along the Atlantic coast of the United States. Wildlife Monographs. The Wildlife Society.

**WaterMask**: Rasterized data of the water area in Broward County using 25m x 25 m cells. Layer based upon a statewide shoreline accurate to a scale of 1:12,000 and compared to aerial photography.

If more information is needed about any of the above data or documents, please contact Scott Calleson of the Florida Fish and Wildlife Conservation Commission at 850-922-4330.