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Unexpected Opportunities for Manatee (*Trichechus manatus latirostris*) Education and Citizen Science

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The Florida manatee (*Trichechus manatus latirostris*) mainly resides within the state's coastal waters, but sharing this habitat with thousands of watercrafts, either registered, unregistered, or visiting, has proven challenging for its survival (Bassett et al., 2020). The primary source of mortality for the Florida manatee is collisions with boats (Runge et al., 2007). The boating industry is extensive within Florida, and the state hosts multiple international boat shows annually, including the Miami International Boat Show (MIBS). MIBS attracts over 700 vendors from more than 60 different countries as well as over 100,000 attendees. An important component of the MIBS is vessel sea trials where vendors take potential buyers on test rides. During MIBS 2022, the location for these sea trials was within a State Manatee Protection Zone with regulations stating, "slow speed all year" (Florida Fish and Wildlife Conservation Commission [FWC], 1991).

Stakeholders during boat show sea trials include local and state agencies and government officials tasked with manatee and participant protection, vendors whose aim is to sell their product, a mix of vessel captains and crews who may or may not know manatee safety laws, and show attendees interested in the charismatic manatees. All these interests led to the same question: How do we best protect the manatees? At the 2022 MIBS, one answer came in the form of a manatee observation team. This group of observers also provided a venue to educate members of the general public, some who had never seen a manatee.

Manatees are found within the estuaries, springs, rivers, and coastal waters of Florida (Lefebvre et al., 2001; Deutsch et al., 2003) where they feed on aquatic plants, predominantly seagrasses (Alves-Stanley et al., 2010). Manatee movements within the water column are typically slow and driven by resting, traveling, foraging, thermoregulation, mating, and calving. Within the water column, that depth is normally very shallow (< 1.25 m) (Edwards et al., 2016), increasing the likelihood of manatee–boat interactions (Bassett et al., 2020). Slow travel rates for manatees often occur in shallow areas, while faster travel speeds normally occur in deeper water (Edwards et al., 2016).

From 1974 through 2016, 21% of manatee deaths reported in Florida were watercraft related. Collisions occur so often that one in four adult manatees have been hit by a watercraft at least 10 times in their life, and approximately 96% of all adult manatees have been hit at least once by a watercraft (Bassett et al., 2020). An important effort put forth to protect manatees from watercraft collisions is regulation zones regarding the operation and speed of motorized watercrafts within specific areas (Calleson & Frohlich, 2007; Calleson, 2014; Rycyk et al., 2018; Udell et al., 2019).

Sea Isle Marina, the originating site for the 2022 MIBS sea trials, is located along the western edge of the Intracoastal Waterway as it transects Miami and Miami Beach, Florida. It is located within a State Marine Protection Zone, largely due to the immediate proximity of seagrass beds surrounding the marina. A recent flora survey found seagrass beds extending north and east of Sea Isle Marina containing two types of seagrasses: (1) paddle grass (*Halophila decipiens*), the dominant species, and (2) manatee grass (*Syringodium filiforme*) (The Chappelle Group, 2022).

Informa, the parent company of U.S. Boat Shows, including MIBS, worked with the authors to create an action plan for manatee monitoring during the 5-day show in February 2022 when vessel sea trials occurred. This placed an emphasis on manatee safety during the show. The plan included a team of observers, comprised of 15 to 25 people per day, who were tasked with spotting manatee(s) in the marina's vicinity, inside and out. Manatee observers consisted of undergraduate and graduate students and alumni from Nova Southeastern University's Department of Marine and Environmental Sciences.

The manatee observation team, wearing graphically identifiable manatee observer t-shirts, monitored for manatees from three different locations during show hours: (1) Sea Isle Marina, (2) commercial water taxis, and (3) sea trial vessels. Observers within Sea Isle Marina continuously patrolled the seawall and piers during show hours. For the commercial water taxis, there were five that traveled a set route consisting of four stops in the vicinity of the boat show, with Sea Isle Marina as one of the stops. Each water taxi had an observer positioned on the bow near the captain to watch for manatees within the Intracoastal Waterway (Figure 1). All sea trial vessels also had a required manatee observer while underway. All observations, whether a manatee was present or not, were recorded every hour on a data log at all three monitoring platforms. Data consisted of time, general location, animal description (length, markings), and movement/direction.

Because initially no photo-identification techniques were employed to distinguish individual manatees, an absolute number of animals could not be ascertained. Over the course of the show, a minimum of 18 individual manatees and a maximum of 23 manatees were spotted. Observations were made daily from 0900 to 1800 h, with most manatees spotted from 0900 to 1100 h closest to shore, followed by sightings farther from the coastal margin from 1200 to 1600 h. These times corresponded to slack high tide and the ebbing tide (www.tides.net). Two-thirds (n = 11 to 16) of the manatees were spotted from the docks in Sea Isle Marina. One manatee was spotted during a single sea trial out of more than 300 trials in the Intracoastal Waterway, and six manatees were spotted from the water taxis in the Intracoastal Waterway. Manatees were spotted most often on the north and northeast side of the marina closest to the seagrass bed (Figure 2). These data concur with other studies where manatees were more likely observed near seagrass as it is their main food source (Axis-Arroyo et al., 1998; Jiménez, 2005; Olivera-Gómez & Mellink, 2005; Bauduin et al., 2013). Sightings and manatee movement diminished with distance from the seagrass beds.

While many members of the public expressed excitement at seeing manatees and gratefulness for the extra protection the MIBS employed by using dedicated manatee observers, not all people were happy with the extra manatee protection added for the show. Some vendors were annoyed with the need to wait for a manatee to leave the area before they could begin their sea trial. There were also times when a vessel returning from a sea trial had to remain outside the marina as a manatee was either near their boat slip or at the entrance of the marina.

Manatee observations, including time, location, and movement, were also recorded on a whiteboard positioned at the observer tent within the marina (Figure 3). Boat show attendees and workers who

Figure 1. A manatee observer departing on a vessel for a sea trial (*Photo credit:* Sierra Potts)

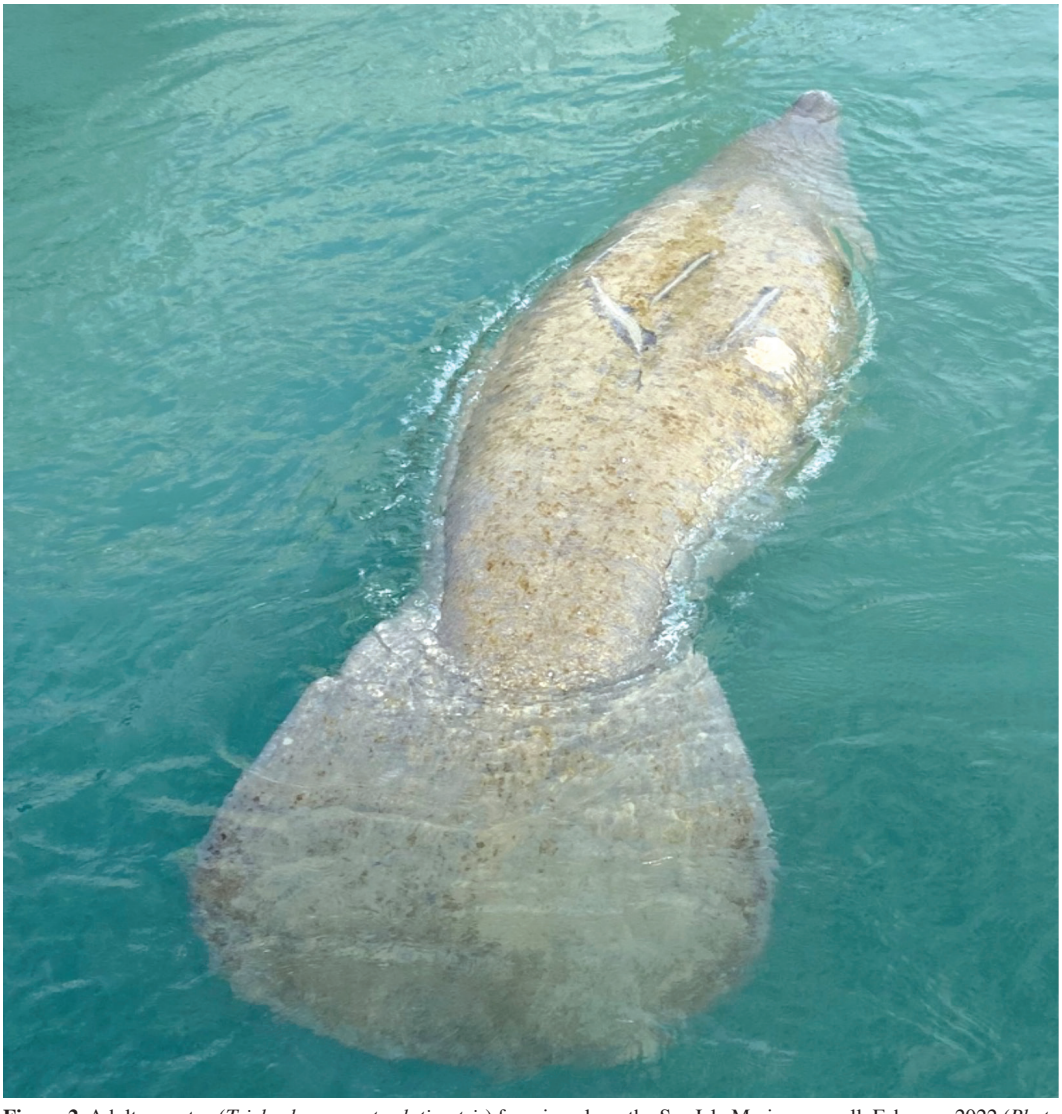

Figure 2. Adult manatee (*Trichechus manatus latirostris*) foraging along the Sea Isle Marina seawall, February 2022 (*Photo credit:* Sierra Potts)

passed by the tent located along the main marina thoroughfare could follow the manatee sightings and ask questions about the animals. This visual information prompted public interest and served as an educational venue. The manatee observation tent also displayed manatee fact placards and the manatee data log used by the observers.

Observers stationed at the tent and throughout the marina were educated in manatee facts prior to the boat show; they were regularly approached by the public throughout the show for information related to manatees. These interactions included informing the public about what manatees are, why they are threatened, and the role manatee observers were conducting at the show. These people were then welcomed to volunteer as an informal manatee observer during the show. The only requirements were that they wear the provided manatee observer t-shirt and when they spotted a manatee, they needed to report the sighting to an observer on the marina piers or at the observer tent. This opportunity prompted many patrons who were curious about manatees to become engaged as either they had never before seen a manatee or they enjoyed seeing the manatees that frequented areas where they live.

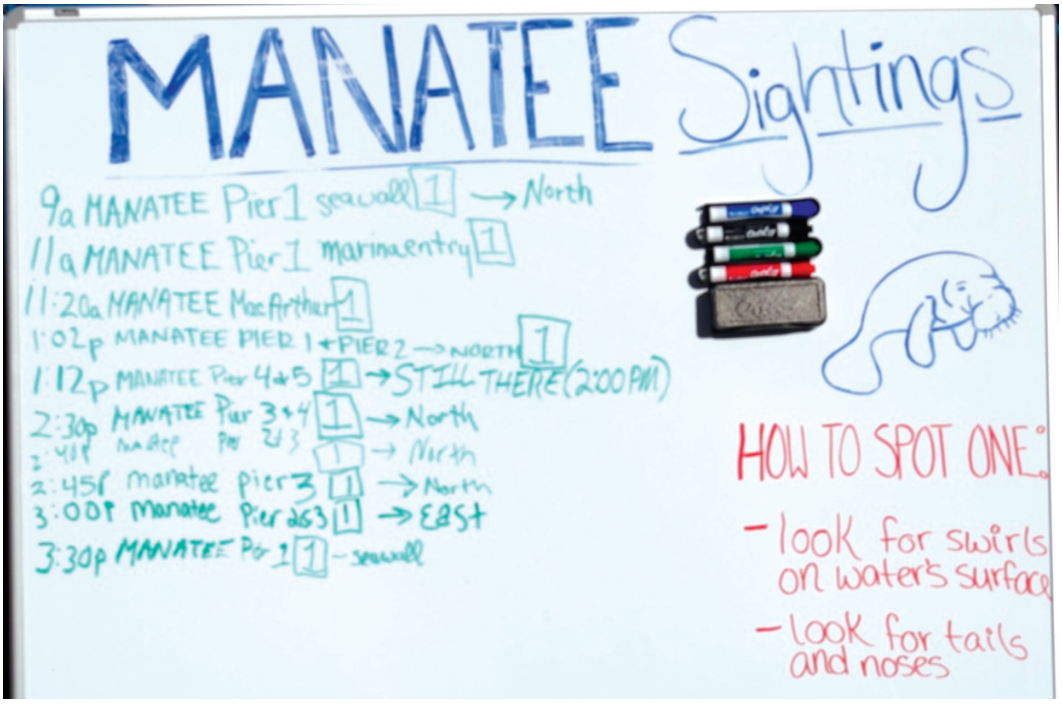

Figure 3. Manatee observation whiteboard used during MIBS 2022 for boat show attendee information (*Photo credit:* Sierra Potts)

With the prospect that manatee observers will be utilized in subsequent boat shows and sensing an avenue to promote public engagement in manatee conservation, the development of a citizen science platform as well as a data gathering venue are being explored. Persons dedicated to providing manatee information to the attendees, including educational talks, will be incorporated throughout the sea trial site and boat show venue. They will be available to answer questions and, when a manatee is present anywhere at the site, inform the public present about manatee conservation. The use of a manatee data log will be demonstrated as well as how data are collected during an observation.

An interactive app with multiple tabs can be created for manatee observations. One tab on the app would be available strictly for manatee observers to digitally report data on manatees observed within the boat show venue. A second tab would be used as the platform for citizen science. Show attendees would be able to report and post pictures of manatees that they have spotted; the site would prompt specific information in easy-to-follow language. This tab would be monitored by observer team members to filter posted material. The date/time stamp of the post and associated photos would be cross-referenced with manatee observer data to more closely monitor manatee movement and allow for easier identification of individual animals. A third tab would provide factual information about manatees to help dispel inaccuracies the public may possess.

The use of multiple drones would be beneficial for furthering manatee data collection during the boat show. During MIBS 2022, a team of three drones was used to assist with manatee observations, but the drones were not used to collect detailed data at this show. Unmanned aerial vehicles, such as drones, are a low-cost and non-invasive way to track an animal in a shallow area as well as to assess a manatee's body condition (Ramos et al., 2022). Drones would be better able to track and monitor manatee movement than humans can at sea level. Aerial data could also be used to confirm if multiple manatee sightings per day are distinct individuals or repeated sightings of one or more manatees. The drone footage will also be a way to confirm any sightings reported by a manatee observer or a citizen scientist.

The future of manatee research among scientists and citizen scientists has strong potential. By taking advantage of venues of opportunity such as boat shows, not only is local population data gathered, but a stronger positive relationship with the public is forged. When people feel they have a stake in the conservation of a species or habitat, they will likely become and remain engaged.

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