



2021 Whale Research Report

Documenting distribution of marine life near Jeffreys Ledge in the Gulf of Maine

Submitted by:

Blue Ocean Society for Marine Conservation

400 Little Harbor Road, #1103

Portsmouth, NH 03801

Prepared by:

Dianna Schulte and Nicole Abate

May 2022

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Abstract

Jeffreys Ledge is a rocky feature in the western Gulf of Maine approximately 32 km off the coasts of Maine, New Hampshire and Massachusetts. It is a productive and important habitat for a variety of marine life, including federally protected marine mammals under the Marine Mammal Protection Act and Endangered Species Act. Although several whale-watching boats visit Jeffreys Ledge during the feeding season for whales, Blue Ocean Society for Marine Conservation is the only organization to collect detailed data on several factors to study the area and has been doing so since 1996. This report documents and summarizes the data collected during the 2021 season including whale distribution and habitat usage, combined with perceived threats and behaviors. A total of 152 trips were taken to the Jeffreys Ledge area from 05 June 2021 until 11 October 2021. One of these trips was a full-day scouting trip, 2 were full-day bird watching trips while the rest were half-day public whale watching trips. Two trips were conducted daily on 60 days, while single trips (including the one scouting and two bird trips) were conducted on the remainder of the days (32). The area observed included water from the coastline east as far as -070.03150W, between the latitudes of 43.09286N and 42.67662N. A minimum of 4602 animals were observed. Twelve species were documented, including 3 species of baleen whales, 2 species of toothed whales, 1 species of shark, 2 species of large fish, 2 species of pinnipeds, 1 species of sea turtle and 1 species of large jelly. Seventy-four individual humpback whales (*Megaptera novaeangliae*) were identified. Six of these were calves. Sightings of note include a second year with a spike in ocean sunfish (*Mola mola*) sightings as well as a continued decline in fin whale (*Balaenoptera physalus*) sightings. One humpback whale calf was documented with a new injury apparently caused by entanglement in heavy line, one humpback calf was documented with propeller wounds and other injuries of unknown origin, three humpback whales were observed entangled in monofilament line, two humpbacks exhibited injuries from unknown causes. A total of 428 pelagic marine debris items were documented with 28 of these items seen near whales. Of the debris items that were identifiable, balloons (n=108), plastic wrappers (n=52) and plastic bags (n=43) were the top three items recorded.

Introduction

Jeffreys Ledge is a productive marine habitat due to the upwelling currents that surround the ledge. This productivity makes it an important habitat for a variety of marine life, including federally protected marine mammals under the Marine Mammal Protection Act and Endangered Species Act. Animals are attracted to the area due to the abundant fish and plankton resources. Large whales are facing human-related threats including collisions with ships of all sizes and entanglements in fishing gear. By monitoring the whale population annually, injuries can be documented and brought to the attention of management agencies including the National Oceanic and Atmospheric Administration (NOAA).

Commercial whale-watching vessels regularly transit the area from May through October, the known feeding season for migratory whales. Data collected from these platforms of opportunity assist in understanding the habitat, populations, and threats.

Methods

Study Area

Jeffreys Ledge (Figure 1) is a rocky feature in the western Gulf of Maine approximately 32 km off the coasts of Maine, New Hampshire, and Massachusetts. The southern end of Jeffreys Ledge is included in Stellwagen Bank National Marine Sanctuary (SBNMS) boundaries. The ledge is approximately 54 km long by 9 km wide. The water depth above the ledge is 45-60 m while the depth surrounding it is 90-150 m. Upwelling currents stir nutrients from the seafloor making for a more productive environment. Jeffreys Ledge is not regularly surveyed by other organizations. Whale-watching boats from Kennebunk, Maine; Rye, Hampton, and Seabrook, New Hampshire; and Newburyport and Gloucester, Massachusetts regularly visit this area, but not all vessels collect detailed data on marine life sightings and behaviors.

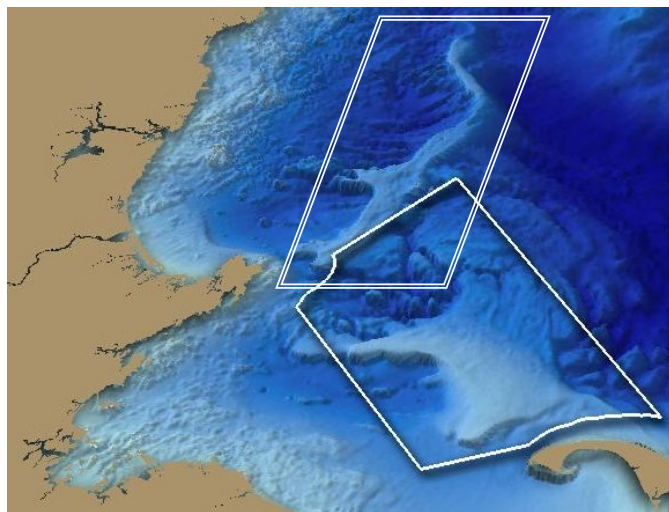


Figure 1. Jeffreys Ledge outlined in a double line. Stellwagen Bank National Marine Sanctuary outlined in a solid line. Image credit www.stellwagen.noaa.gov

Opportunistic Surveys

One commercial whale-watching vessel based in Rye Harbor, NH, was used for opportunistic surveys in 2021. The average cruising speed of this 21m vessel, *Granite State*, was 14 knots. Whale watch trips were generally 4-5 hours long and were usually conducted once daily in June and Sept-October, and twice daily in July-August, weather permitting. When running two trips per day, the vessel would return to port in between trips.

Standard half-day trip lengths ranged from 37.14km to 115.03km, with the average trip length being 73.86km. Trips were generally conducted in conditions of Beaufort 0-4. Visibility ranged from 0-32km. Trip routes and destinations were usually dependent on recent sightings as well as on information from other vessels. For example, if sightings were good in one area for the past few days, the vessel would likely return to that area. If sightings in that area began to drop, the vessel would choose a different area, often based on reports from fishing boats or other recreational boats. Since the vessel was working as a commercial whale-watching vessel and not as a dedicated research boat, standardized track line surveys were not possible.

The whale watch vessel crew consisted of a captain, a naturalist, two mates, and two to three interns with at least two people on watch at all times. Interns collected data after receiving extensive hands-on training in the classroom and the field and also acted as informal educators.

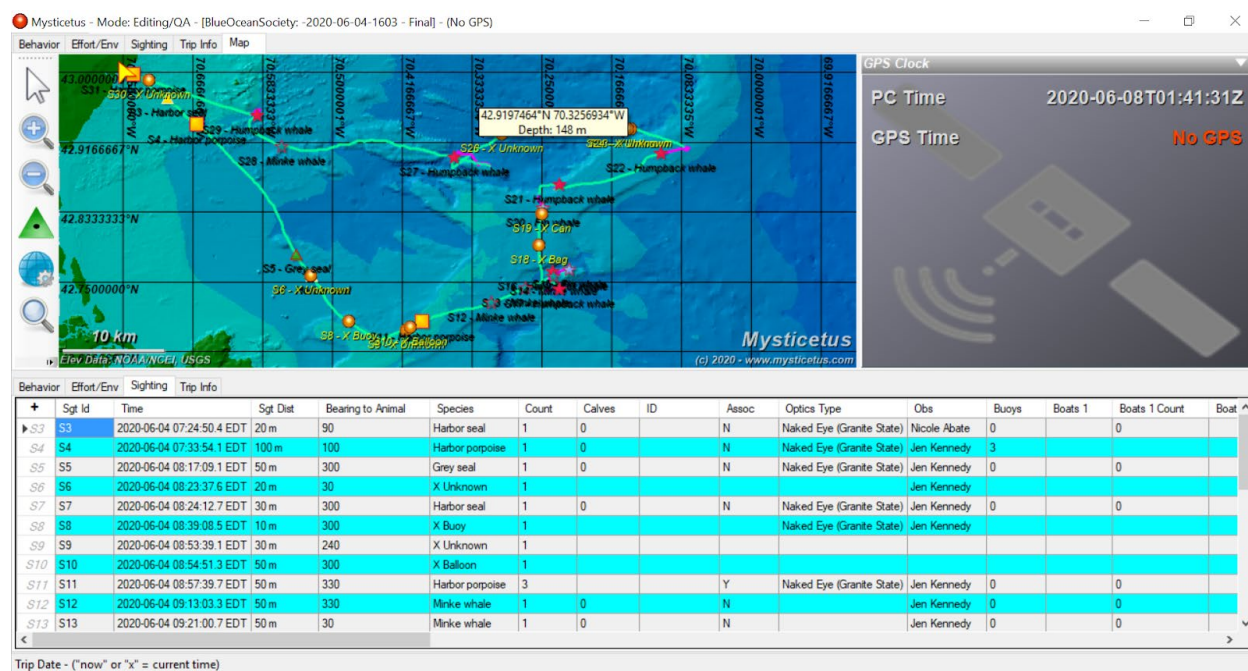


Figure 2. Screenshot of Mysticetus interface

Data collectors also recorded potential threats (vessels, fishing gear, and marine debris) to marine life with each sighting. Ship strikes and entanglements in fishing gear are two of the leading causes of injury and mortality for large whale species (Henry et al., 2012). The number of boats of each type (whale watching, fishing, recreational) seen within 1 km of a sighting was recorded. By documenting the vessels of each kind near a sighting, the potential for collision can be determined. If a newly injured whale was

observed, it was reported to Northeast Fisheries Science Center and National Oceanic and Atmospheric Administration (NOAA). If the strike itself was observed, the United States Coast Guard (USCG) and NOAA were contacted immediately while also obtaining vessel registration numbers and images.

By documenting the amount of fixed and active fishing gear near a sighting, the potential for entanglement can be determined. Each fishing buoy marks a vertical line in the water column that is attached to a set of fixed fishing gear (gear that is left unattended for one or more days). The type of gear is not always apparent based on the surface buoy system. However, the most prevalent fixed gear types in the region are lobster trawls and gill nets. Large whales are known to get tangled in the vertical buoy line from both types of gear, while smaller marine mammals (dolphins, porpoises, seals) are known to get tangled in gill net panels (Reeves et al., 2013). If an entangled whale is observed, USCG, NOAA, and or Center for Coastal Studies (CCS) are contacted immediately to launch a disentangling rescue. If the entanglement is not evident in the field and later noticed in image post-processing, it will be submitted to NOAA and CCS.

By using digital images, injuries over time can be documented and monitored to determine the survival rates of the afflicted individuals. These images are also used to determine the trend of injuries in the populations (increasing or decreasing) as well as the severity of each event.

Marine debris items (plastics, in particular) have been found in at least 9 deceased baleen whale species (Baulch & Perry, 2014). By documenting the amount of pelagic marine debris near whales, the potential for ingestion can be determined.

Photographic Identification

Digital images of marine life were collected by the naturalist using digital SLR cameras outfitted with 70-300mm lenses to identify the species and the individual whale. Images were often examined in the field but were also downloaded daily for a more thorough analysis. Detailed photo analysis continued into the fall and winter months. Humpback whales were identified by the unique pigmentation markings on their flukes (Katona & Whitehead, 1981). Fin whales and minke whales were identified by the unique pigmentation markings on their backs (chevron and blaze) as well as their dorsal fin shape (Aglar et al., 1992). Right whales were identified by the unique patches of rough skin (callosities) on their heads (Kraus et al., 1986).

Results

Surveys

One hundred and fifty-two watching trips (surveys) were conducted over 92 days during the 2021 season (05 June 2021 to 11 October 2021). Three trips were full-day trips lasting 8-10 hours (one scouting trip and two bird watching trips). One trip ended early due to rough seas. Days with no trips were primarily due to unacceptable weather conditions or lack of passengers to make the trip financially feasible. Survey range extended from the coastline eastward to -070.03150 W, northward to 43.09286 N, and southward to 42.67662 N.

Sightings

A minimum of 4602 animals were observed during the 2021 season. Some individuals were observed multiple times throughout the study period. Twelve species were documented including 3 species of baleen whales, 2 species of toothed whales, 1 species of shark, 2 species of large fish (non-shark), 2 species of pinnipeds, 1 species of sea turtle and 1 species of large jelly.

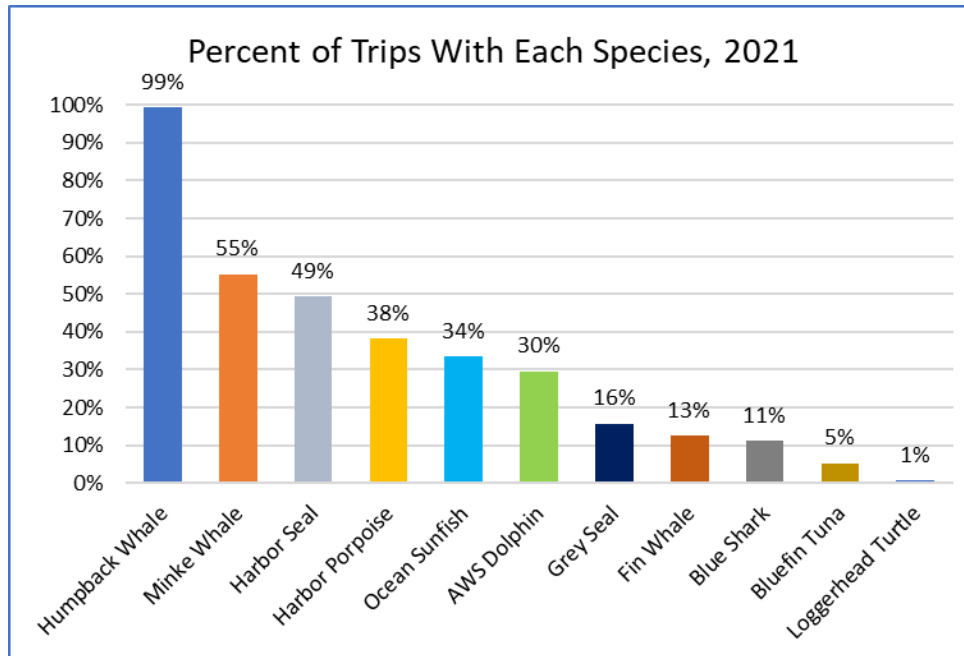


Figure 3. Percentage of trips with each species.

Sightings of Note

- Humpback whales were seen on nearly 100% of trips. The only trip that did not see a humpback whale was incomplete due to rough seas.
- Fin whales were sighted on 13% of trips (see figure 4 for annual comparisons)
- Ocean sunfish were sighted on 34% of trips (see figure 5 for annual comparisons)

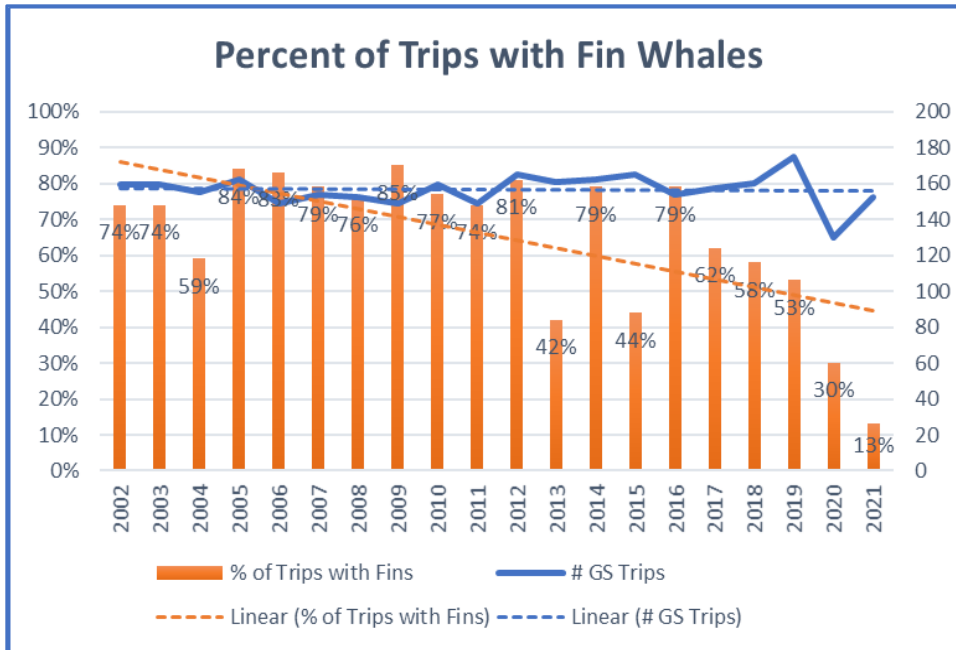


Figure 4. Percentage of trips that saw fin whales, 2002-2021.

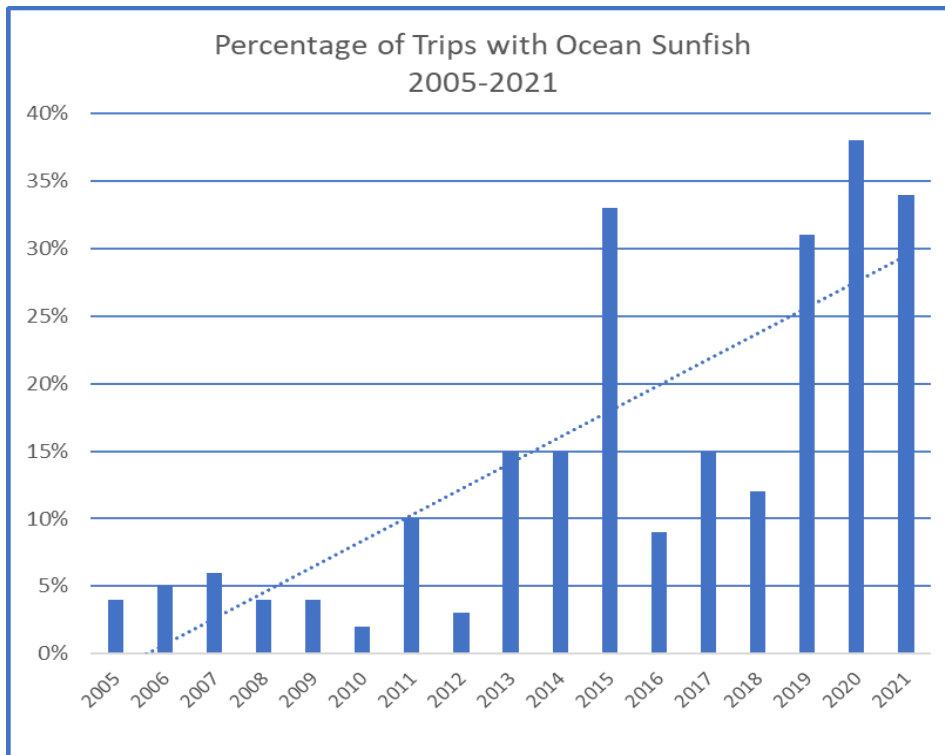


Figure 5. Percentage of trips that saw ocean sunfish, 2005-2021.

Locations and details of sightings

The following maps depict the locations for the four most historically encountered species of *Cetacea*. A sighting is defined as the location where one or more whales of a certain species were seen. Group size refers to the temporary association of individual mysticetes (baleen whales). Pod size refers to the semi-permanent association of odontocetes (toothed whales). Sightings may represent multiple sightings of the same individual whales over the season.

Humpback whales:

A total of 942 humpback whales were seen accounting for 74 individuals. Mother/calf pairs were seen 14 times (accounting for 6 separate pairs). Associations with Atlantic white-sided dolphins occurred 10 times.

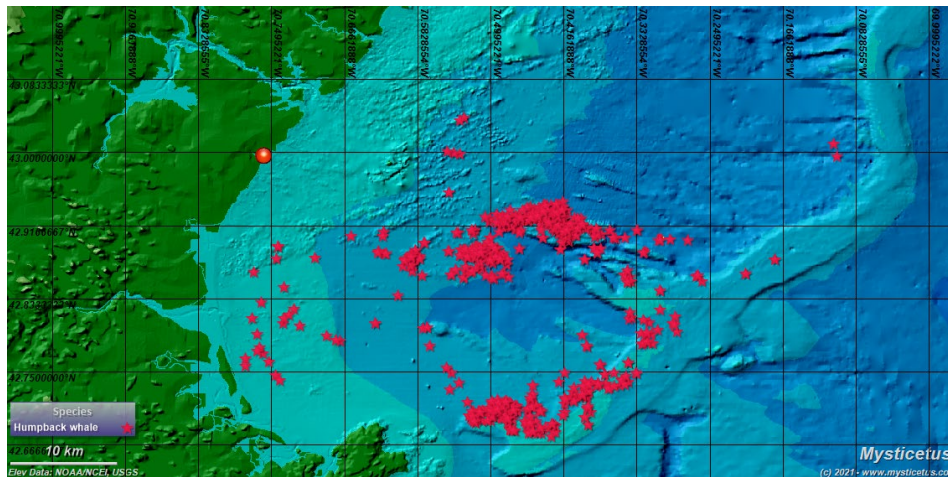


Figure 6. Humpback whale sightings near Jeffreys Ledge, 2021. The red globe icon is Rye Harbor.

Fin whales:

Fin whales were seen at 26 locations with a total of 29 fin whales seen. Associations of fin whales occurred during two sightings of mothers and calf pairs and one sighting of two adult whales. Associations with Atlantic white-sided dolphins were observed once (with #9709).

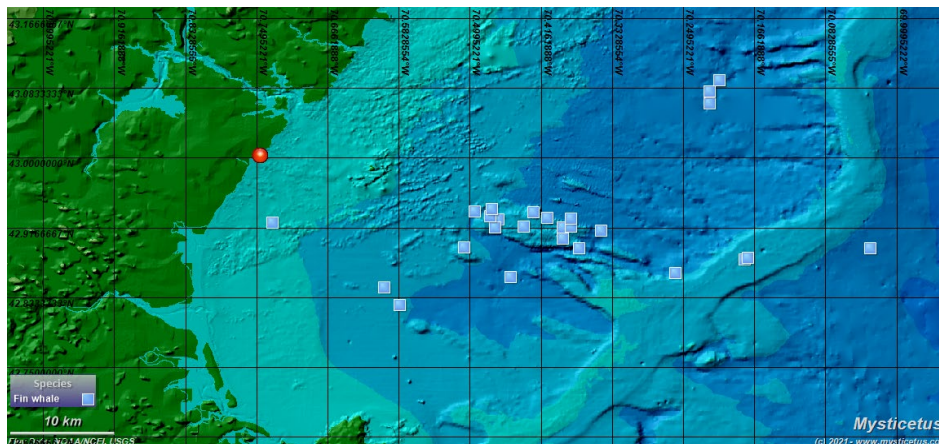


Figure 7. Fin whale sightings near Jeffreys Ledge, 2021. The red globe icon is Rye Harbor.

Minke whales:

Minke whales were seen at 172 locations with a total of 178 minke whales seen. Three associations of minke whales were observed. Minke whales were not observed to be associated with Atlantic white-sided dolphins.

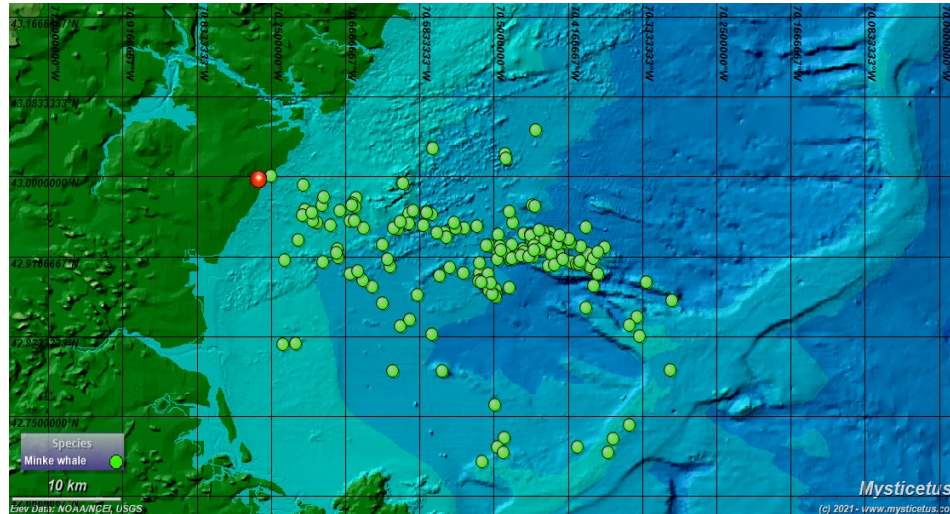


Figure 8. Minke whale sightings near Jeffreys Ledge, 2021. The red globe icon is Rye Harbor.

Atlantic white-sided dolphins:

Atlantic white-sided dolphins were seen at 58 locations with a total of 2663 Atlantic white-sided dolphins seen. Pod size ranged from 1-200 individuals with the average pod size being 46 individuals. Associations with other species occurred 11 times (10 with humpback whales and once with a fin whale).

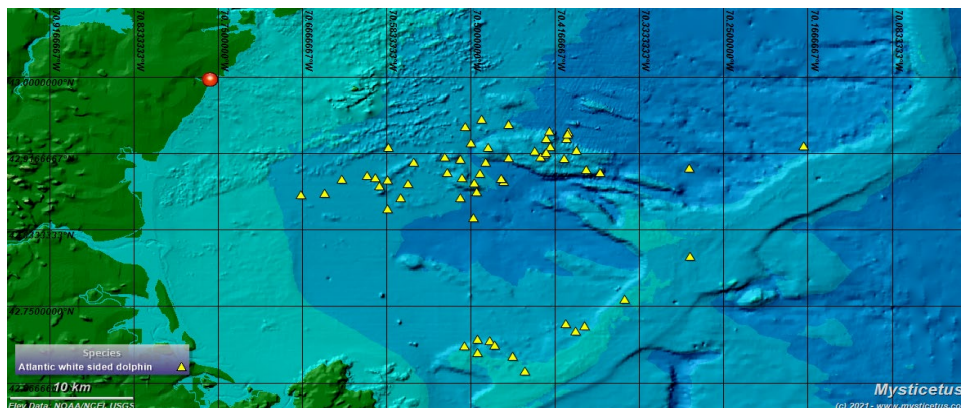


Figure 9. Atlantic white-sided dolphin sightings near Jeffreys Ledge, 2021. The red globe icon is Rye Harbor.

All Species:

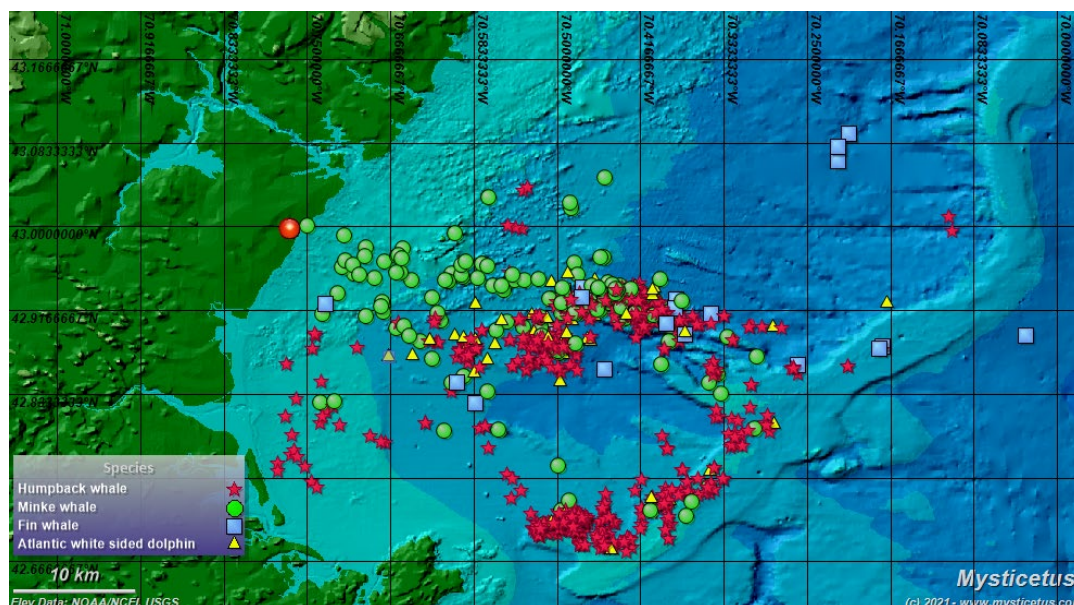


Figure 10. All sightings of commonly sighted species, 2021. The red globe icon is Rye Harbor.

Identification of individual whales

Humpback whales are individually identified by unique natural pigmentation markings on their flukes. Additionally, humpback whales that feed in the Gulf of Maine (GOM) are assigned names by GOM whale researchers and whale watch naturalists. The names generally refer to a specific marking or overall pattern on the flukes. Sixty-eight individual humpback whales, plus six calves, were observed in 2021 (Table 1). The majority of these individuals were adults (seven or more years old). Five juveniles were observed, and one individual was of unknown age (see figure 10). More female humpback whales were seen than males, 50% versus 44% respectively, and 6% of unknown gender, not including the six calves (Figure 11).

Table 1: Identifications of humpback whales seen in 2021.

Angus 2016 calf	Clamp 2016 calf	Ebony	Halfmoon	Owl	Quote	Sword
Aye Aye	Clipper	Fan	Hatchmark	Palindrome	Ravine	Tongs
Badge	Crisp	Fan 2021 calf	Jabiru	Partition	Repeat	Tornado
Basmati	Decimal	Frost	Jabiru 2021 calf	Patches	Satula	Trickle
Bayou	Diablo	Galapagos	Jawa	Pina	Scylla	Tripod
Bayou 2021 calf	Ditto	GOM 1557	Lollipop	Pinball	Sedge	Valley
Benthic	Dome	GOM 17107	Mogul	Pipette	Shuffleboard	Valley 2020 calf
Brine	Dome 2021 calf	GOM 17135	Nile	Pitcher	Spoon	Wigwam
Calanus	Doric	Gondolier	Nine	Pixar	Squiggle	
Chromosome	Downsweep	Grommet	Nine 2021 calf	Pox	Squiggle 2021 calf	
Clamp	Draco	Gunslinger	Nuke	Quill	Striation	

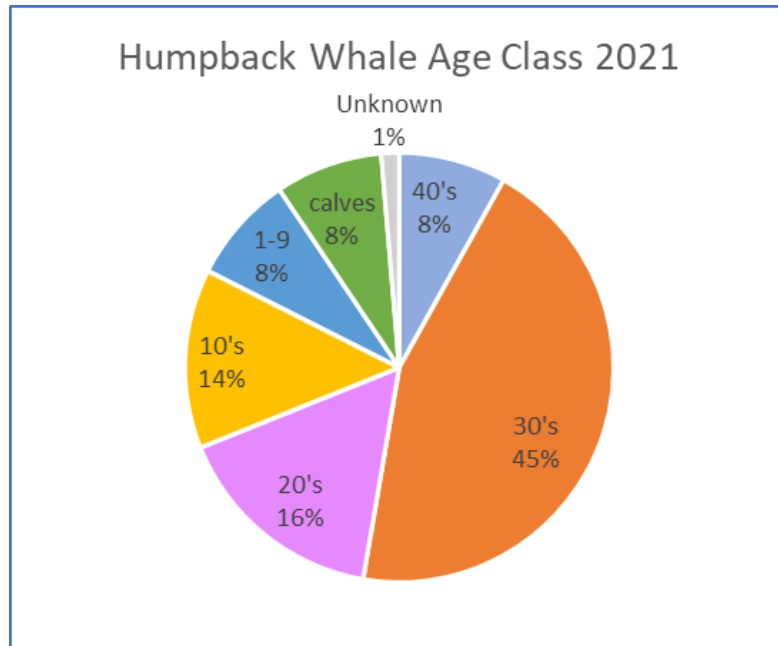


Figure 11. Age of humpback whales seen in 2021. (Data provided by Center for Coastal Studies)

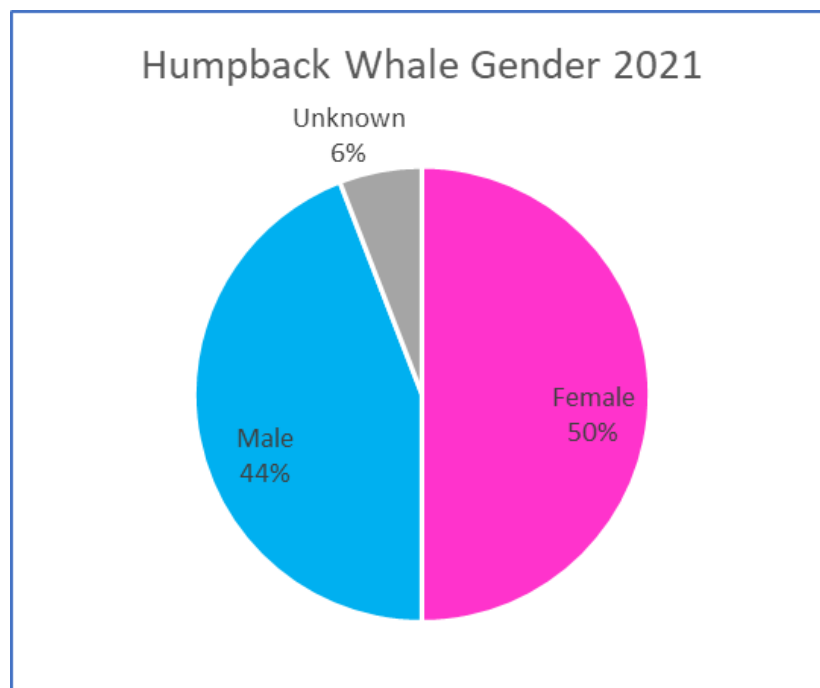


Figure 12. Gender of humpback whales seen in 2021. (Data provided by Center for Coastal Studies)

Four previously identified individual fin whales were observed in 2021 (Table 2). Two of these individuals are female (documented having at least one calf in the past), and one is a known male (based on genetic data provided by Allied Whale). Individual identification is still in progress and will be summarized in a later report.

Table 2: Identification numbers of fin whales seen in 2021.

Blunt
Crow
9709
0818 and calf

Documented Threats

Ship Strikes

Humpback whales Nine and her 2021 calf were spotted on July 11, 2021. The calf showed signs of a ship strike, with injuries to the right side of the body by the pectoral flipper insertion and the right flipper itself near the insertion, in addition to poor body condition (thin, improper swimming, poor blowhole function). The calf had been observed by other whale watching companies throughout the season and spent most of its time close to boats.



Figure 13. Wound at the base of the flipper of Nine's 2021 calf



Figure 14. Propeller scars on Nine's 2021 calf

Entanglements

Clamp and Sword were briefly entangled in monofilament line. Clamp was first spotted with line on June 28th, and free of this line by the next time she was sighted on July 6th (Fig 15). Sword's monofilament included a hook, which was embedded in the dorsal fin and ran along his left side and over his flukes. He was first spotted with this entanglement on September 25th, and free the next time he was sighted on October 11th (Fig 16).



Figure 15. Clamp with monofilament line on June 28th (top), and without on July 6th (bottom)

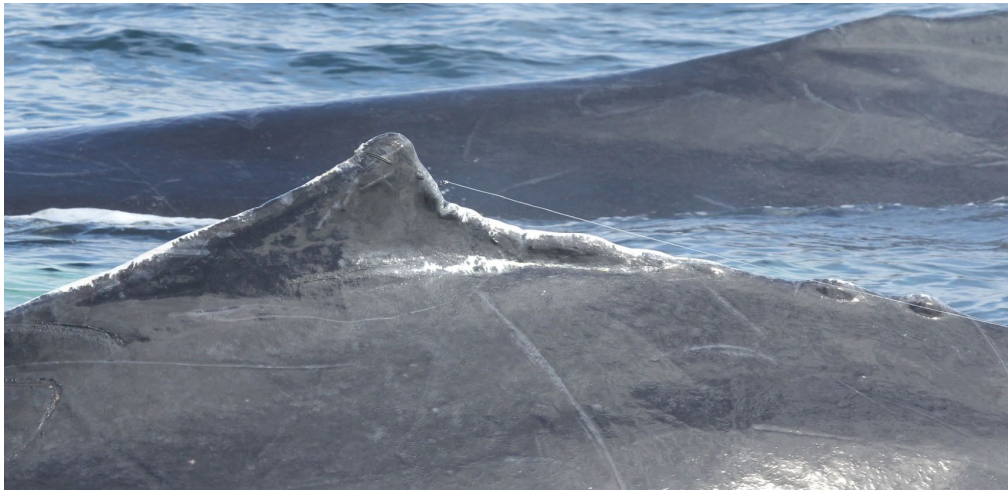


Figure 16. Sword with a hook and monofilament line on September 25, 2021 (top). He was seen again on October 11, 2021, with no evidence of the hook/line still attached (bottom).

Another humpback whale, Mogul, was also seen with monofilament line, however this sighting was reported by another whale watching boat in the area and was never witnessed by our team.

Humpback whales Jabiru and her 2021 calf were seen on July 4, 2021. The calf had a deep entanglement around the front portion of the body which had been documented prior from other organizations. Several additional scars were also present, including those from disentanglement attempts. It was unclear whether the rope was still embedded at the time of our sightings (Fig 17). The calf was last seen with Jabiru on September 5, 2021. Jabiru was spotted on four more occasions without the calf.

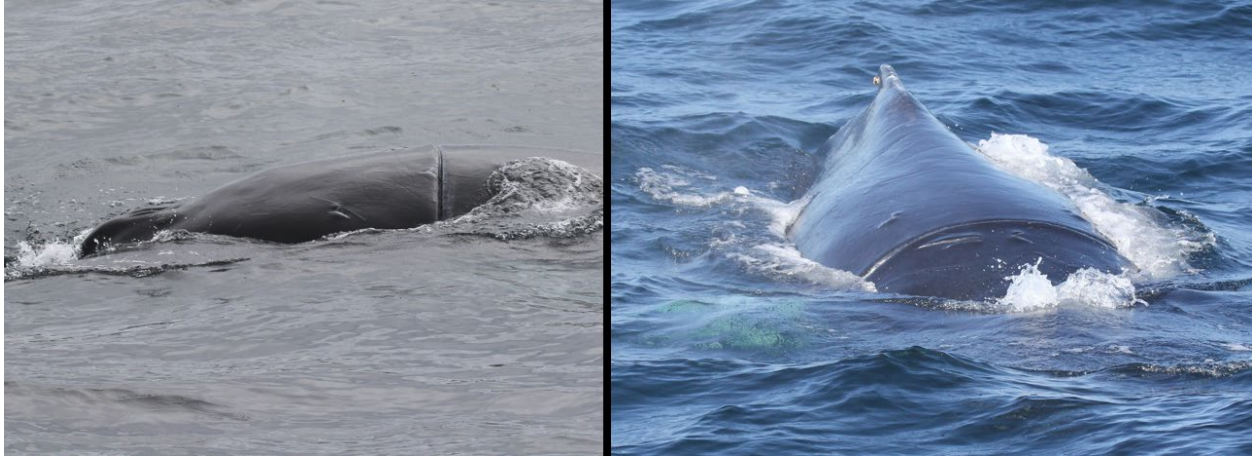


Figure 17. Jabiru's 2021 calf on July 4th (Left) and September 4th (Right). The calf appears to be wrapped completely, and it is unclear if the rope is still present. The small X-Shaped marks are from the disentangling attempt.

Other Injuries

Humpback whale Chromosome was first spotted on June 29, 2021 with a piece of his fluke missing. There were no signs of this injury in 2020. (Fig 18)



Figure 18. Chromosome's fluke in 2020 (Top) and 2021 (Bottom), with a new injury.

Humpback whale Patches also lost a piece of his fluke, the progression of which was observed throughout the season. He was first seen on August 13, 2021 with a slight separation of this section, and by his last sighting on October 10, 2021 the section was apparently necrotic. (Fig 19)



Figure 19. Patches with the start of a wound on August 13th (Top), and the piece ready to fall off on October 10th.

Humpback whale Satula also had a wound that progressed over the season. The skin appeared to be raised slightly in June, with some skin sloughing. By the end of July, the wound had opened to reveal a bright open area (Fig 20). It is not clear what caused this injury.

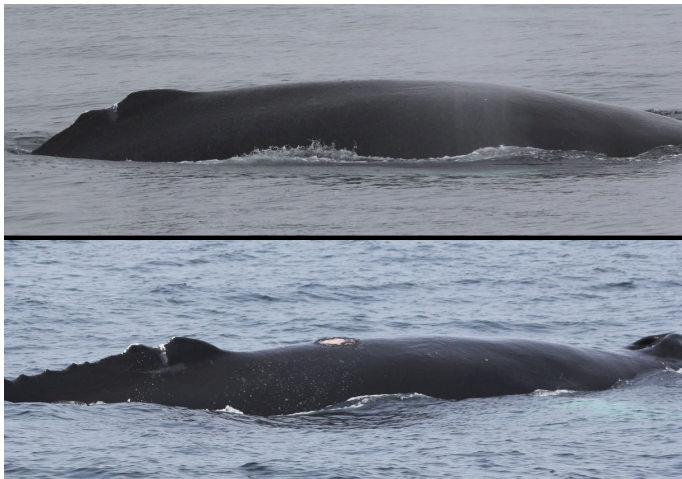


Figure 20. Satula with no open wound on July 15th (top) and with an open wound on August 7th (bottom)

Healing

Humpback whales Quote and Valley's 2020 calf both showed signs of entanglement injury to the peduncle region in 2020. Both whales exhibited healed wounds when they were re-sighted in 2021.

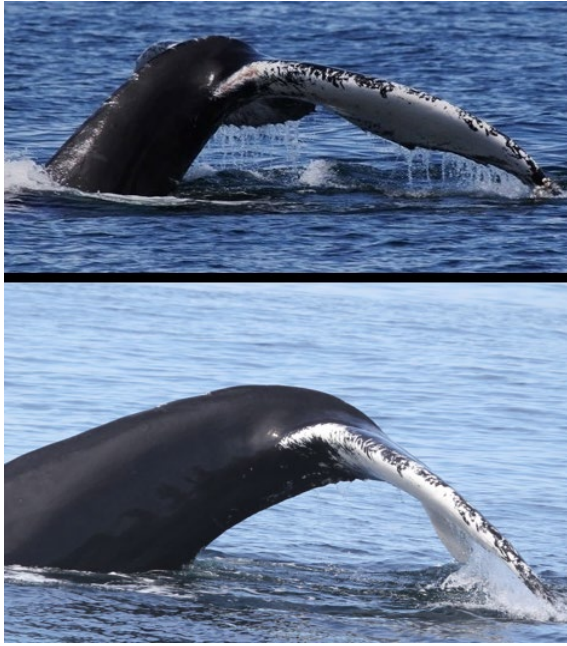


Figure 21: Quote's peduncle wound in 2020 (top) and 2021 (bottom).



Figure 22. Valley's 2020 calf's peduncle wound in 2020 (top) and 2021 (bottom).

Potential Threats

Fixed Fishing Gear

A total of 5615 buoys were recorded within 30 meters of cetacean sightings. Of the 1304 cetacean sightings, 883 had buoys associated (range 1-53 buoys). The average number of buoys present at a sighting was 6.4. Baleen whales are more likely to become entangled in the vertical line between the surface buoy and the fishing gear than other marine species. Baleen whales accounted for 762 of the sightings where cetaceans and buoys co-occurred. The number of buoys near baleen whales was 4387, with an average of 5.8 buoys per baleen whale sighted.

Marine Debris

Pelagic marine debris items were recorded throughout the entire trip (Figure 25). Debris items that were within 30 meters of a whale were flagged in the database.

- 432 pieces documented in total (Figure 23)
- 28 pieces recorded near whales (6.5%) (Figure 24)

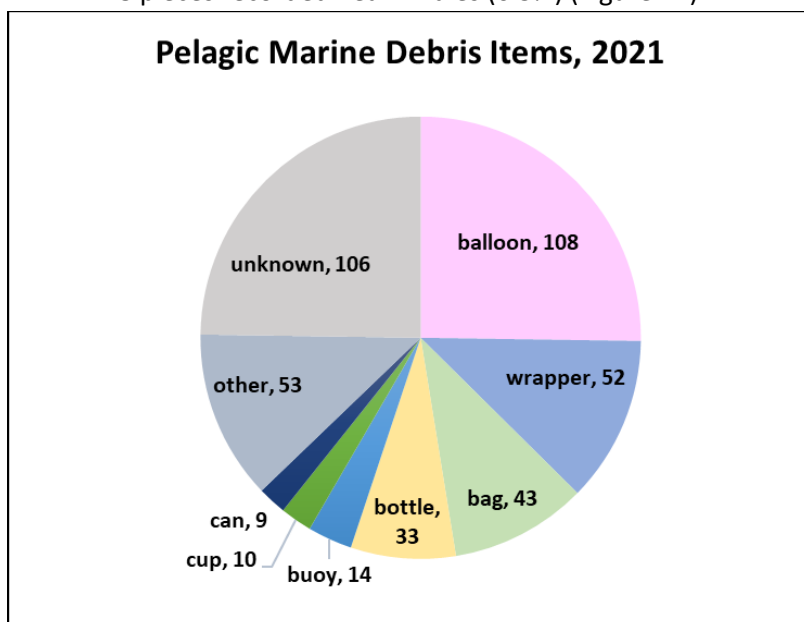


Figure 23. Number of all pelagic debris items recorded during whale watching trips, 2021.

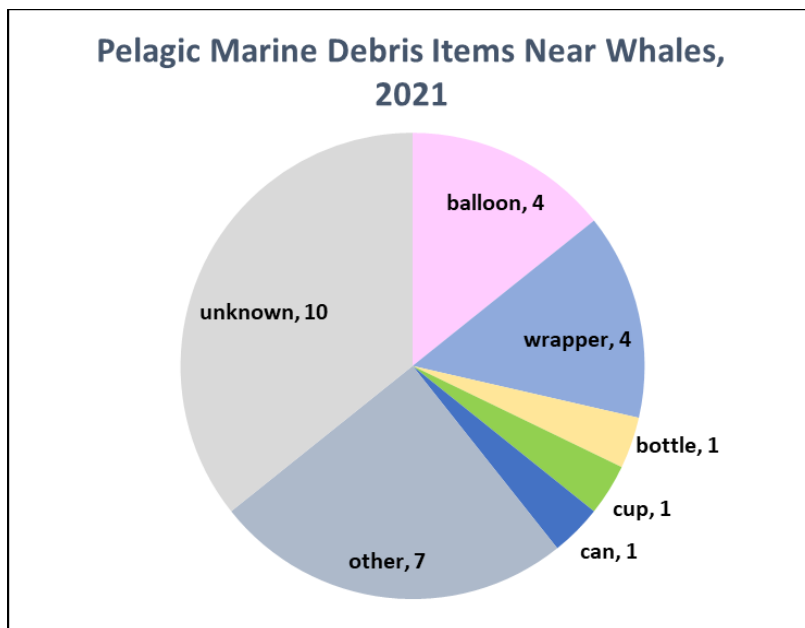


Figure 24. Number of debris items found near whales, 2021.

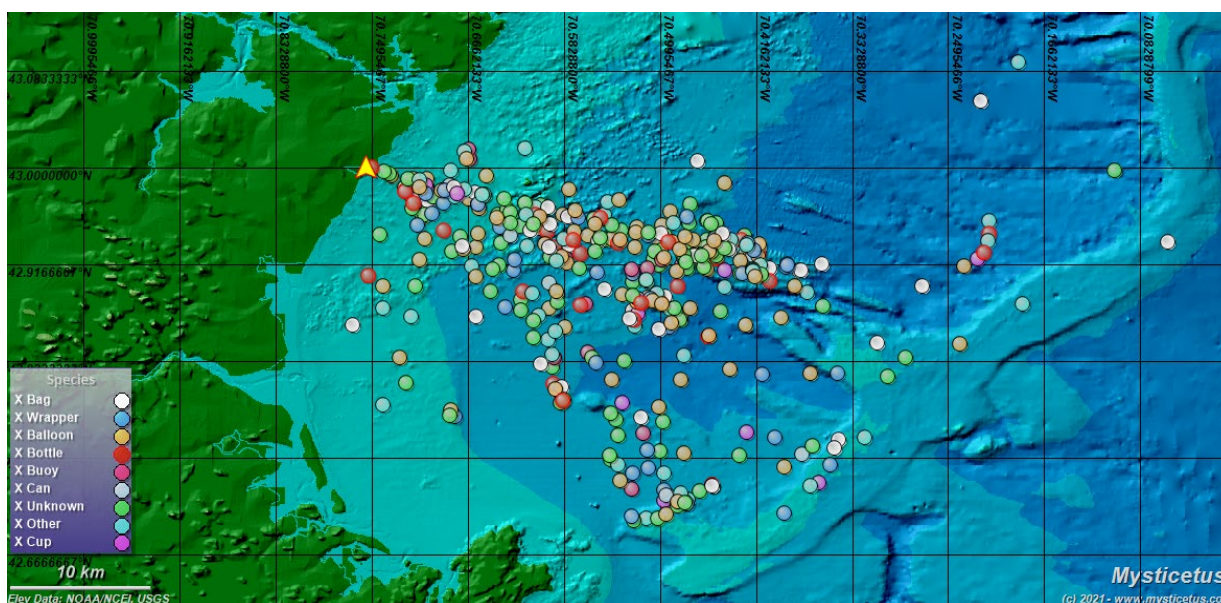


Figure 25. Pelagic marine debris sightings, 2021. The yellow arrow icon is Rye Harbor.

Summary and Recommendations

During the 2021 whale watching field season (June 05-Oct 11), a minimum of 4602 animals were observed during 152 whale watching trips/surveys. Twelve species of marine life were documented, including 3 species of baleen whales (fin, humpback, minke), 2 species of toothed whales (Atlantic white-sided dolphin and harbor porpoise), 1 species of shark (blue), 2 species of large fish (ocean sunfish and bluefin

tuna), 1 species of turtle (loggerhead), and 2 species of pinnipeds (grey and harbor seals) and one species of large jelly. Sightings of note included another elevation in ocean sunfish sightings, a loggerhead turtle, and several Lion's Mane jellies that are rare to see from the platform of opportunity used. Sixty-eight individual humpback whales (plus six calves) were identified. Four additional whales have yet to be identified. Of the rest, all but four of the non-calf individuals were adults.

The northernmost and easternmost areas of Jeffreys Ledge were not surveyed as consistently as the rest of the Ledge due to the limitations of working from a commercial whale watch vessel, which limited the ability to complete coverage spatially and temporally. Plans are underway to charter a vessel(s) to allow more consistent coverage of these under-surveyed areas.

Although potential threats to marine mammals were documented, this aspect of the data collection should be more detailed in the future to properly guide authorities. For example, additional data would include the specific type of vessel, vessel's action (underway or anchored, holding course or variable course), vessel speed, and the number of lines in the water when appropriate. Additionally, AIS data can be incorporated into sightings maps to better understand the potential impact of large ship traffic.

Trends involving potential threats in this area should also be investigated. Further research will be done to examine the behaviors of whales in proximity to fishing gear and marine debris to analyze the potential risk for entanglement or debris ingestion.

Conservationists, researchers, and managers have speculated that the current boundaries of the Stellwagen Bank National Marine Sanctuary (SBNMS) habitat, established in 1992 may not accurately delineate the areas in need of management measures to allow these species to thrive and reduce anthropogenic mortality.

Acknowledgements

We want to thank Granite State Whale Watch for allowing us to bring interns aboard to collect opportunistic data and be willing to maneuver the vessel to achieve maximum photo-ID opportunities. Our captains, Peter Reynolds and Jonathan Gwalthney were critical in obtaining the information necessary to provide this report. Thank you to our research affiliates and naturalists, Melanie White, Nicole Abate, and Jen Kennedy, for overseeing the data collection and for obtaining digital images of all animals when possible. And most notably, thank you to our interns who worked tirelessly to collect the data aboard the whale watching trips: Eva Anderson, Kaden Ballou, Neleigh Brown, Ashley Goland, Natalia Herb, Tiffany Kay, Megan Masciola, April Montooth, Kaela Preston, Brighid Weedon, and Julia Wilcox. Also, thank you to the Center for Coastal Studies for assistance with identifications and demographics.

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