



2023 Whale Research Report

Documenting the 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

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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 2023 season, including whale distribution and habitat usage, combined with perceived threats and behaviors. One hundred fifty-five trips were taken to the Jeffreys Ledge area from April 21, 2023, until October 06, 2023. Five of these trips were full-day scouting trips, 2 were full-day bird-watching trips while the rest were half-day public whale-watching trips. Two trips were conducted daily on 58 days, while single trips (including the five scouting and two birding trips) were conducted on the remainder of the days (39). The area observed included water from the coastline east as far as -070.01600W, between the latitudes of 43.17819N and 42.62837N. A minimum of 5865 animals were observed. Eleven species were documented, including 3 species of baleen whales, 2 species of toothed whales, 2 species of shark, 2 species of large fish, and 2 species of pinnipeds. Ninety-one individual humpback whales (*Megaptera novaeangliae*) were identified. Seven of these were calves. Sightings of note include 23 individual humpback whales that were only sighted during full-day scouting or birding trips, making for 27% of all humpback whales (not including calves) identified, and 64% of all trips had at least one humpback whale calf observed. One humpback whale (Woodwind) was documented to have a new injury caused by a boat propeller. One humpback whale (Startrail) was observed entangled in heavy line. Two humpback whales (Pinball and Diablo) were observed the day before and after their entanglements. Six other humpbacks exhibited injuries from prior entanglements, including four calves. A total of 924 pelagic marine debris items were documented, and 125 of these items were seen near whales or other marine life. Of the identifiable debris items, plastic wrappers (n=218), balloons (n=190), and plastic bags (n=86) were the top three items recorded.

Introduction

Jeffreys Ledge is a productive marine habitat due to the upwelling currents surrounding 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 face human 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; Newburyport and Gloucester, Massachusetts regularly visit this area, but not all vessels collect detailed data on marine life sightings and behaviors.

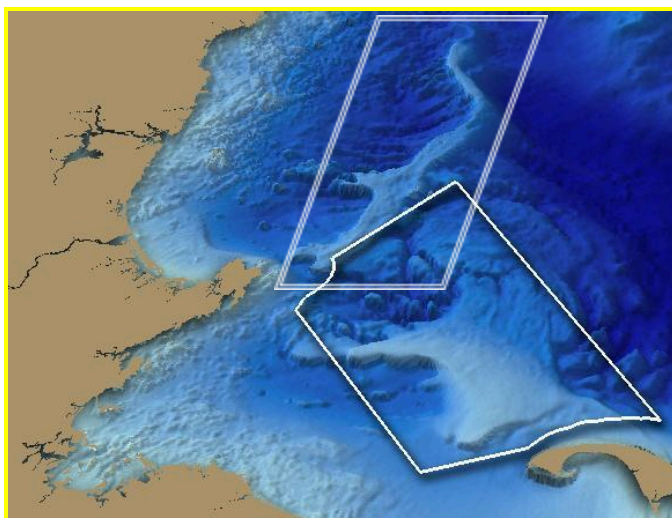


Figure 1. Jeffreys Ledge is outlined in a double line. Stellwagen Bank National Marine Sanctuary is outlined in a solid line. Image credit www.stellwagen.noaa.gov

Opportunistic Surveys

One commercial whale-watching vessel based in Rye Harbor, NH, was used for opportunistic surveys in 2023. 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 May-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 53.6km to 117.4km, with the average trip length being 84.4km. 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 interns, with at least two people on watch at all times. After receiving extensive hands-on training in the classroom and the field, interns collected data using the program *Mysticetus* (Fig 2.).

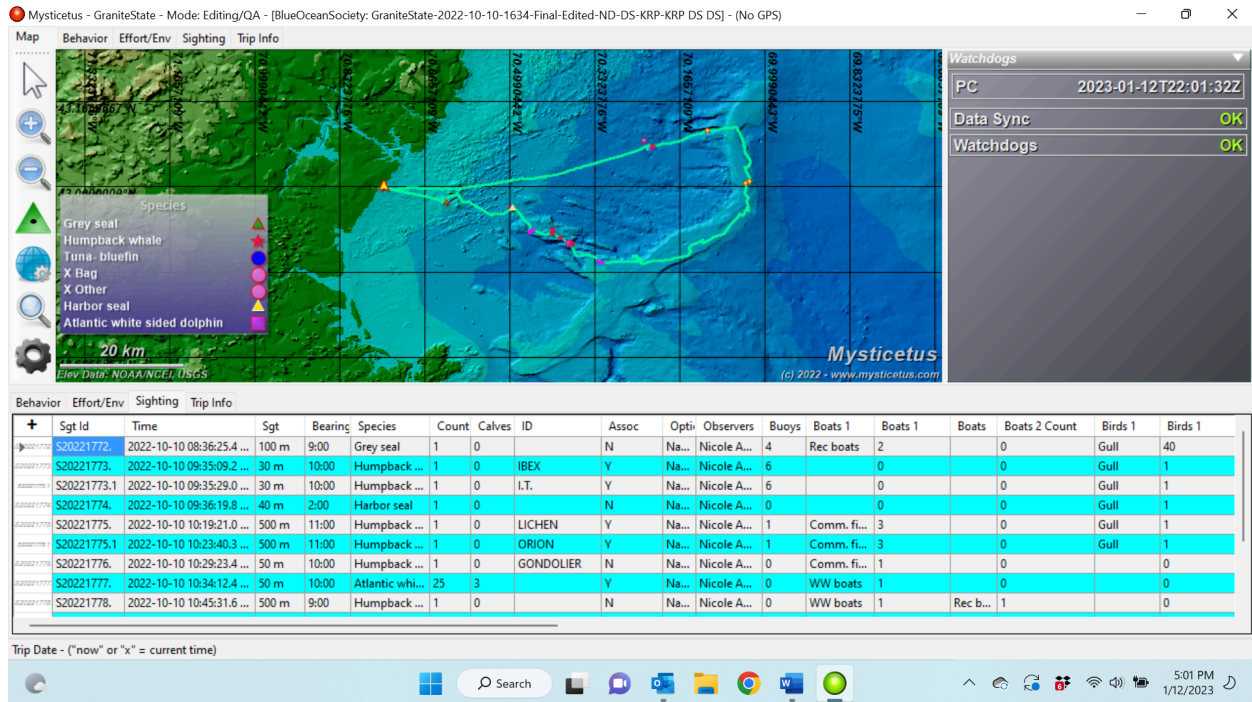


Figure 2. Screenshot of *Mysticetus* interface

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 the Northeast Fisheries Science Center and the 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 disentanglement 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 or 150-600mm 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 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 (Agler et al., 1992).

Results

Surveys

One hundred and fifty-five whale-watching trips (surveys) were conducted over 169 days during the 2023 season (April 21, 2023 to October 06, 2023). This range was similar to last season because we began our season with the four scouting trips occurring before the beginning of the regular season (mid to late May). Seven trips were full-day trips lasting 8-10 hours (five scouting trips and two birding trips). Days with no trips were primarily due to unacceptable weather conditions or a lack of passengers to make the trip financially feasible. The survey range extended from the coastline eastward to -070.01600 W, northward to 43.17819 N, and southward to 42.62837 N.

Sightings

A minimum of 5865 animals were observed during the 2023 season. Some individuals were observed multiple times throughout the study period. Eleven species were documented including 3 species of baleen whales, 2 species of toothed whales, 2 species of shark, 2 species of large fish (non-shark), and 2 species of pinnipeds. (Figure 3.)

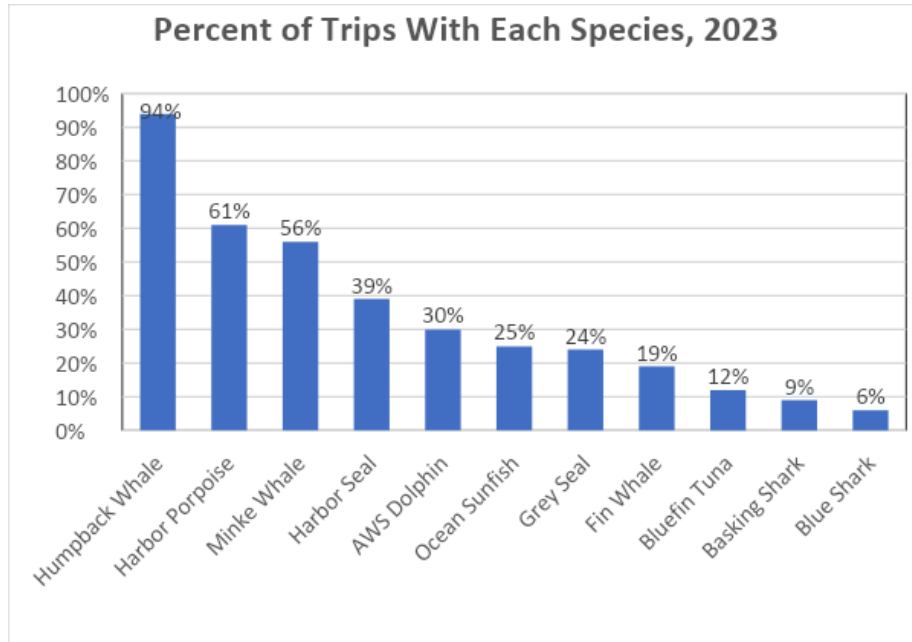


Figure 3. Percentage of trips with each species.

Sightings of Note

- 27% of all non-calf humpback whales were only observed during the seven full-day scouting or birding trips
- 64% of all trips had at least one humpback whale calf observed

Locations and details of sightings

The following maps depict the locations of the four most historically encountered species of *Cetacea*. A sighting is defined as the location where one or more whales of a particular species were seen. Sightings may represent multiple sightings of the same individual whales over the season.

Humpback whales:

A total of 761 humpback whales were seen (Fig. 4), accounting for 91 individuals. Mother/calf pairs were seen 141 times (accounting for seven individual pairs). Associations with Atlantic white-sided dolphins occurred six times.

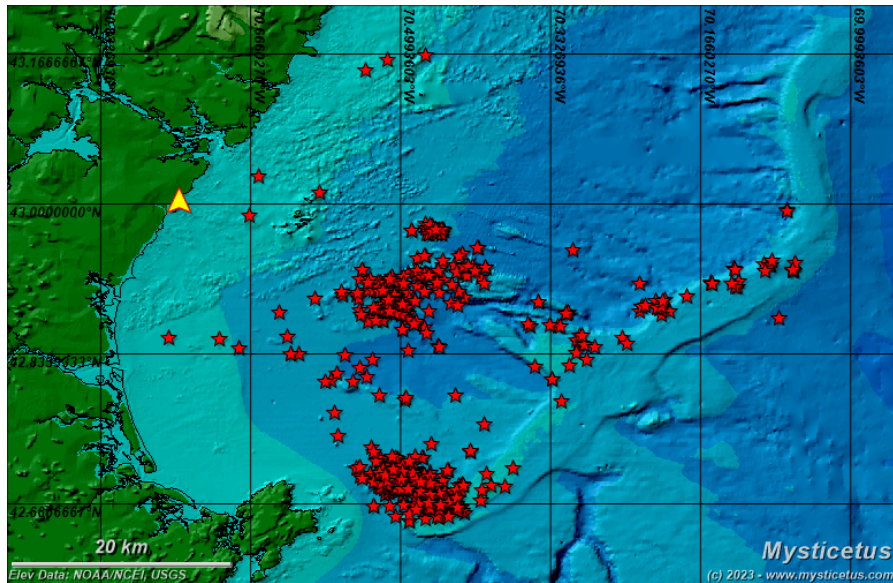


Figure 4. Humpback whale sightings near Jeffreys Ledge, 2023. The yellow arrow icon is Rye Harbor.

Fin whales:

Fin whales were seen at 45 locations, with a total of 52 fin whales seen (Fig 5). Associations of fin whales occurred during six sightings, including one trio, four adult pairs, and one mother and calf pair. Associations with Atlantic white-sided dolphins were not observed.

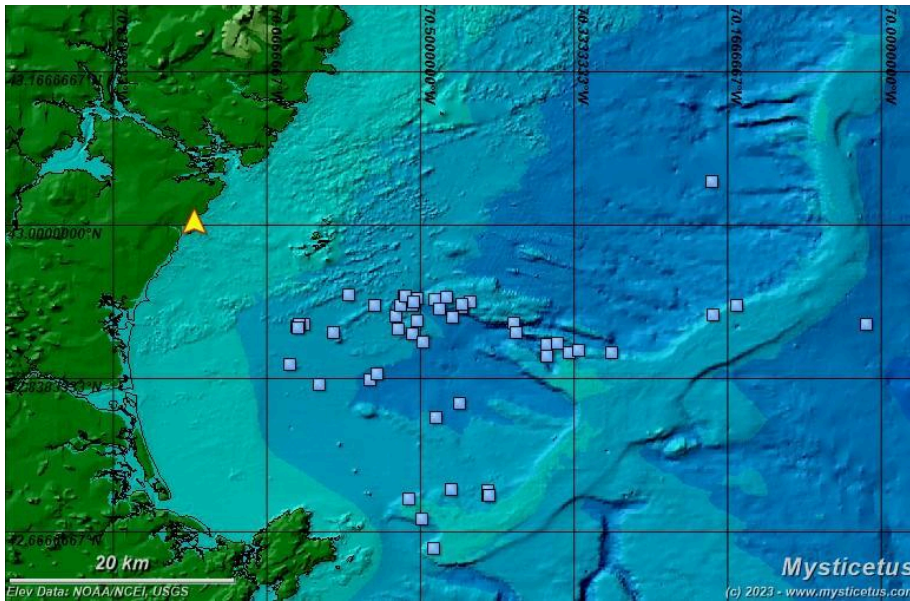


Figure 5. Fin whale sightings near Jeffreys Ledge, 2023. The yellow arrow icon is Rye Harbor.

Minke whales:

Minke whales were seen at 165 locations, with a total of 165 minke whales seen (Fig 6). No associations of minke whales were observed. Minke whales were not observed to be associated with Atlantic white-sided dolphins.

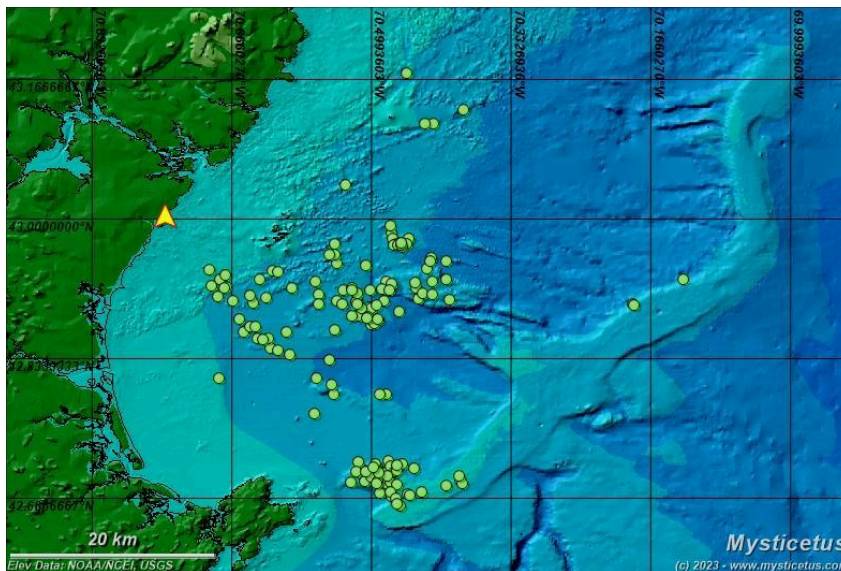


Figure 6. Minke whale sightings near Jeffreys Ledge, 2023. The yellow arrow icon is Rye Harbor.

Atlantic white-sided dolphins:

Atlantic white-sided dolphins were seen at 60 locations, and a total of 3635 Atlantic white-sided dolphins were seen (Fig 7). Pod size ranged from 3-1000 individuals, with the average pod size being 61 individuals. Associations with other species occurred 6 times, each of which were with humpback whales.

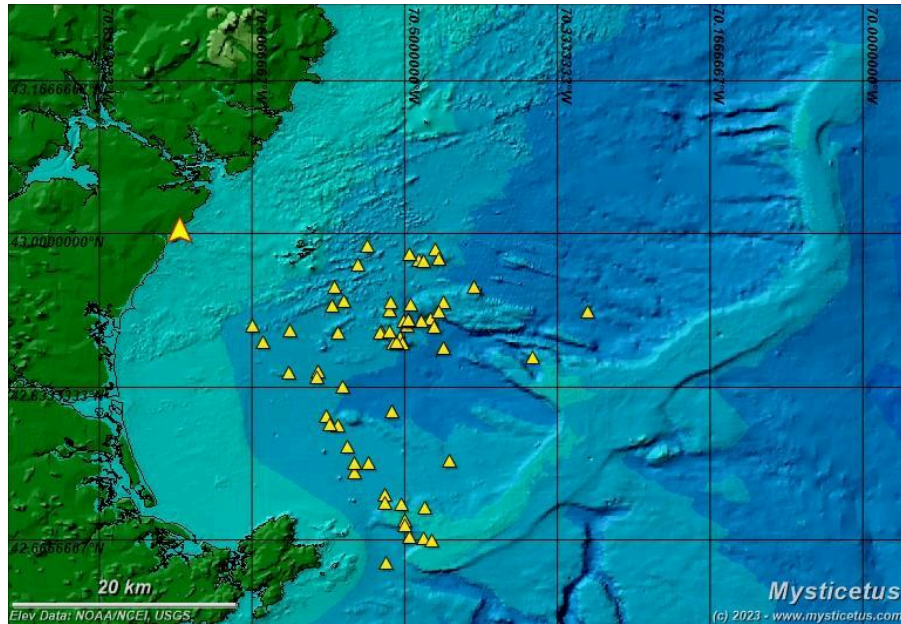


Figure 7. Atlantic white-sided dolphin sightings near Jeffreys Ledge, 2023.
The yellow arrow icon is Rye Harbor.

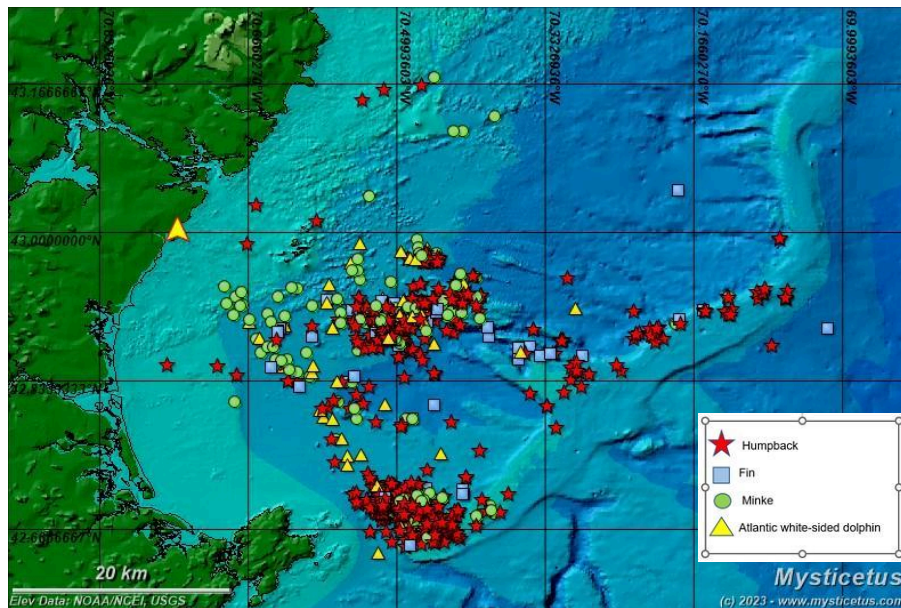


Figure 8. All sightings of common species combined, 2023.
The yellow arrow icon is Rye Harbor.

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. Eighty-four individual humpback whales, plus seven calves, were observed in 2023. Fourteen humpbacks have not been cataloged yet hence this is the first year they have been documented by any group in the Gulf of Maine. Table 1 lists the individuals that have been identified so far. The majority (73%) of these individuals were adults (seven or more years old). Four juveniles were observed, and 14 individuals were of unknown age but presumed to be juveniles (Fig. 9). More female humpback whales were seen than males, 34 to 28 respectively; however, 22 were of unknown gender, not including the seven calves (Fig. 10).

Table 1: Identifications of cataloged humpback whales seen in 2023.

A-Plus	Ebony	Lacey	Piano	Sargasso 2014 calf	Valley
A-Plus 2023 calf	Espresso	Lagoon	Picket	Satula	Valley 2023 calf
Badge	Fan	Lascaux	Pinball	Sedge	Vault
Bottleneck	Freckles	Littlespot	Pinball 2023 calf	Shuffleboard	Victim
Cacophony	Gondolier	Mocha	Pisces 2021 calf	Shuffleboard 2023 calf	Watchtower
Chromosome	Grand Manan	Mogul	Pitcher	Sigma	Woodwind
Clamp	Gremlin	NewJersey	Quarry	Sliver	Yurt
Crisp	Grommet	Nike	Quarternote	Spoon	
Dashdot	Gunslinger	Nile	Quill	Startrail	
Diablo	Half Moon	Othello	Quixote	Sterna	
Ditto	Highlighter	Owl	Quote	Sword	
Dross	Jabiru	Partition	Ravine	Tripod	
Dross 2023 calf	Jawa	Patches	Ravine 2023 calf	Tripod 2023 calf	
Dyad	Kickoff	Photon	Repeat	Tusk	

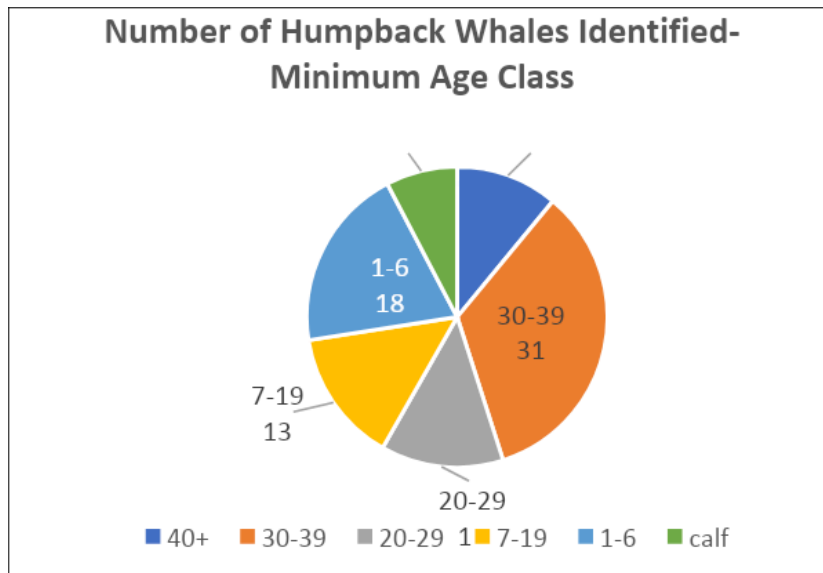


Figure 9. Age or minimum age of humpback whales seen in 2023.

(Data provided by Center for Coastal Studies)

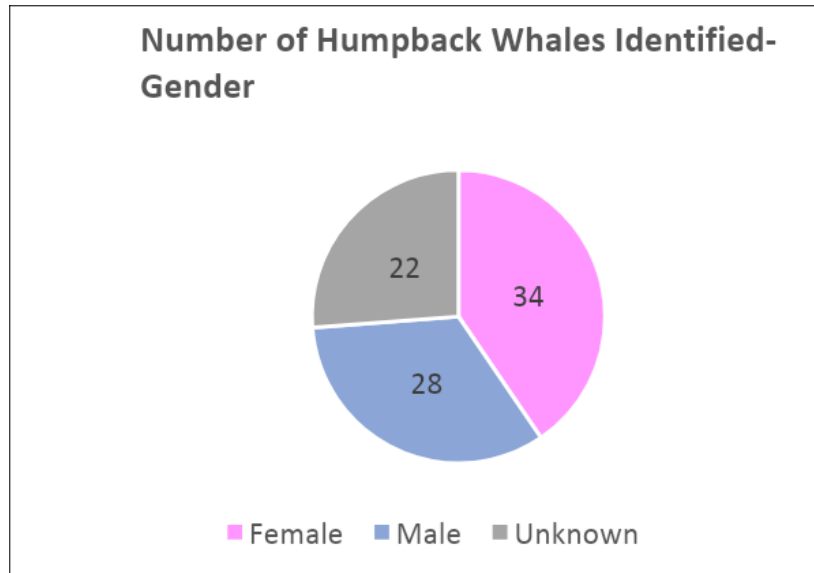


Figure 10. Gender of humpback whales seen in 2023.
(Data provided by Center for Coastal Studies)

Fin whales are individually identified by the shape of their dorsal fin as well as the pigmentation patterns on their back, called the chevron and blaze markings. Two previously identified individual fin whales were observed in 2023: Bp 0611 and Bp 9709. Individual identification is still in progress and will be summarized in a later report after our fin whale catalog is up to date.

North Atlantic right whales were not seen in 2023.

Documented Threats

Ship Strikes

One humpback whale showed evidence of a recent ship strike. Woodwind was observed on September 5, 2023, with fresh cuts on its left fluke tip indicative of a propeller cut (Fig. 11). This sighting was the first and only time we had seen Woodwind on Jeffreys Ledge in our history.



Figure 1. Woodwind (foreground) with propeller cuts on its left fluke tip

Entanglements

On July 17, 2023, humpback whale, Startrail, was observed entangled in gear on southern Jeffreys Ledge (Fig. 12). The Marine Animal Entanglement Response Team from the Center for Coastal Studies (CCS) was called and responded. Another whale watch vessel, *Hurricane II*, took over and stood by the whale until CCS arrived on the scene. The gear configuration was difficult to assess as the water was murky brown due to the heavy algal bloom of *Ceratium* that had persisted in the area since spring. Startrail was seen a few weeks later with no signs of gear.



Figure 12. Startrail with rope across its back, just aft of blowholes.

Humpback whale, Diablo, was seen by a whale watch boat on southern Stellwagen Bank on August 12, 2023 with monofilament line trailing from her flukes (Fig. 13). She was seen on southern Jeffreys Ledge on August 11 and 13, 2023, with no line visible.



Figure 13. Humpback whale, Diablo, with line trailing from fluke. Image courtesy of Whale and Dolphin Conservation.

Humpback whale, Pinball, was seen by a recreational boater on southern Jeffreys Ledge, just off of Cape Ann, Massachusetts, on August 12, 2023, entangled in multiple sets of gear (Fig. 14). The Marine Animal Entanglement Response Team from CCS responded and successfully freed her from the gear. During the time she was entangled, her calf would leave for extended amounts of time but return periodically for bouts of nursing. Blue Ocean Society had seen Pinball and her calf the day before and after the entanglement, August 11, 2023, proving that she was entangled for less than 24 hours.

Figure 14. Pinball entangled in gear on August 12, 2023



Humpback whale, Mogul, was seen on July 07, 2023, with new entanglement injuries (Fig.15). It is unclear when he was entangled.



Figure 15. Humpback whale, Mogul, showing new injuries to his tailstock and fluke insertion, indicative of an entanglement.

Humpback whale, Quote, was seen on August 27, 2023, thin and with new entanglement injuries. (Fig. 16) It is unclear when she was entangled.



Figure 16. Humpback whale, Quote, with linear scars just aft of the blowholes, indicative of an entanglement.

Additionally, four of the seven humpback whale calves observed had injuries indicative of an entanglement (Fig. 17).



Figure 17. Humpback whale calves exhibiting injuries indicative of an entanglement. Pinball's calf (UL), Shuffleboard's calf (UR), Ravine's calf (LL) and Valley's calf (LR).

Other Injuries

No other injuries were detected in 2023.

Healing

Humpback whale, Valley, acquired a new injury on her back between July 24 and August 10, 2022. Although the cause of this injury is unknown, it resembles injuries suffered from blunt force trauma, possibly a collision with a boat hull. (Fig. 18.) By this season, the injury had healed (Fig. 19).



Figure 18. Valley, August 10, 2022



Figure 19. Valley, August 24, 2023

Potential Threats

Fixed Fishing Gear

A total of 19310 buoys were recorded within 30 meters of marine life sightings. Of the 1259 cetacean sightings, 989 had buoys associated (range 1-117 buoys). The average number of buoys present at a cetacean sighting was 14.6. Baleen whales are more likely to become entangled in the vertical line between the surface buoy and the fixed fishing gear than other marine species. Baleen whales accounted for 757 of the sightings where cetaceans and buoys co-occurred. The number of buoys near baleen whales was 8368, with an average of 11 buoys per baleen whale sighted.

Marine Debris

Pelagic marine debris items were recorded throughout all trips. Debris items within 30 meters of a whale were flagged in the database (Figure 23).

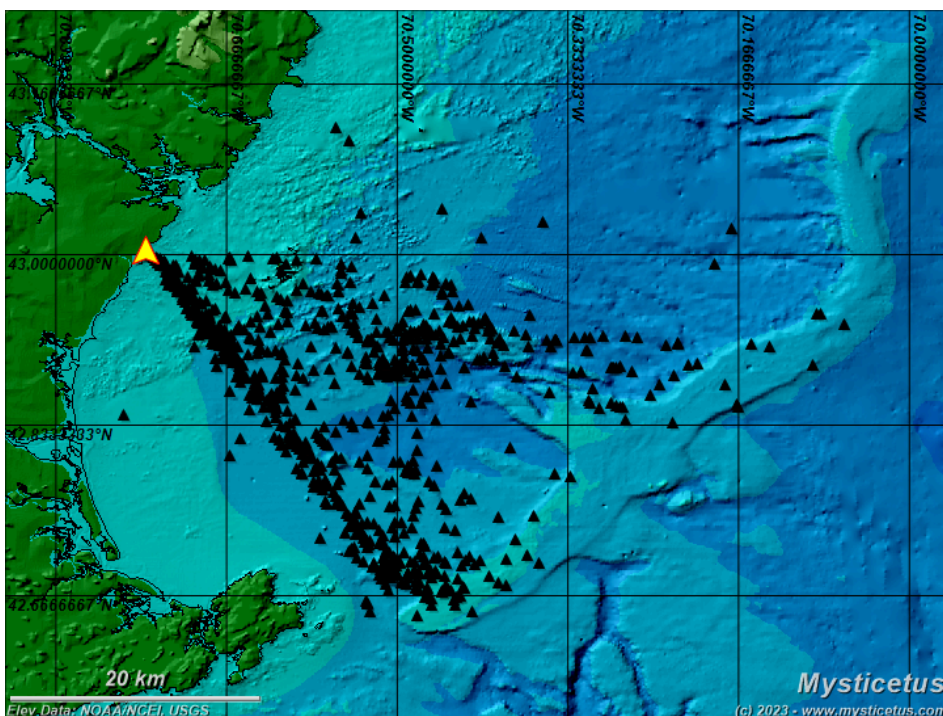


Figure 23. Pelagic marine debris sightings, 2023. The yellow arrow icon is Rye Harbor.

- 924 pieces documented in total (Figure 24)
- 125 pieces recorded near whales (13.5%) (Figure 25)

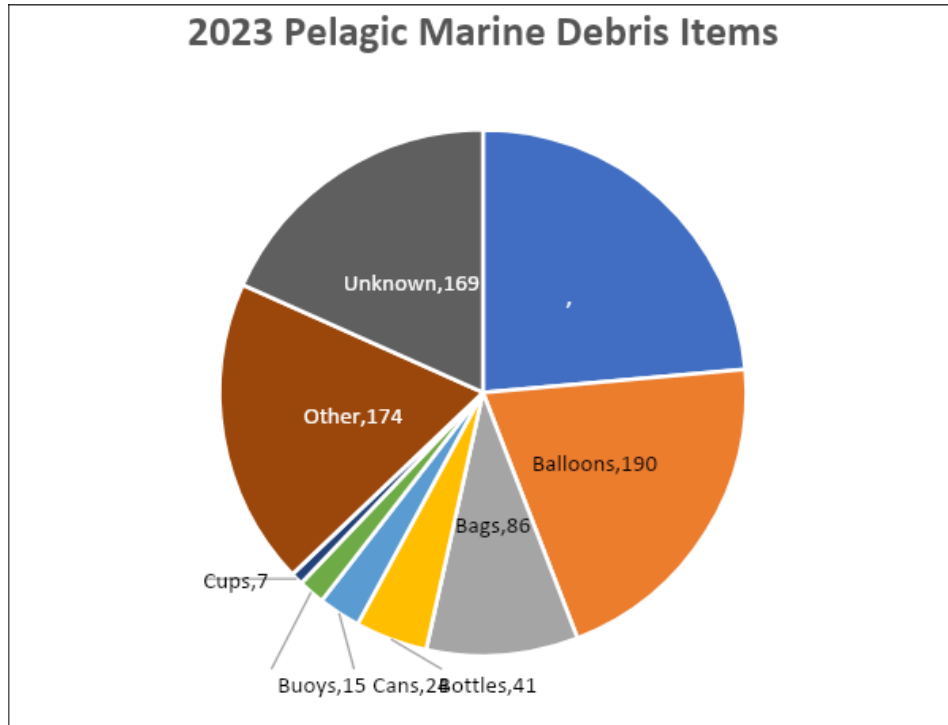


Figure 24. Number of all pelagic debris items recorded during whale watching trips, 2023.

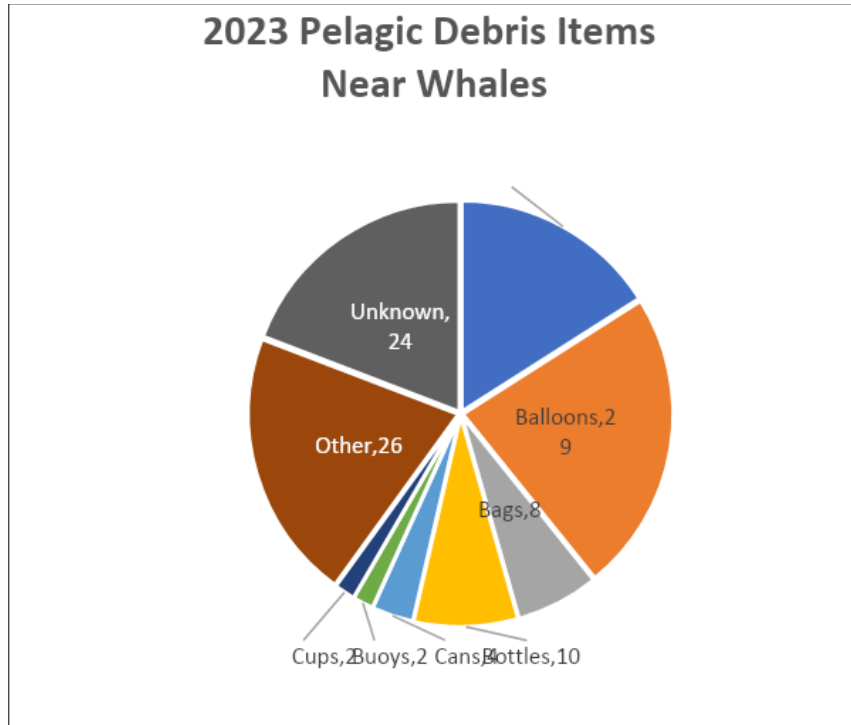


Figure 25. Number of debris items found near whales, 2023.

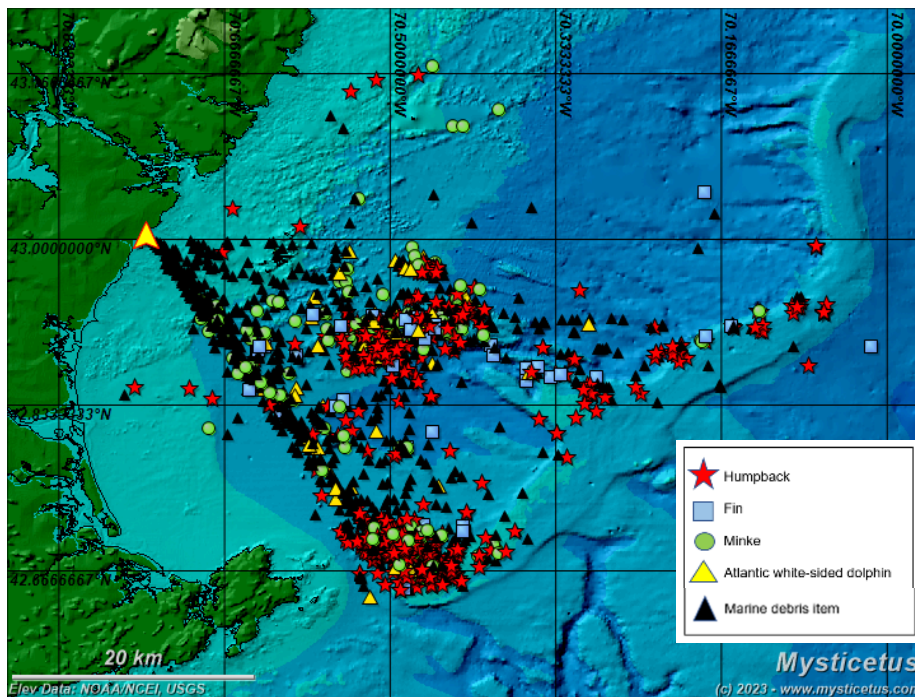


Figure 26. Pelagic marine debris and common species sightings combined, 2023.
The yellow arrow icon is Rye Harbor.

Summary and Recommendations

During the 2023 whale-watching field season (April 21-October 06), a minimum of 5865 animals were observed during 155 whale-watching trips/surveys. Eleven species of marine life were documented, including 3 species of baleen whales (fin, humpback, and minke), 2 species of toothed whales (Atlantic white-sided dolphin and harbor porpoise), 2 species of shark (basking, blue), 2 species of large fish (ocean sunfish and bluefin tuna), and 2 species of pinnipeds (harbor and grey seals). Sightings of note include 23 individual humpback whales were only sighted during full day scouting or birding trips, making for 27% of all humpback whales (not-including calves) identified, and 64% of all trips had at least one humpback whale calf observed.

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 restricted 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, at least in the shoulder seasons.

Although potential threats to marine mammals were documented, this aspect of the data collection should be more detailed in the future to guide authorities properly. For example, additional data would include the vessels' actions (underway or anchored, holding course or variable course), size, 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 (65+ feet) 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 needing 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 Todd Herderhurst and his vessel, *Seacoast Lady*, for taking us out in the spring to conduct scouting trips. Thank you to our research affiliates and staff naturalists, Melanie White, Jen Kennedy, and Susan Conant Wilson, for overseeing the data collection and obtaining digital images of all animals when possible. Thank you to our Data Coordinator, Kaela Preston, for diligently managing data files in a timely manner. Most notably, thank you to our interns who worked tirelessly to collect the data aboard the whale watching trips: Hannah Brown, Julia Collum, Graham Piercey, Avery Settele, and Hannah Stairs. Also, thank you to the Center for Coastal Studies for assistance with identifications and demographics.

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