Species Status Assessment

Common Name: Sperm whale **Date Updated:** 2/16/2025

Scientific Name: *Physeter macrocephalus* **Updated by:** Meghan Rickard

Class: Mammalia

Family: Physteridae

Species Synopsis *(a short paragraph which describes species taxonomy, distribution, recent trends, and habitat in New York):*

Sperm whales are the only toothed large whale species, the most sexually dimorphic of all cetaceans, and have the largest brain of any animal that has ever lived (Rice 1989, Perry et al. 1999, Whitehead 2002, Jefferson et al. 2015). They are named for the waxy substance in their head, spermaceti, which is a high-quality oil for which sperm whales were globally commercially hunted for more than two and a half centuries (NMFS 2010). Direct harvest of sperm whales went unregulated until quotas were introduced in the North Pacific Ocean in 1970, and all whale species were not afforded complete protection from commercial whaling until the global Internal Whaling Commission (IWC) moratorium went into effect in 1986 (NMFS 2010). There has been extreme under-reporting and misreporting of modern catch data for sperm whales but estimates of the number of animals killed range in the tens of thousands in the North Atlantic alone and over one million worldwide (Best et al. 1984, NMFS 2010). The estimated overall decline of the species from 1711 to 2022 was 56% (Whitehead and Shin 2022).

There is only one recognized species of sperm whale. There has been some debate over whether *Physeter catodon* or *Physeter macrocephalus* is the correct name for the species. The name *P. macrocephalus* is used most often but *P. catadon* is considered a synonym (Taylor et al. 2019). For management purposes, all sperm whales in the North Atlantic are considered one stock; the IWC also recognizes one stock for the North Atlantic. The United States recognizes two sperm whale stocks on its Atlantic coast: a North Atlantic stock and a northern Gulf of Mexico stock due to significant genetic subdivision found between the Gulf of Mexico stock and the North Atlantic stock (Engelhaupt et al. 2009, Hayes et al. 2024). More fine scale population structure may exist but is difficult to determine (Reeves and Whitehead 1997, Lyrholm and Gyllensten 1998, Hayes et al. 2024).

Sperm whales are found throughout all oceans. Sperm whales occur primarily on the continental shelf edge, continental slope, and open ocean though distribution extends into partially enclosed areas like the Mediterranean Sea (NMFS 2010). Sperm whales in the U.S. Exclusive Economic Zone (EEZ) are closely associated with the edge of the Gulf Stream and other oceanographic features such as bathymetry (Waring et al 1993, Hayes et al. 2024). In New York, sperm whales are most frequently observed in deep waters at the continental shelf break, but also in relatively shallow areas on the continental shelf close to land (Sadove and Cardinale 1993, Scott and Sadove 1997). They are present year-round but are most often seen in summer (Sadove and Cardinale 1993, Scott and Sadove 1997, Zoidis et al. 2021, NYSERDA 2021).

Geographic distribution is also likely linked to social structure and a low reproductive rate (Hayes et al. 2024). The basic social unit of sperm whales is a mixed group of adult females, their calves, and juveniles of both sexes, usually about 20 to 40 animals (Christal et al. 1998). Females and juveniles generally inhabit tropical and subtropical waters while males are wide-ranging (Hayes et al. 2024). Only males range into Arctic waters, particularly in the summer feeding season, then migrate back to warmer waters to breed (NMFS 2010). Stable social groups, site fidelity, and latitudinal range limitations for females and juveniles are hallmarks of the species (Whitehead 2002).

There is no reliable population estimate for North Atlantic sperm whales and current population trends are unknown (Hayes et al. 2024). The best recent abundance estimate for western North Atlantic sperm whales is 5,895 individuals, with a minimum population estimate of 4,639 (Hayes et al. 2024).

I. Status

a. Current legal protected Status

i. **Federal:** Endangered **Candidate:**

ii. **New York:** Endangered

b. Natural Heritage Program

i. **Global:** G3G4

ii. **New York:** SNA **Tracked by NYNHP?:** Yes

Other Ranks:

-New York 2025 SGCN status: High Priority Species of Greatest Conservation Need

-IUCN Red List: Vulnerable

-CITES: Appendix I

-Northeast Regional SGCN: Highly imperiled, migratory species; very high conservation concern

-Canada Species at Risk Act (SARA): Not At Risk

-Marine Mammal Protection Act (MMPA): Strategic

-COSEWIC: Not At Risk

Status Discussion:

The hunting of sperm whales began in New England in the early 1700s and spread throughout the North Atlantic Ocean by mid-century (Starbuck 1878). Two of the major 19th century whaling grounds for sperm whales were off the U.S. East Coast (Townsend 1935). Oil and spermaceti products drove the sperm whale hunt, though ambergris and tooth ivory were also valuable harvests. Demand fluctuated over the years; it decreased due to petroleum use, relieving the need for whale oil, but increased again for use in cosmetics. The meat from sperm whales has reportedly only been consumed in Japan, the West Indies, and Indonesia (NMFS 2010).

The consideration of historical data on sperm whale hunting is essential to understanding the current global population status. The total take of sperm whales worldwide between 1800 and 1909 has been estimated as close to 700,000 individuals, and between 1910 and 1973, as close to 605,000 (Best et al. 1984). In the eastern and central North Atlantic, as far west as Iceland, nearly 30,000 sperm whales were killed between 1893 and 1975 (Jonsgård 1977). Canadian whalers killed over 500 sperm whales in the 1900s (Mitchell 1975).

The International Whaling Commission (IWC) moratorium gave sperm whales protection beginning in 1981 and the moratorium was fully implemented in 1986. Norway and Iceland object to the IWC moratorium and actively whale but do not take sperm whales. Japan objected to the IWC moratorium and focused on hunting minke whales in Antarctica under a scientific research program permit. In 2018, Japan withdrew from the IWC and resumed commercial whaling in 2019 within its territorial waters. Currently Japanese whaling targets minke whales, Bryde’s whales, sei whales, and fin whales (Ministry of Foreign Affairs Japan 2025). However, Japan has taken sperm whales in the past and even hunted them under Special Permit while a member nation in the IWC as recently as 2013 (IWC 2025a).

The extent of depletion and degree of recovery from commercial whaling for sperm whales is uncertain at best (NMFS 2010). A pre-whaling global population of about 1,100,000 sperm whales was reduced by about 29% by 1880, and then to approximately 360,000 by the 1990s. The global sperm whale population experienced a total reduction of 67% during whaling, although there is much uncertainty with these estimates (Whitehead 2002). Whitehead (2002) estimated current global sperm whale abundance to be approximately 300,000 to 450,000 individuals. The most extensive surveys in the North Atlantic were conducted from 1966-1969 and produced a population estimate of approximately 22,000 sperm whales (Mitchell 1972).

It is often assumed that sperm whale numbers have increased since the 1986 whaling moratorium but there is insufficient data to assess this assumption (NMFS 2015). There is no direct evidence that any part of the population has increased, though for most areas there is also no direct evidence that they have *not* increased (Taylor et al. 2019). Abundance estimates are complicated by the wide-ranging nature of sperm whales, their offshore distribution, and extended dive periods (Whitehead 2002). All estimates from sighting surveys are negatively biased due to the long submergence times of sperm whales, which often perform dives lasting up to two hours. Due to imprecise estimates and lengthy survey intervals, there is not enough statistical power to detect trends in abundance (NMFS 2010, Hayes et al. 2024). Population growth and recovery can be expected to be low in the species; long-lived animals such as sperm whales are not well adapted to recover from depletion on the scale that commercial whaling was conducted. For example, even in the absence of whaling, the Mediterranean population appears to have declined over the past 20 years, with bycatch in driftnets a likely principal cause (Reeves and Notarbartolo di Sciara 2006).

In the United States, the sperm whale has been protected under the Marine Mammal Protection Act since 1972 and has been listed as endangered by the Endangered Species Act since it was enacted in 1973. The species is considered strategic under the MMPA due to its endangered status under the ESA. Sperm whales are listed on the IUCN Red List as Vulnerable with an unknown population trend (Taylor et al. 2019). The sperm whale U.S. Recovery Plan mandated under the ESA was created in 2010 and has not been updated since (NMFS 2010). The 5-Year Status Review of sperm whales, also mandated under the ESA, was last updated in 2015 and is currently being updated since being initiated in 2021 (NMFS 2015, Department of Commerce 2021).

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Unknown	Unknown			Choose an item.
Northeastern US	Yes	Unknown	Unknown		Endangered	Yes
New York	Yes	Unknown	Unknown		Endangered	Yes
Connecticut	Yes	N/A	N/A		Not listed	No
Massachusetts	Yes	Unknown	Unknown		Endangered	Yes
Rhode Island	Yes	Unknown	Unknown		Not listed	No
New Jersey	Yes	Unknown	Unknown		Not listed	No
Pennsylvania	No	Choose an item.	Choose an item.			Choose an item.

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
Vermont	No	Choose an item.	Choose an item.			Choose an item.
Ontario	No	Choose an item.	Choose an item.			Choose an item.
Quebec	Yes	Unknown	Unknown		Not listed	No

Column options
Present?: Yes; No; Unknown; No data; (blank) or Choose an Item
Abundance and Distribution: Declining; Increasing; Stable; Unknown; Extirpated; N/A; (blank) or Choose an item
SGCN?: Yes; No; Unknown; (blank) or Choose an item

Monitoring in New York *(specify any monitoring activities or regular surveys that are conducted in New York):*

Sperm whales are difficult to study due to their far offshore habitat and lengthy submergence times. In addition, funding for monitoring, especially visual surveys, is extremely limited. Until 2016, monitoring of large whales in New York was very narrow in scope. Previous examples of surveys that included the New York area and recorded large whales were done coast-wide, seasonally, and/or focused on multiple taxa and were therefore not carried out at the most appropriate temporal or spatial scale for an assessment of large whale species in the New York Bight (CETAP 1982).

One of the first NYB-focused large whale surveys was a passive acoustic monitoring effort that took place from 2008 to 2009 (Muirhead et al. 2018). The 258-day project included 10 sites, with a line of moored receivers perpendicular to Long Island and 3 sites around the entrance to NY Harbor. The data was analyzed for blue, fin, humpback, and North Atlantic right whales only.

In 2010, the Atlantic Marine Assessment for Program for Protected Species (AMAPPS) joint program between the National Oceanic and Atmospheric Administration (NOAA) and the Bureau of Ocean Energy Management (BOEM) began, with the goal of determining the abundance and distribution of protected species along the U.S East Coast. The NOAA Northeast Fisheries Science Center (NEFSC) Protected Species Branch leads the surveys which are conducted by plane and ship and includes both visual and acoustic monitoring methods. AMAPPS is a broadscale survey and therefore does not match the specific needs of New York Bight monitoring in time or space but has, however, recorded sightings and acoustic detections of sperm whales in and around New York (Palka et al. 2021). AMAPPS II (2015-2019) and AMAPPS III (2019-2024) have both been completed but AMAPPS was not picked up for continued funding by BOEM (NMFS 2025b). Instead, the U.S. Navy plans to work with NOAA on similar surveys beginning in 2025 (US Navy 2024).

NOAA conducts regular, year-round monitoring focused on North Atlantic right whales (i.e., the North Atlantic Right Sighting Advisory System) that also collects data on other taxa including sei whales (Johnson et al. 2021). In addition, the New England Aquarium also conducts regular aerial surveys, and sometimes shipboard surveys, in the Southern New England area and records sightings of sperm whales. Sightings of sperm whales off the coast of New England are common and occur year-round, though typically include single individuals.

In 2016, to support the state’s commitment to offshore wind energy, the New York State Energy Research and Development Authority (NYSERDA) began a seasonal 3-year ultra-high resolution digital aerial survey of all marine taxa within the New York Bight (e.g., the offshore planning area delineated by NY Dept. of State; NYSERDA 2021). All large whale species were observed during the digital aerial survey. Also in 2016, the Woods Hole Oceanographic Institute (WHOI) deployed the first of an ongoing succession of real-time monitoring buoys, and later gliders, to record the presence of large whales in the New York Bight. This effort had first been introduced off the coast of Massachusetts and proved helpful for both data collection and real-time management of vessel speeds to prevent collision with whales. Currently, the data shared publicly is limited to four large whale species: sei, humpback, fin, and North Atlantic right whales (WHOI 2025).

Beginning in 2017, DEC launched the first three years of a monitoring program for large whales (Tetra Tech and LGL 2020, Estabrook et al. 2021). Using monthly visual aerial surveys and 24/7 passive acoustic monitoring over a three-year period, the NYS Whale Monitoring Program gathered enough data to estimate large whale abundance in the NYB and identify probable discreet periods of space and/or time that sperm whales are likely to be found. The NYS Whale Monitoring Program will conduct another three years of visual aerial surveys for a total of 18 surveys beginning in November 2024. Additionally, DEC funds a long-term Indicators of Ocean Health monitoring program. Data collection on whales during the 10-year program has at various times included gliders outfitted with PAM (i.e., the WHOI near real-time system), shipboard line transect surveys, and recording opportunistic sightings. Currently, this effort is set to be completed in 2027.

Marine mammal stranding response is performed by two federally permitted groups in New York: the New York Marine Rescue Center (NYMRC) and the Atlantic Marine Conservation Society (AMSEAS). For all live and dead large whale events, AMSEAS is the lead response team. The DEC has supplied funding for stranding response in New York since the program began in 1980. While sperm whale strandings are rather rare, they do occur in New York and provide valuable data, making stranding response an essential component of monitoring. Marine mammal stranding records are submitted to and managed by the National Oceanic and Atmospheric Administration (NOAA) in the NOAA National Stranding Database, which dates back to 1991 (NMFS 2025b). To date, there are nine records of sperm whale strandings in New York, most of which stranded alive. Since 2015, there have been four strandings, three of which were alive, including two calves in late 2022. There are a number of stranding records that pre-date the national database, as previously noted. The most publicized sperm whale stranding in New York happened in April 1981 when a live juvenile male stranded at Coney Island, was pushed back into the water, and re-stranded at Oak Beach the next day. The whale was nicknamed “Physty” and was towed to an area where he was diagnosed with and treated for pneumonia by divers that fed him squid containing antibiotics. Less than 10 days later, the whale was herded back into the Atlantic Ocean by small boat.

Trends Discussion *(insert map of North American/regional distribution and status):*

It’s estimated that the worldwide population of sperm whales was at about 32% of its pre-whaling level in 1999 (Whitehead 2002). The rate of population increase was estimated to be 0.965% per year (Chiquet et al. 2013). However, this rate is sensitive to changes in survivorship especially of mature females, where a decrease of just over 2% could lead to population decline (Chiquet et al. 2013). A more recent study estimated 11,185 sperm whales in the North Atlantic (Gunnlaugsson et al. 2009). However, there is no reliable estimate for sperm whale abundance in the western North Atlantic (NMFS 2015). Recently, Westell et al. (2022) used passive acoustic line transect data collected between June and August 2016 to estimate the abundance of foraging sperm whales in the western North Atlantic from Virginia to the southern tip of Nova Scotia. The resulting estimated number of sperm whales was 2,199. Roberts et al. (2022) used density modeling to estimate coast-wide abundance of sperm whales. The mean abundance predicted was 6,147 sperm whales, with the highest abundance at the slope and past the slope in deep offshore waters. Temporally, the lowest abundance was estimated in February at 5,516 and the highest in September at 6,856. The current best estimate for sperm whale abundance in the U.S. Atlantic is 5,895, which comes from surveys conducted in 2021 (Hayes et al. 2024).

Sperm whales can be found across the entire North Atlantic, which the International Whaling Commission recognizes as one stock (NMFS 2010, Hayes et al. 2024). Lack of genetic differentiation and documented movements of male sperm whales across the ocean basin suggest that there is not distinct separation between the western and eastern North Atlantic populations (Reeves and Whitehead 1997, Dufault et al. 1999, Engelhaupt et al. 2009). Examples of movements include a tag returned in 1973 from whalers in Spain to Nova Scotia, where the male sperm whale was tagged in 1966 (Mitchell 1975) and harpoon fragments from the Azores found in sperm whales killed off Iceland, which indicates movement across the eastern North Atlantic as well (Martin 1982, Aguilar 1985).

The range of sperm whales in the western North Atlantic extends across the Scotian Shelf and into the Labrador Sea and Davis Strait (Reeves and Whitehead 1997). As such, sperm whales occurring off the U.S. East Coast are only a fraction of the total stock, but it's unclear how the sperm whales in the U.S. are connected to others in the North Atlantic. Generally, studies tend to find low genetic differentiation among ocean basins and little evidence of subdivision within ocean basins, with the exception of some distinct areas such as the Mediterranean Sea and Gulf of Mexico (Lyrholm and Gyllensten 1999, Lyrholm et al. 1999, Engelhaupt et al. 2009).

It's likely that the Gulf Stream plays an important role in sperm whale distribution due to the seasonal cycle of presence in the U.S. (Mitchell 1972, CETAP 1982, Scott and Sadove 1997, Hayes et al. 2024). The overall distribution of sperm whales along the U.S. East Coast is centered along the shelf break and over the slope (CETAP 1982, Hayes et al. 2024). In winter, sperm whales are concentrated around Cape Hatteras, North Carolina (NMFS 2013, Stanistreet et al. 2018). In spring, the center of distribution shifts to the north, off Virginia and Delaware, and is more widespread throughout the mid-Atlantic and the southern part of Georges Bank (Stanistreet et al. 2018, Roberts et al. 2022, Hayes et al. 2024). The Block Canyon area in particular appears to be part of a primary pathway for sperm whales in Southern New England pursuing migrating squid (CETAP 1982, Scott and Sadove 1997). During the summer months, movement and abundance increase, with distribution spreading even farther north onto Georges Bank, onto the continental shelf in Southern New England, and into the Northeast Channel (Roberts et al. 2022, Hayes et al. 2024). In fall, high numbers of sperm whales remain on the continental shelf south of New England and most presence is predicted along the continental shelf break in the mid-Atlantic (Roberts et al. 2022, Hayes et al. 2024).

Another factor influencing sperm whale distribution and migration patterns is social structure. The complex social dynamics exhibited by sperm whales ultimately determine their movements, where adult females (some related to each other and some not) travel with their calves and sub-adult offspring. Because these social groups are stable, there is evidence of site fidelity and latitudinal range limits for females, their calves, and juveniles (Whitehead 2002). Females rarely, if ever, migrate north of the southern boundary of the Canadian EEZ while adult males regularly migrate to and from polar regions to feed and breed (Best 1979, Reeves and Whitehead 1997, Whitehead 2002, Engelhaupt et al. 2009).

Figure 1. Conservation status of sperm whale in North America (NatureServe 2024).

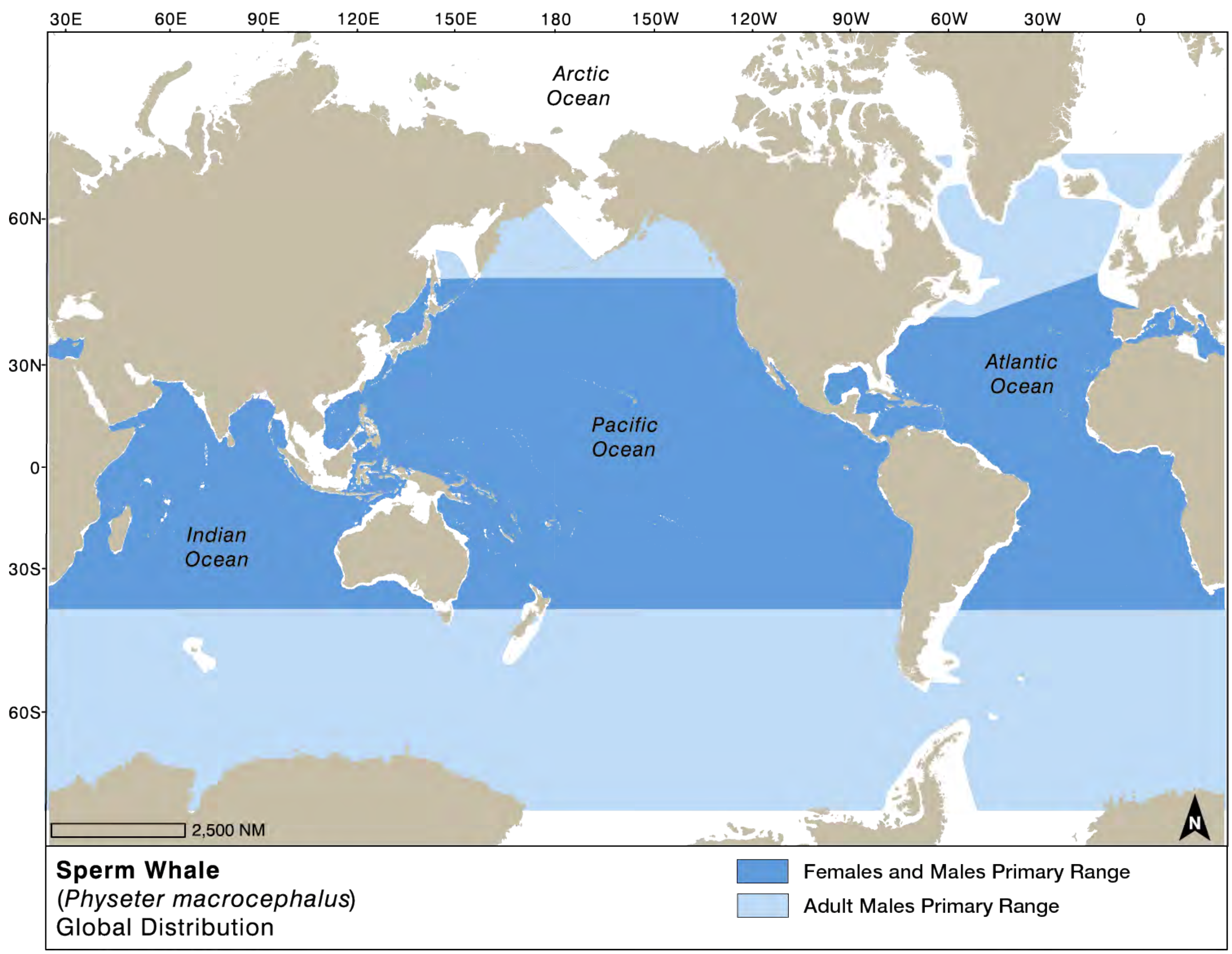

Figure 2. Sperm whale global distribution. Adapted by Nina Lisowski from Würsig,B., Thewissen, J.G.M. and Kovacs, K.M. Editors (2018) "Encyclopedia of Marine Mammals", 3rd ed. Academic Press, Elsevier: San Diego, CA (IWC 2025b).

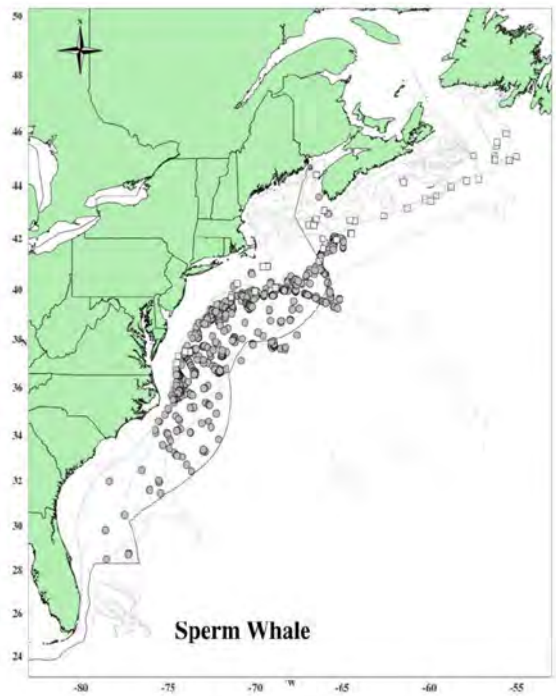

Figure 3. Distribution of sperm whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1998, 1999, 2002, 2004, 2006, 2011, 2016 and 2021 and Department of Fisheries and Oceans Canada 2007 TNASS and 2016 NAISS surveys. Isobaths are the 100m, 1,000m, and 4,000m depth contours. Circle symbols represent shipboard sightings and squares are aerial sightings (Hayes et al. 2024).

III. New York Rarity *(provide map, numbers, and percent of state occupied)*

Years	# of Records	# of Distinct Waterbodies/Locations	% of State
Pre-1995			
1995-2004			
2005-2014			
2015-2023			

Table 1: Records of sperm whale in New York.

Details of historic and current occurrence:

During the early days of American whaling some sperm whales were killed in waters off Long Island but Murphy (1918) noted that generally, sperm whales avoided shallow waters and therefore did not get close enough to be sited from shore. Peak whaling years in Sag Harbor, New York were the late 1830s to 1840s, followed by a rapid decline and eventual final whale hunt in 1871. Townsend (1935) mapped favored whaling grounds, including one southeast of Long Island known as the “Southern Ground”; the western edge of the area aligned with the continental shelf off New York. Influenced by the Gulf Stream, sperm whales were killed on this whaling ground from May to September, and the whales found closest to Long Island were present May through July.

Connor (1971) claimed the oldest record of a sperm whale stranding in New York was a 12-meter whale captured in Fishers Island Sound in December 1894. A different stranding account stated that there was indeed an earlier stranding, a 4.8-meter sperm whale in East Hampton in March 1891. Additional historic stranding records in New York include a 39-foot female that stranded alive on Fire Island in February 1918 but died soon after (Murphy 1918, Connor 1971) and an 18-foot young male sperm whale that swam inside New York Harbor and into Upper New York Bay, where it was captured alive but subsequently died (Raven and Gregory 1933).

Despite the period of lucrative whaling just offshore, Connor (1971) reported that sperm whales are “very rare near the shores of Long Island” and are “uncommon offshore”. If this was the case in the 1970s, it did not last long. Beginning in the late 1970s and continuing well into the 1990s, a local group collected cetacean sightings mostly during whale watch cruises (Sadove and Cardinale 1993, Scott and Sadove 1997). From 1981 to 1995, sperm whales were documented in 8 of the 14 years in shallow coastal waters off Long Island (Scott and Sadove 1997). Sightings were made in an average water depth of 55 meters during late spring and early summer months (e.g., May through July) on nearly 30 separate occasions. Sightings included either single animals or groups of up to seven individuals. No calves were recorded, but both sexes and all other age classes were seen, and the longest continuous sighting period was seven weeks. Scott and Sadove (1997) noted that the “whales do not appear to be transient visitors but take up a short-term residence”. Most of these whales were sighted in a seafloor depression marking a channel between Block Island Sound and Block Canyon (Scott and Sadove 1997). Scott and Sadove (1997) speculated that the channel is used to follow prey (e.g., spawning squid) inshore during late spring and early summer. Therefore, sperm whales took up a “short-term residence” of one to four weeks before migrating farther east. At that time, sperm whales were typically not reported off Long Island after July.

Southern New England is one of the rare locations in the world where sperm whales occur frequently well inshore of the shelf break (CETAP 1982, Scott and Sadove 1997). Sightings on the shelf in waters shallower than 200 m have occurred in all four seasons, many of them aggregated in the relatively narrow channel off Montauk Point. Notable sightings recorded in this location are: a multi-species feeding aggregation in July 1983 including one sperm whale, six fin whales, one humpback whale, and two minke whales; three mature male sperm whales in May 1997, which were resighted for three weeks, and a separate May 1997 sighting of multiple adults amongst squid at the surface; and a September 1994 sighting in which two of the four whales were breaching, an uncommon behavior for sperm whales.

CETAP surveys were conducted from 1979 through 1981, from Cape Hatteras, North Carolina to Nova Scotia, Canada. In total, the program recorded 341 sightings of 1,034 individual sperm whales (CETAP 1982). The number of individuals per sighting ranged from 1 to 100 with an average of 3. Sperm whale distribution was centered at the 1,000-meter depth contour but extended seaward of the 2,000-meter contour, confirming that sperm whale habitat extends well beyond the shelf edge and into mid-ocean areas. CETAP surveys also documented shoreward presence related to squid in southern New England, which was most common from August to November and occurred in areas as shallow as 60 meters. Many sightings included calves and juveniles, which were most common off New York in summer. Abundance estimates specific to the New York Bight were 27 individuals in spring, 63 in summer, 17 in fall, and zero in winter (CETAP 1982). Some sightings were recorded in September and October, but since the whale watch was not operational in the fall and winter, it is unknown whether the few additional fall sightings represented a seasonal return to New York waters or were random, chance sightings (Scott and Sadove 1997). Though these were opportunistic sightings, 17 individual sperm whales were identified in this inshore New York area, which produced an estimate of 102 animals.

Based on data collected since the 1990s, sperm whale presence in New York appears to have remained consistent. Towed arrays of acoustic devices have picked up extensive vocalizations of sperm whales at the shelf break and into the abyssal plain (PACM 2025). There is a steady presence throughout the year though numbers are slightly higher in summer and fall then decrease in spring (PACM 2025).

During the 2017-2020 DEC Whale Monitoring Program, aerial surveys recorded 72 individuals in 32 sightings (Zoidis et al. 2021). The sightings occurred during all survey years and all calendar months except May and November. The sighting rate was highest in summer followed by spring, fall, then winter. Group size ranged from 1 to 7 individuals and four calves were seen. There were 18 single-animal sightings, five pairs (including mother-calf pairs), and nine groups of 3+ individuals (including mother-calf pairs). Newly described behavioral observations for sperm whales in the NYB are rosette formation, phalanx (shoulder to shoulder) formation, and nursing (Zoidis et al. 2023), as well as a record of socio-sexual behavior in which mating could not be ruled out (Rickard et al. 2022).

The 2017-2020 DEC Whale Monitoring Program passive acoustic monitoring (PAM) effort was also successful in detecting the presence of sperm whales (Estabrook et al. 2021). However, sampling effort for sperm whales was inconsistent due to limited capability (4 of 14 receivers were able to detect sperm whales) and receiver malfunction (no data was collected during the third survey year). During the first year, sperm whales occurred mostly between January and September 2018, with a mean percent calendar-day presence of 58%. Sperm whales were not detected during November 2018 – February 2019. During the second year, sperm whales were detected between May and September 2019, with a mean percent calendar-day presence of 25%. Both years showed lower presence of sperm whales during fall months. Sperm whales were detected at all four receiver locations, with highest presence near the shelf edge. Interestingly, sperm whale presence was also recorded at the receiver location closest to New York Harbor. Per historic documentation, it’s not unheard of for sperm whales to travel inshore towards the harbor hunting squid. Importantly, sperm whale presence in this area was also visually documented during the NYSERDA digital aerial surveys. In total, the NYSERDA survey documented 13 sperm whale sightings, most in the summer and some in fall and winter. Generally, sperm whale records in New York indicate presence concentrated at the shelf edge through all seasons (Johnson et al. 2021). Additionally, sperm whales are tagged annually off the coast of Virginia during vessel-based surveys (Engelhaupt et al. 2018, 2019, 2020, 2023). Sperm whales were only recorded in waters deeper than 1,000 meters and tagged individuals traveled mostly in waters deeper than 1,000 meters and in all directions (north to Georges Bank, offshore to the Gulf Stream, and south to Blakes Plateau). Available tag data to date shows a maximum dive depth of 2,127 m and maximum dive duration of 70 minutes (Engelhaupt et al. 2019).

The Ocean Biogeographic Information System (OBIS) Spatial Ecological Analysis of Megavertebrate Populations (SEAMAP), or OBIS-SEAMAP, is an online database for marine mammal records that is contributed to by researchers from all over the world (Halpin et al. 2009). There are 186 records for sperm whales in the Offshore Planning Area developed by NYS Dept. of State, 52 of which are from the past 10 years.

New York’s Contribution to Species North American Range:

Percent of North American Range in NY	Classification of NY Range	Distance to core population, if not in NY

1-25%	Core	

Column options
Percent of North American Range in NY: 100% (endemic); 76-99%; 51-75%; 26-50%; 1-25%; 0%; Choose an item
Classification of NY Range: Core; Peripheral; Disjunct; (blank) or Choose an item

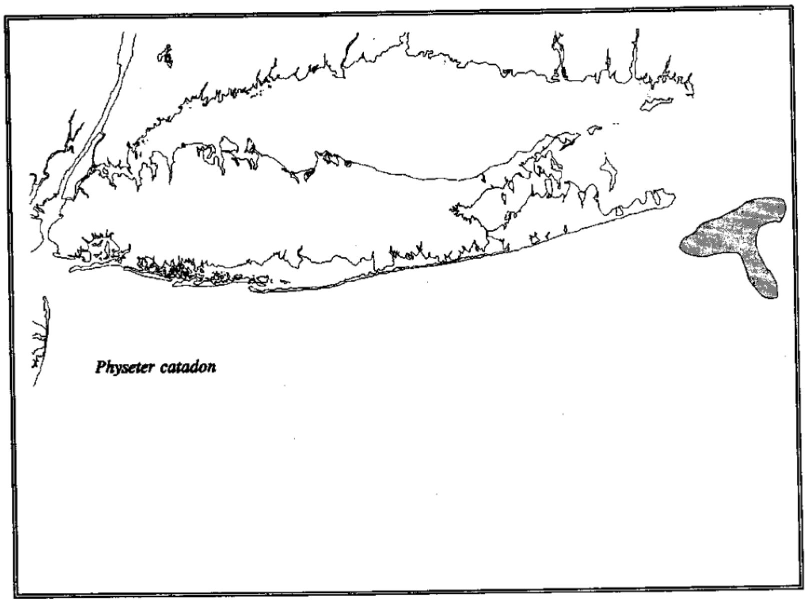

Figure 4. Sighting locations of sperm whales from the 1970s to the early 1990s (Sadove and Cardinale 1993).

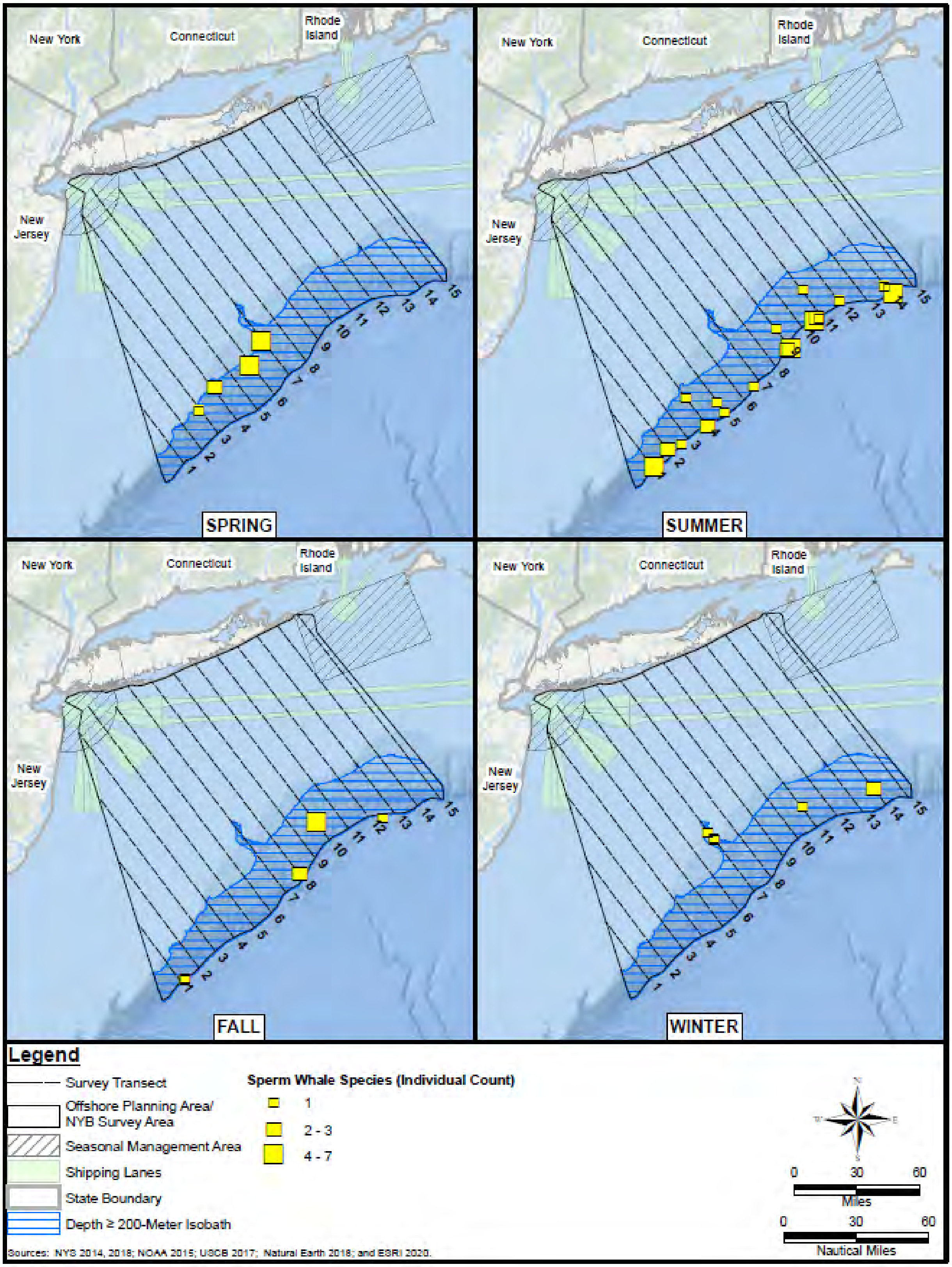

Figure 5. Locations of all sperm whale sighting by count and season for Years 1, 2, and 3 (Tetra Tech and LGL 2020).

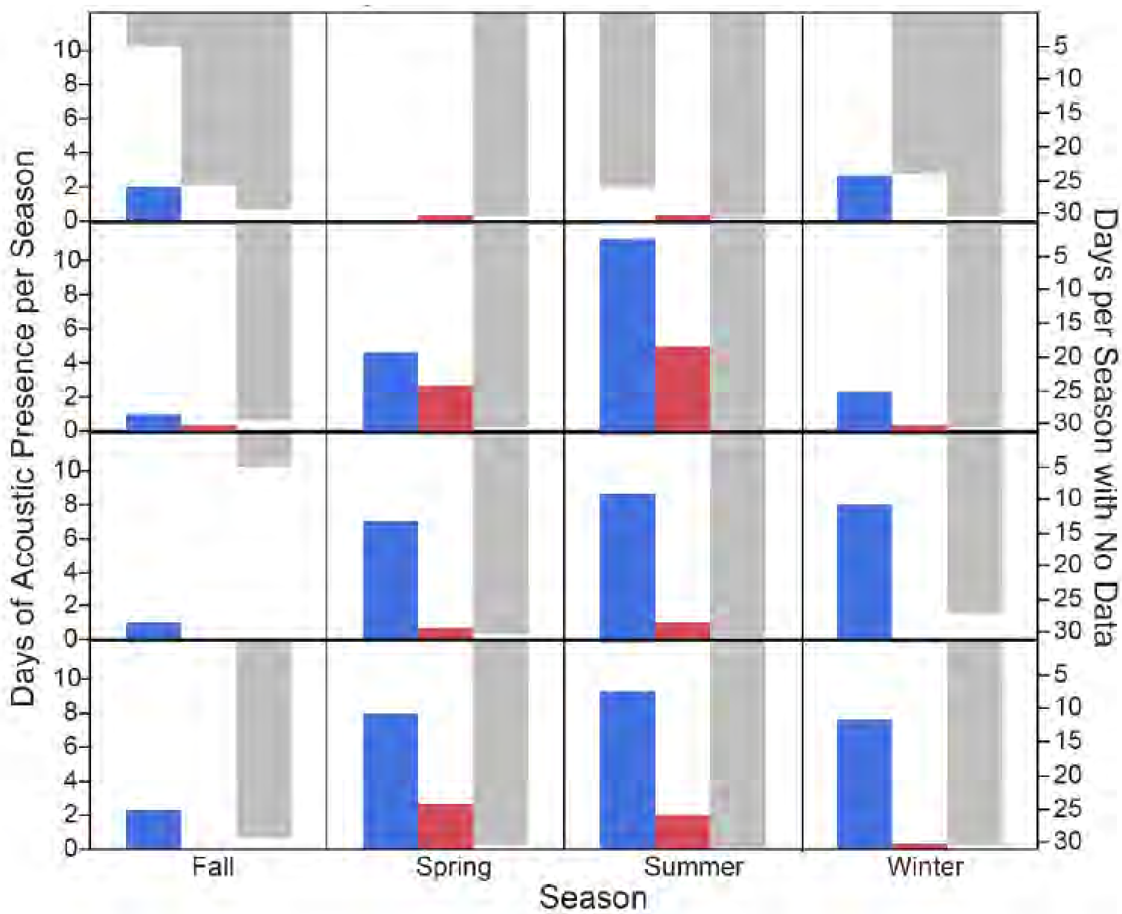

Figure 6. Interannual sperm whale seasonal acoustic presence in New York Bight for survey Year 1 (blue) and Year 2 (red) as a function of days with acoustic presence per month. Data gaps are shown in gray as the number of days missing per month (no data was collected during Year 3; Estabrook et al. 2021).

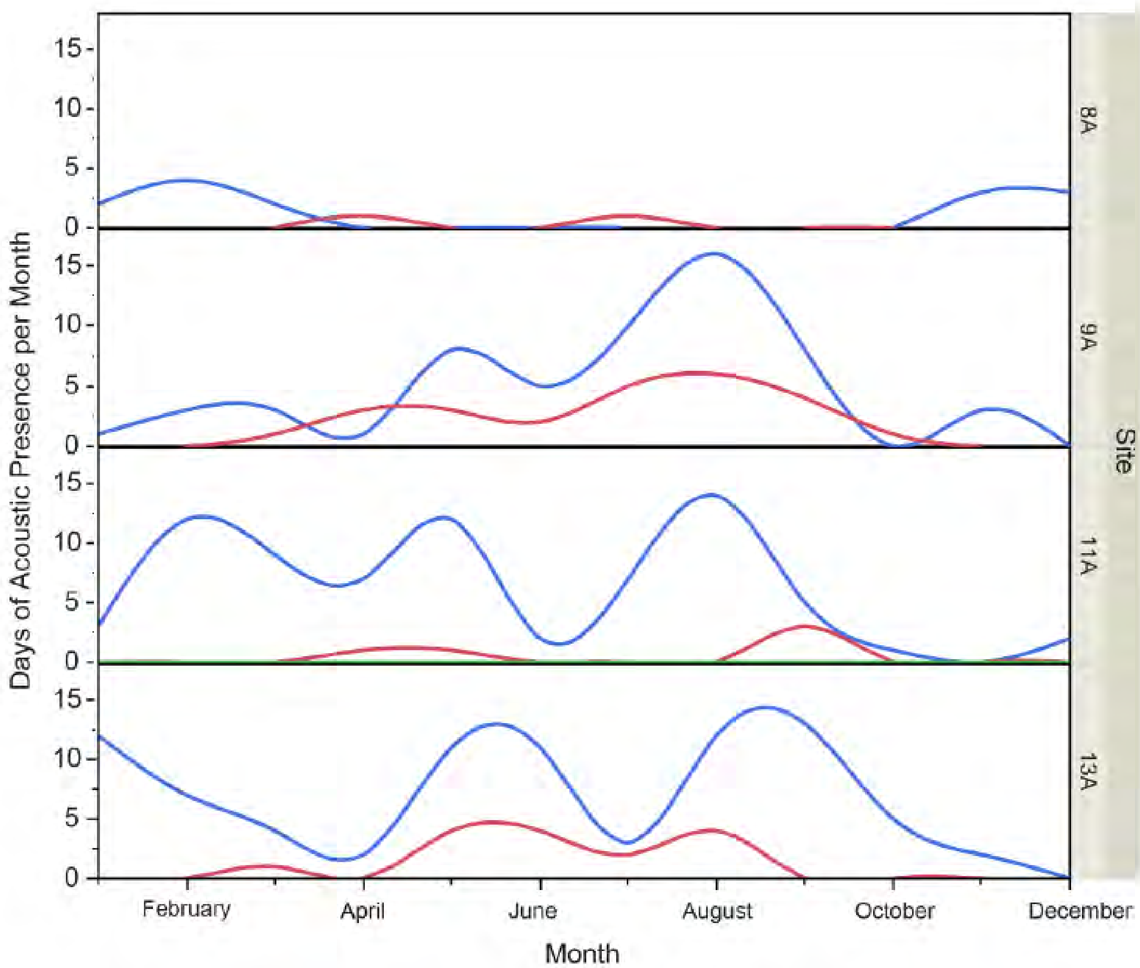

Figure 7. Interannual sperm whale monthly acoustic presence per site in New York Bight for Year 1 (blue) and Year 2 (red) as a function of days with acoustic presence per month (Estabrook et al. 2021).

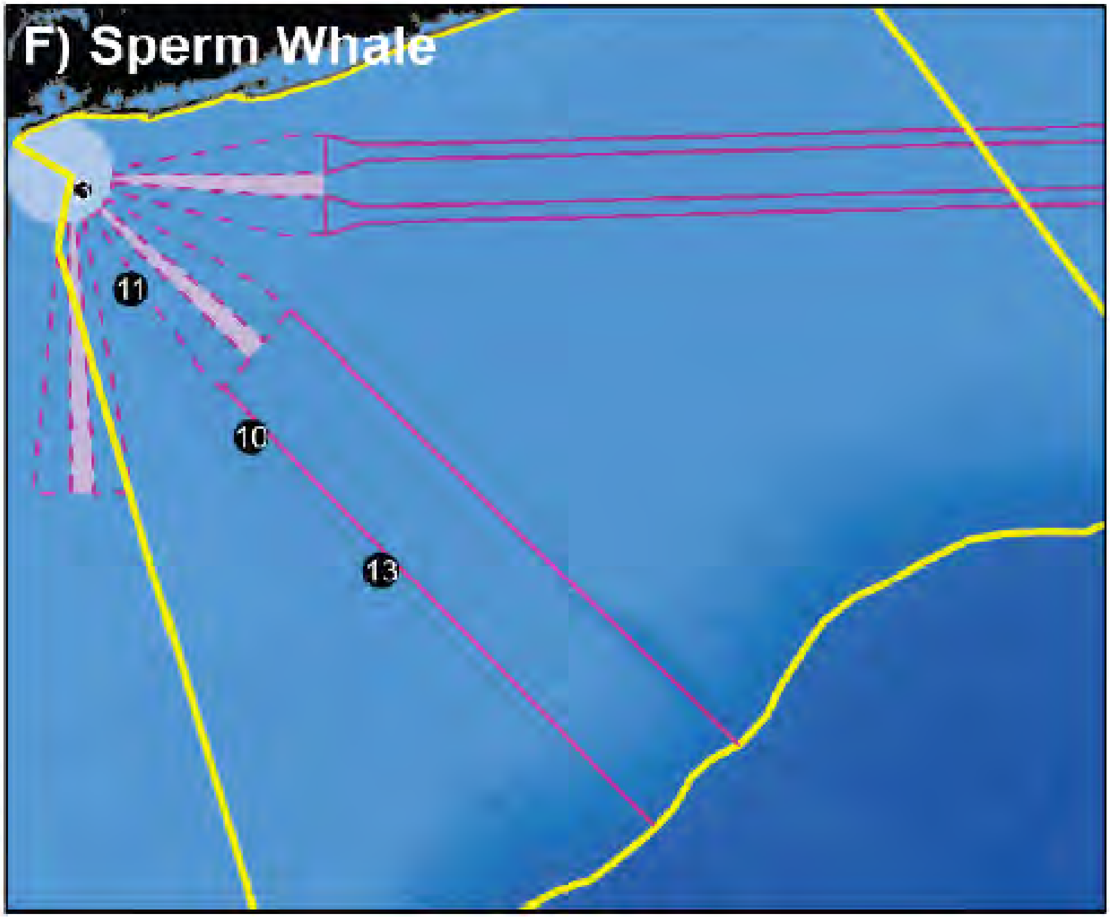

Figure 8. Cumulative spatial distribution of acoustic detection from sperm whales within the New York Bight across 3 survey years. The black circles correspond to the position of recording instruments and are proportionately scaled in size for the percentage of days (white text) with detections over total days recorded (Estabrook et al. 2021).

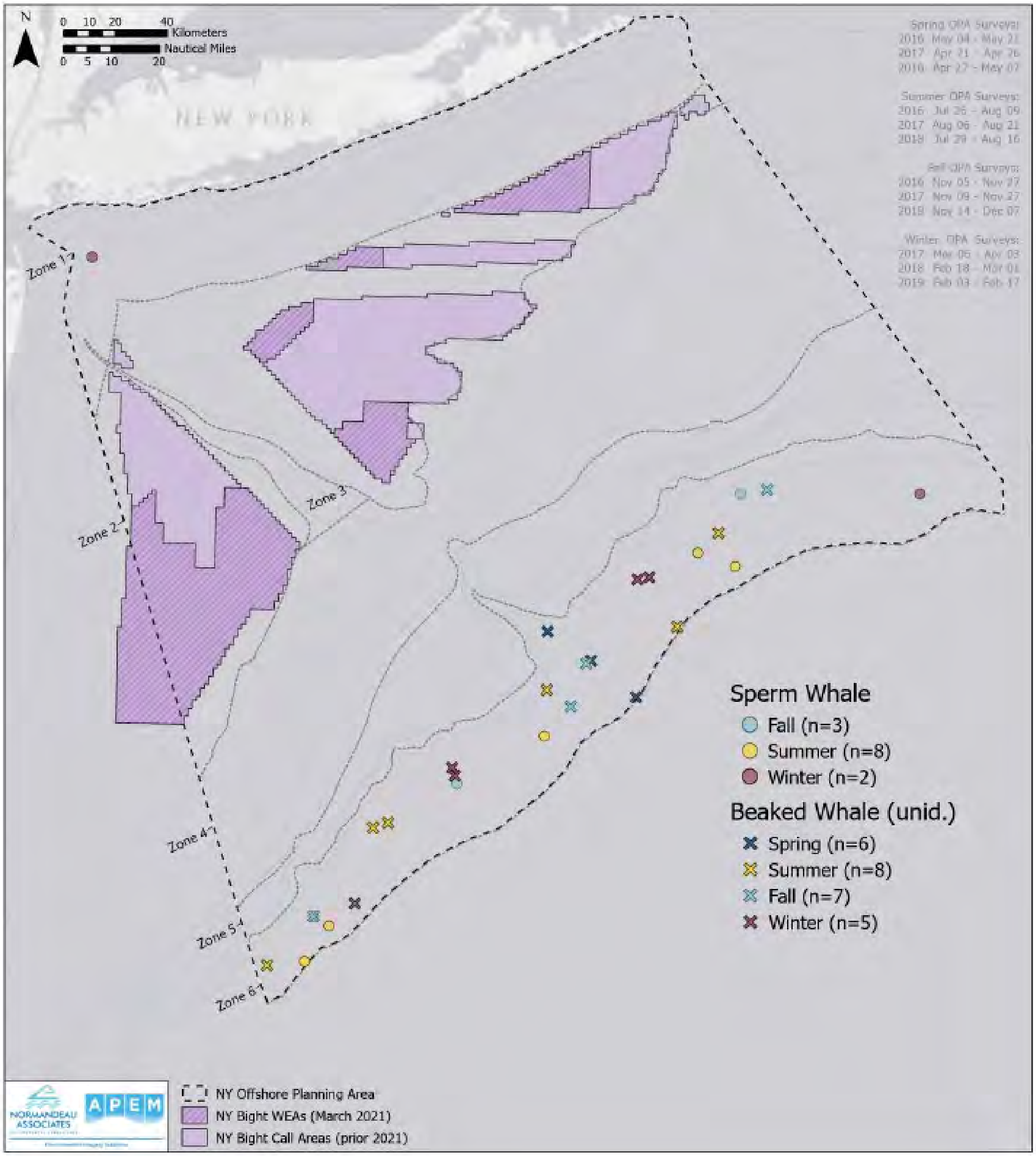

Figure 9. Spatial distribution of mid-frequency cetacean species with fewer than 30 occurrences across all surveys (NYSERDA 2021).

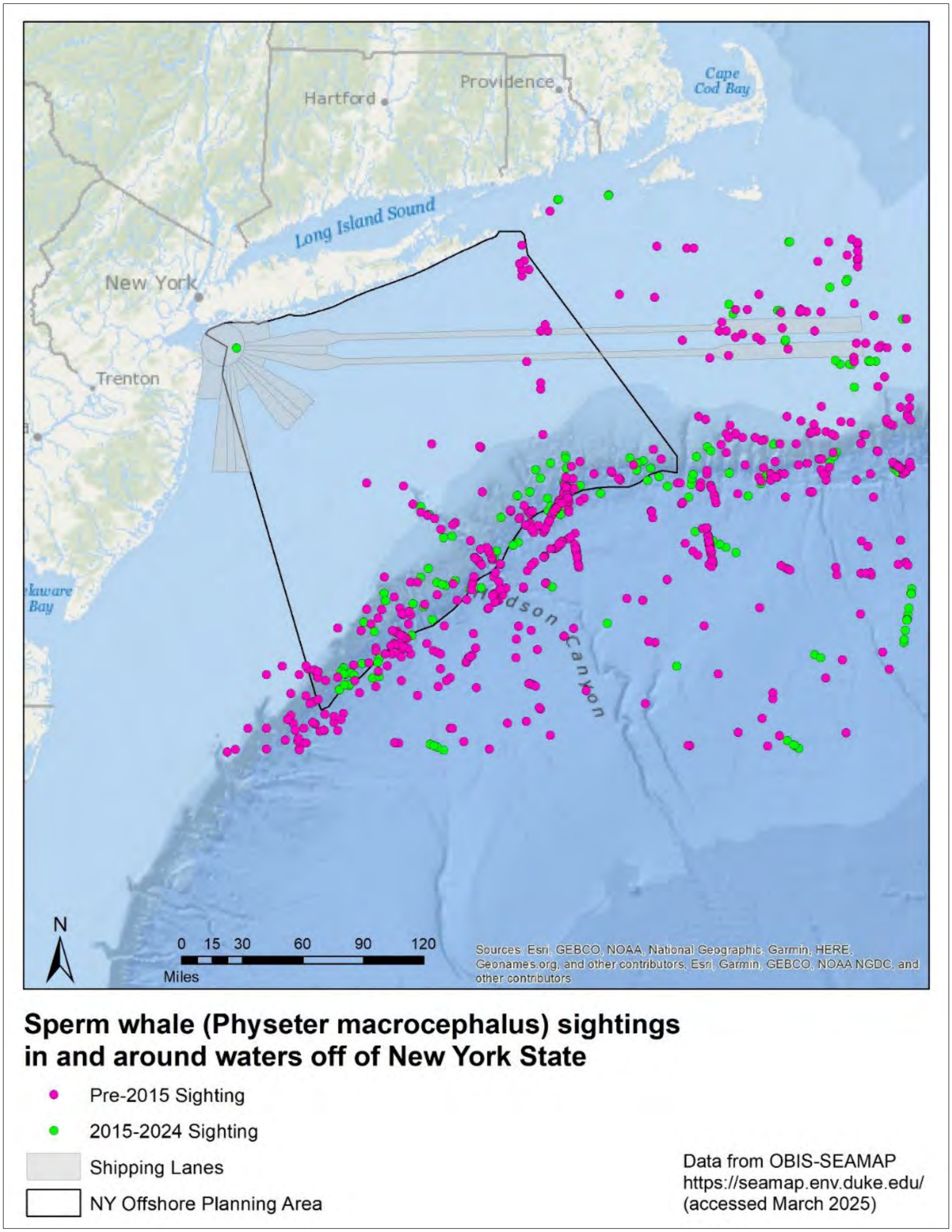

Figure 10. Records of sperm whales in New York. Data downloaded from OBIS-SEAMAP and mapped in ArcMap10.2.

IV. Primary Habitat or Community Type *(from NY crosswalk of NE Aquatic, Marine, or Terrestrial Habitat Classification Systems):*

a. Pelagic

b. Marine, Deep Subtidal

Habitat or Community Type Trend in New York

Habitat Specialist?	Indicator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
Yes	Yes	Unknown	

Column options
Habitat Specialist and Indicator Species: Yes; No; Unknown; (blank) or Choose an item
Habitat/Community Trend: Declining; Stable; Increasing; Unknown; (blank) or Choose an item

Habitat Discussion:

Almost all marine waters deeper than 1,000 meters and not covered by ice are sperm whale habitat (Rice 1989, Whitehead 2003). Sperm whale distribution on the U.S. East Coast centers around the continental shelf edge, at approximately the 1,000-meter depth contour, and farther offshore into open ocean (CETAP 1982, Waring et al. 2001). Deep waters in the mid-Atlantic Bight are an area of sperm whale concentration year-round (CETAP 1982). They often show a strong preference for areas of high sea floor relief, like seamounts and underwater canyons (Rice 1989, Waring et al. 2001). Sperm whales are also often associated with the Gulf Stream edge and warm-core eddies (Waring et al. 1993, 2001). For example, the seamount chain off New England is an important foraging area for sperm whales due to productivity provided by the Gulf Stream(Wong and Whitehead 2014). Though few sightings are documented in waters less than 200 m deep, North Atlantic sperm whales, especially males, are known to occur in shallow waters (Leatherwood et al. 1976). These seasonal movements onto the continental shelf, usually in spring and fall, bring sperm whales into nearshore waters less than 100 m deep (CETAP 1982, Whitehead et al. 1992, Whitehead and Kahn 1992, Scott and Sadove 1997).

Distribution seems to be driven primarily by suitability of the area for breeding and the availability of prey. Sperm whale diet consists of mostly large squid but can also include sharks, skates, fish, and octopus (Rice 1989, NMFS 2024). Sperm whales are able to perform long, deep dives to access their prey and use echolocation to hunt. Dives regularly last more than 60 minutes and reach depths of 600 m (NMFS 2024). Most sperm whales feed from 500 to 1000 m below the surface and regularly throughout the year. Lockyer (1981) estimated that sperm whales consume around 3% of their body weight per day.

In addition to localized feeding movement, sperm whales also exhibit long-distance migrations related to reproduction and social organization (CETAP 1982). Even in winter, sperm whales are present at low to moderate levels along the shelf edge in the mid-Atlantic and along the southern edge of Georges Bank (CETAP 1982). This is because males range farther north into cooler waters than females, calves, and juveniles, which remain in temperate and tropical waters year-round (NMFS 2010). During the CETAP surveys, the average water temperature was 17.7 degrees Celsius, the warmest out of all the large whales, and 90% of sperm whale sightings were in water temperatures between 9.5 and 26 degrees Celsius (CETAP 1982). Sexually mature males then join these groups throughout the winter to mate (NMFS 2010).

Roberts et al. (2022) developed a single, year-round density model that incorporated survey data from 1998-2019 and provided monthly predictions for sperm whales. The model highlighted significant habitat covariates including sea surface temperature (sperm whale density increased above 17 degrees Celsius), bottom salinity (density declined), bottom temperature (less sperm whales present if 18 degrees Celsius or greater), anticyclonic eddies (more whales predicted closer to these eddies), fronts (fewer animals predicted farther away), and the 1,500-m isobath (fewer animals predicted farther away).

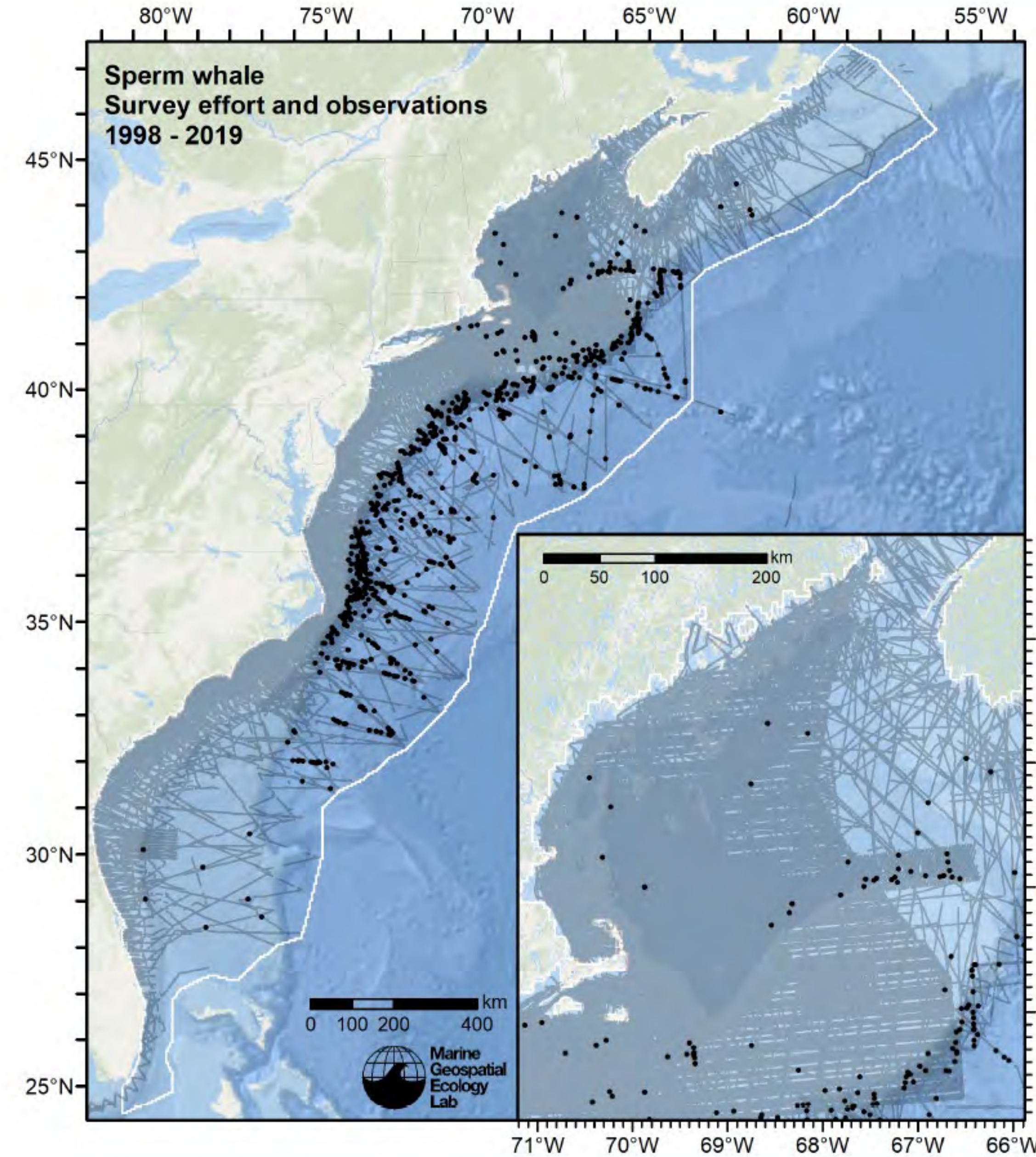

Figure 11. Survey effort and sperm whale observations available for density modeling, after detection functions were applied, and excluded segments and truncated observations were removed (Roberts et al. 2022).

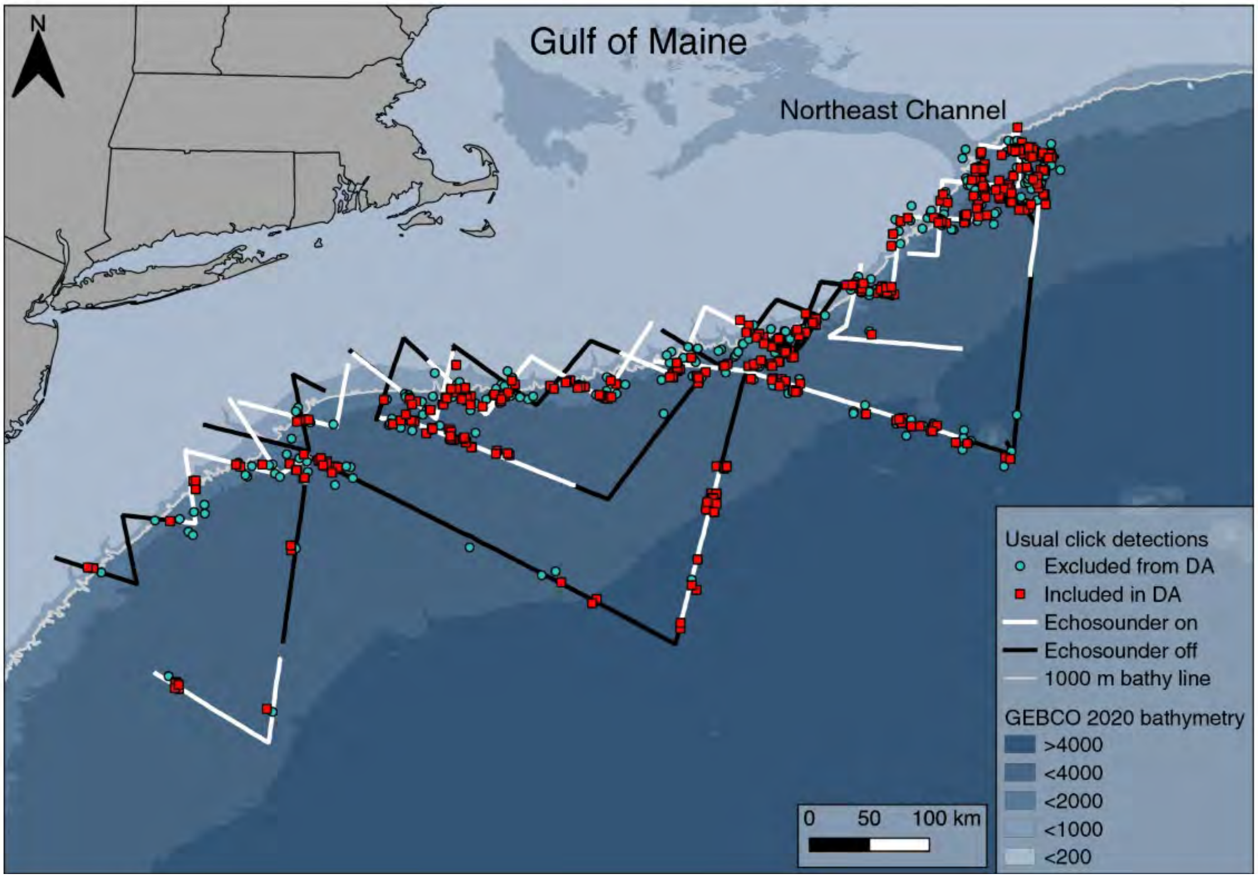

Figure 12. Map of the AMAPPS acoustic survey conducted between June 27 and August 25, 2016, covering 5661 km. Red and green circles are acoustic click detections (Westell et al. 2022).

V. Species Demographics and Life History

Breeder in NY?	Non-breeder in NY?	Migratory Only?	Summer Resident?	Winter Resident?	Anadromous/ Catadromous?
Unknown	Choose an item.	No	Yes	Yes	Choose an item.

Column options
First 5 fields: Yes; No; Unknown; (blank) or Choose an item
Anadromous/Catadromous: Anadromous; Catadromous; (blank) or Choose an item

Species Demographics and Life History Discussion *(include information about species life span, reproductive longevity, reproductive capacity, age to maturity, and ability to disperse and colonize):*

Sperm whales are known to live for at least 60 years, with females potentially living up to 80 years (Rice 1989, Whitehead 2003). Sperm whale generation time has been calculated to be just over 27 years (Taylor et al. 2019). A sperm whale's large, squarish head is one-third of its body size and contains most of the oil that the species was hunted for (DeKay 1842). Oil was also obtained from the blubber, which can be 8 to 14 inches thick (DeKay 1842). The blow hole is set at an angle and offset on the top left side of the head, creating a unique blow that is distinctly slanted. Sperm whales have between 30 and 50 conical teeth on a long, narrow lower jaw. When foraging, the long jaw and teeth help capture deep-sea squid. They are dark gray in color and have a dorsal ridge or “humps” rather than a traditional dorsal fin. Photographs of distinctive markings on the dorsal ridge and flukes of sperm whales are used in studies of life history and behavior (Whitehead 1990).

Sperm whales display extreme sexual dimorphism, with adult males nearing three times the mass of adult females. The average age of physical maturity is 45 years for males and 30 years for females (Best 1974, Best et al. 1984, Lockyer 1981, Rice 1989). Adult weight averages 57 metric tons for males and 24 metric tons for females (Rice 1989). Female sperm whales reach sexual maturity at around nine years of age (Rice 1989, Whitehead 2003). Sexual maturity among males is prolonged and occurs between the ages of 10 and 20, with an average of 19 years, though males are generally not active breeders until their late twenties (Best 1979). Length at sexual maturity averages 11-12.5 meters for males and 8.3-9.2 meters for females. In the Northern Hemisphere, mating occurs from December to August with a peak breeding season from March to May during the spring migration north (Katona et al. 1978, Best et al. 1984). Gestation lasts over a year and is believed to range from 15 to over 18 months. Births typically occur in late summer to early fall, from July to November (Katona et al. 1978, NMFS 2010). Length at birth is about four meters. The calving interval is estimated to be about four to six years and females rarely become pregnant after the age of 40 (Best et al. 1984, Whitehead 2003). Females nurse their offspring for at least two years (Katona et al. 1978, Best et al. 1984). Nursing females may change their vocalizations and separate from their social unit (Gero et al. 2013). However, alloparental care has been well documented in sperm whales, with many individuals from the social unit participating in caring for calves. Females may also feed calves that are not their own, a phenomenon called allonursing (Gero et al. 2009).

Sperm whales have a complex, multilevel society. Like other odontocetes, they are extremely social and live in permanent matrilineal groups (Whitehead 2003). The basic unit of sperm whale social organization is the mixed school, consisting of adult females of all ages (both related and unrelated), juvenile males, and calves (Best 1979, Christal et al. 1998). Mixed schools are predominantly female (70% or more) and usually consist of 20 to 30 animals (Christal et al. 1998). Adult females in the school are closely related, and the calves and immatures of both sexes are their offspring. Mixed schools travel together, care for each other’s offspring, and defend each other (Whitehead 1998, Christal et al. 1998, Pitman et al. 2001, Gero et al. 2008, Ortega-Ortiz et al. 2012). There is evidence that these bonds persist for many years, and most females remain within their social unit their entire life (Christal et al. 1998). These stable social units generally stay within temperate and tropical waters, and home ranges extend approximately 2,200 km in any direction (Whitehead et al. 2008). In the North Atlantic, sperm whales tend to aggregate in smaller groups and exhibit higher calving rates than other oceans, likely due in part to the lack of predation pressure by killer whales (Whitehead et al. 2012). Other social units such as nursery schools, harem or mixed schools, juvenile schools, bachelor schools, bull schools or pairs, and solitary bulls have also been identified (Best 1979, Whitehead et al. 1991, Christal et al. 1998). These social units may join other groups, and multiple groups may then comprise a clan, though clans are unlikely to occur in the North Atlantic Ocean (Whitehead et al. 2012).

Males typically leave their mothers around age 10 to move to colder waters and form bachelor groups, (Christal and Whitehead 2001, Whitehead 2003). Evidence of the bonding among males is seen in the mass strandings of adult males around Europe and the long-term relationships formed by juvenile males in the Mediterranean Sea (Pace et al. 2014, IJsseldijk et al. 2018). During their prime breeding period, male sperm whales are usually solitary. They travel south in the winter from near-polar waters and move among and between mixed schools (Christal and Whitehead 2001, Whitehead 2003). Male sperm whales are known to fight among each other for dominance or during courtship of females (Best 1979, NMFS 2010). The extent of intraspecific fighting can result in broken or missing teeth, broken jaws, and sometimes death (Clarke and Paliza 1988). Most “sexual fighting” is done by males over 50 ft in length (Clarke and Paliza 1988). A male’s association with a female group can be as short as a few hours due to the tendency for females to enter estrus synchronously (Best and Butterworth 1980). New research shows that adult males initiate migration for breeding at any time of year, suggesting there is not actually a specific breeding season (Lydersen et al. 2025). Satellite tag data from this study also showed an average travel time of 40 days to reach breeding areas, an average of 76 days spent roaming in lower latitudes, and an average round trip of 180 days (Lydersen et al. 2025).

Hearing and acoustics, specifically for communication and hunting, are essential to a sperm whale. The sperm whale's disproportionately large head is an evolutionary adaptation and evidence of the importance of sound to their survival (Clarke 1979, Cranford 1992). Southall et al. (2007) categorized sperm whales as mid-frequency cetaceans, the same hearing groups as dolphins, beaked whales, and bottlenose whales. Most sperm whale clicks are 2-4 kHz and 10-16 kHz (NMFS 2010). Sperm whales produce four different types of sound: codas, usual clicks, creaks, and slow clicks (Weilgart and Whitehead 1988). Codas are distinctive, short, patterned series of clicks and are associated with social behavior (Weilgart and Whitehead 1993). They are shared among individuals of a social unit and are primarily for intra-group communication to reinforce social bonds (Weilgart and Whitehead 1997, Schulz 2008). When socializing, sperm whales repeat codas, which have a specific rhythm and last for hours (Watkins and Schevill 1975). Certain acoustic features of codas may be unique to individual sperm whales within a social unit, allowing for distinction among members (Antunes et al. 2011). Schulz et al. (2011) found that mother/calf pairs had different vocalizations from other group members; adult females were able to switch from the social unit coda to a distinctive vocalization to locate and nurse her calf, suggesting that adults with calves rely on unique calls to locate each other and maintain the social bond. Further studies suggest that distinct coda dialects are culturally transmitted (Rendell et al. 2012, Whitehead et al. 2012). Usual clicks are separated by one second or less and used when sperm whales are diving (Whitehead and Weilgart 1991). These clicks can be used for feeding, contact calls, and orientation during dives. Creaks, on the other hand, are very rapid and used when a sperm whale narrows in on prey. It's believed sperm whales adapted this vocalization to capture prey specifically (Miller et al. 2004). Slow clicks are separated by five seconds or more and are believed to be made only by adult males in the context of mating (Mullins et al. 1988).

Natural Mortality

Both predation and disease are components of natural mortality in sperm whales. Little is known about the full impact disease has on sperm whale populations (Lambertsen 1997, NMFS 2010). Lambertsen (1997) identified two potentially lethal diseases in sperm whales: myocardial infarction and gastric ulceration as a result of nematode infection. Bone lesions have also been observed in sperm whales, which Moore and Early (2005) hypothesized could be caused by the formation of nitrogen bubbles after deep dives and ascents. The bone necrosis appeared to be cumulative, with the bone damage increasing in severity as the size of the whale increased (Moore and Early 2005). A live-stranded sperm whale in Belgium tested positive for a pathogen known to cause sepsis, which produces disorientation and impaired echolocation and likely caused the whale to strand (Cools et al. 2013). It's unknown if parasitism can affect sperm whales on a population level; though parasites may have no impact on healthy animals, effects could become significant if combined with other stressors (NMFS 2015).

There have been several accounts of killer whales harassing and/or attacking sperm whales, though all existing published records of attacks are from either the Pacific or Southern Oceans. Attacks can result in death, but the risk of mortality is believed to be low (Pitman and Chivers 1998, Pitman et al. 2001). There is a surprising record of a group of killer whales killing a seemingly healthy adult female sperm whale off the coast of California (Pitman and Chivers 1998). Sperm whale calves are especially vulnerable to predation by killer whales and likely large sharks (Best et al. 1984, Arnbom et al. 1987). Sperm whale remains have been found in the stomachs of sharks but were most likely from carcasses rather than live animals (Rice 1989). Sperm whales are also harassed by pilot whales (*Globicephala spp.*) and false killer whales (*Pseudorca crassidens*), but most "attacks" by these species do not kill sperm whales (Palacios and Mate 1996, Weller et al. 1996, Fernandez et al. 2022).

Mass strandings may also be a source of natural mortality for sperm whales because the cause(s) of these stranding events are relatively unknown (Rice 1989, NMFS 2010, NMFS 2015). Evidence from mass strandings in different oceanic regions has pointed to a number of potential causes, including lunar cycles, solar cycles, wind patterns, topography, geomagnetic field changes, changes in water temperature or prey distribution, and pollution (Evans et al. 2005, Vanselow and Ricklefs 2005, Wright 2005, Vanselow et al. 2009).

VI. Threats *(from NY 2015 SWAP or newly described)*

Whaling

Despite the international moratorium on whaling, from 1986 through 2013, IWC member states, under reservation or objection, reported harvesting 388 sperm whales (NMFS 2015). While there is currently no evidence of any country targeting sperm whales for direct harvest, the residual effects of whaling continue to affect present-day populations. Removals of large numbers of males may have had lingering effects on pregnancy rates in some subpopulations and large males are rare on some breeding grounds (Best 1979, Whitehead et al. 1997, Whitehead 2003). For example, the Nova Scotian sperm whale fishery's catch between 1966 and 1972 was 98% males (Sutcliffe and Brodie 1977). The importance of females in sperm whale societies and survival cannot be understated (Whitehead et al. 1997, Best 1979, Best et al. 1984). The removal of large numbers of females from social groups, and older females in particular, is most likely disruptive to sperm whale populations. Recovery might be slowed by temporary or permanent loss of social cohesion and of socio-ecological knowledge, as is known to occur in other large-brained, long-lived social mammals such as elephants. Reeves et al. (2011) estimated that 1,179 sperm whales were caught during whaling in the Gulf of Mexico between the 1780s and 1870s, most of which were juveniles and females. The cumulative effects of such removal of breeding capacity and generational knowledge are still unknown.

Vessel Strikes

Vessel strikes of cetaceans have increased over the years (Ritter 2012). Over the past 50 years, increasing vessel traffic has been correlated with a three- to four-fold increase in the number of large whales reportedly struck by vessels annually (Vanderlaan et al. 2009). The increasing number of incidents is likely related to a combination of factors, one of which is the increase in vessel numbers, sizes, and transits (Redfern et al. 2020, Womersley et al. 2023). The global shipping fleet doubled in size from 2005 to 2022, and it's estimated that the number of vessel transits could increase by up to 1200% by 2050 (Sardain et al. 2019, Womersley et al. 2023). The increase in strikes is also related to variable species distributions as habitats shift due to climate change (Meyer-Gutbrod et al. 2023, Redfern et al. 2020).

Vessel speed is a primary factor in lethal vessel strike events involving whales, with faster vessel speed increasing the likelihood of interactions and mortality resulting from an interaction (Vanderlaan and Taggart 2007, Conn and Silber 2013, Garrison et al. 2025). Using simple biophysical models, Kelley et al. (2021) determined that whales can be seriously injured or killed by vessels of all sizes and that a collision with a 50-ton vessel transiting at seven knots has a probability of lethality greater than 50%. Vessel strikes can cause broken bones and massive internal injuries, known as blunt force trauma, or cuts from propellers (e.g., lacerations), known as sharp force trauma. Importantly, there is not always obvious external impacts with blunt force trauma, which requires a necropsy for determination (Moore et al. 2013).

Vessel strikes are believed to be more of a problem than observational studies suggest, as many events are most likely not reported and affected whales may die offshore and never be seen (Heyning and Lewis 1990). Williams et al. (2011) estimated that the carcass recovery rate for sperm whales was, on average, only 3.4% of the actual mortalities. For example, during the AMAPPS spring 2023 aerial survey, observers sighted a dead sperm whale almost 200 miles offshore of Cape Hatteras. Vessel strikes of sperm whales have been reported along the entire U.S. East Coast, from Florida to Maine (NMFS 2015). Jensen and Silber (2004) compiled information on reported ship strikes from 1975 – 2002 and found that sperm whales were involved in 17 out of 292 records. A different study reported that there were six documented vessel strike mortalities of sperm whales in the Northwest Atlantic from 1970-2009 (of 176 total mortalities observe; Van der Hoop et al. 2013). These studies indicate that sperm whale mortalities from vessel strikes are not common in the Northeast U.S., but in certain parts of the world like the Canary Islands and the Mediterranean Sea, vessel strikes are a significant threat. Because of their offshore distribution, it is likely that sperm whales are struck by vessels more often than reported. However, their offshore distribution makes it equally as likely that sperm whales face a lower risk of vessel strike. Likewise, because sperm whales spend relatively long periods of time at the surface between dives, they could be more vulnerable to ship strikes (Jaquet et al. 1998, Whitehead 2003, NMFS 2010). However, Whitehead and Weilgart (1991) noted the surface time of sperm whales accounts for one quarter of their time, meaning they are at depth and out of range of vessels most of the time.

Locally, few sperm whale vessel strike records are available. In May 2000, a merchant ship reported a collision with a sperm whale in Block Canyon off Long Island (Waring et al. 2009). In the spring, Block Canyon is a major pathway for sperm whales entering southern New England continental shelf waters chasing squid, which is perhaps another behavior that makes them vulnerable to vessel strikes due to proximity (CETAP 1982, Scott and Sadove 1997). Overall, ship strikes are believed to have a relatively low effect on the North Atlantic sperm whale stock overall (NMFS 2010). From 2017-2021, no vessel strike serious injury or mortality was reported for wester North Atlantic sperm whales (Hayes et al. 2024).

Recreational vessel activity, such as whale-watching, has been known to affect some species of cetaceans (NMFS 2010). In the waters off New York and the East Coast, sperm whales are rarely sighted by whale-watching vessels, so this unlikely to be much of a threat. However, recreational boating is extremely prevalent in the inshore areas around New York and Southern New England that sperm whales are known to occasionally frequent. These vessels often travel at very high speed and pose a significant risk to all whales, including sperm whales.

<u>Entanglements</u>

Sperm whales can break through or carry away fishing gear once they become entangled, even when injured (NMFS 2010). Whales that experience entanglements, whether actively entangled or not, can become debilitated and seriously injured, and some die (Moore and Van der Hoop 2012). Even if entangled whales do not die from the entanglements, they could suffer from reduced survival and fecundity, as have been documented in North Atlantic right whales (Knowlton and Kraus 2001). Sperm whales do not appear to become entangled in fishing gear as often as several other species of large whales, though their offshore distribution has likely led to an underreporting of entanglement events (NMFS 2010). Sperm whale entanglements recorded off the U.S. East Coast occurred in the pelagic gillnet fishery, which was closed in 1997, and drift gillnets were banned shortly after in 1999 (NMFS 2013). Currently, sperm whales have not been documented as bycatch in U.S. Atlantic commercial fisheries, though abandoned “ghost gear” may still pose a threat (NMFS 2013, Hayes et al. 2024).

Scott and Sadove (1997) reported that one of the adult sperm whales sighted off Montauk had net entanglement scars on its head, allowing them to identify its return to the area over time. This event was likely a product of the drift gillnet fishery that was still active at the time of observation. During the 2017-2020 DEC aerial surveys, observers documented an entangled sperm whale in what appeared to be a fishing trap close to the shelf break. This is likely the only record of an entangled sperm whale in New York but shows the unlikelihood of such offshore events to be reported and to be addressed via disentanglement efforts (Zoidis et al. 2023).

Farther north, depredating sperm whales targeting the halibut and cod fisheries have been recorded off Norway, Greenland, and Canada (Mesnick et al. 2006). Off Alaska, depredation by sperm whales is very common. One sperm whale was taken by the Canadian halibut longline fishery in 2009 and another in 2010 (NMFS 2015). Karpouzli and Leaper (2004) documented interactions between sperm whales and trawlers in the Greenland halibut fishery and one case of entanglement in the trawl was reported.

Anthropogenic Noise

One of the most significant anthropogenic threats to sperm whales is anthropogenic noise. Anthropogenic noise in the marine environment has increased substantially since the 1950s, and this rapid change in the acoustic environment may have profound implications for whales (McDonald et al. 2006, Hildebrand 2009, Clark et al. 2009). The primary sources of anthropogenic noise in the ocean are shipping, oil and gas exploration (e.g., seismic surveys and air guns), military activities, and marine construction (e.g., pile-driving, dredging, etc.) (Nowacek et al. 2007). Marine mammals rely on sound during all stages of life; they use sound to communicate, navigate, locate prey, and sense their environment. Sperm whales rely heavily on sound to both communicate (e.g., maintain social bonds) and to forage (e.g., echolocation). As such, increasing levels of anthropogenic noise in the ocean could hamper these abilities in the form of masking (e.g., not hearing conspecifics), displacement, temporary or permanent hearing loss, stress, and other behavioral changes (Gordon et al. 2004, Nowacek et al. 2007, Tyack 2008, Southall et al. 2019). Noise may seriously disrupt marine mammal communication, navigational ability, and social patterns, but noise is also highly variable in its generation and its reception. Noise may be intermittent or continuous, steady or impulsive, and may be generated by stationary or passing sources. Noise exposure can result in a multitude of impacts, ranging from those causing little to no impact to more severe outcomes like serious injury or mortality (Richardson et al. 1995, Foote et al. 2004).

Response to anthropogenic noise exists on a spectrum, from minor physiological changes to death, and the level of response varies due to many factors. The noise source type and characteristics, the surrounding environment (e.g., distance from shore, bathymetry), distance between the source and receptor, receptor characteristics (e.g., behavioral context, age, sex), and the time of day and/or season all affect the impact and response to noise (Richardson et al. 1995, NRC 2003, 2005). Hearing damage is usually categorized as causing either a temporary threshold shift (TTS) or a permanent threshold shift (PTS) (Southall et al. 2007, 2019). Excessive noise exposure may be damaging during early individual development, may cause stress hormone fluctuations, and/or may cause whales to leave an area or change their behavior within it (Weilgart 2007).

There are also short-term and long-term behavioral changes. Long-term changes include displacement from habitat, which may or may not be recolonized, sensitization (i.e., increased behavioral or physiological responsiveness over time) to noise that could exacerbate other effects, and habituation (i.e., decreased behavioral responsiveness over time) to chronic noise that could cause animals to remain close to noise sources (NMFS 2010). Except for displacement, long-term behavioral changes are subtle and therefore difficult to detect and quantify. The potential effects of chronic noise on whales include stress, acoustic masking, behavioral disturbance, displacement from habitat, temporary hearing loss and, in extreme cases, permanent loss of hearing or other physiological damage (Weilgart 2007).

Short-term changes include stopping a behavior such as feeding, resting, or socializing. Behavioral reactions can vary not only among individuals but also for a given individual between one specific set of variables and another, depending on previous experience. Changes in dive patterns and acoustic behavior of sperm whales in response to anthropogenic noise have been documented (Farmer et al. 2018, Isojunno et al. 2020, Stanistreet et al. 2022). An individual may also stop vocalizing altogether. For example, some individuals stop vocalizing for brief periods when codas are being produced by other individuals, perhaps because they can hear better when not vocalizing themselves (Goold and Jones 1995). Sperm whales have also been frequently observed to stop echolocating during the use of echosounders such as pingers and sonar (Watkins and Schevill 1975, Watkins et al. 1985).

An animal's auditory threshold may be masked by noise at frequencies similar to or louder than biologically important sounds. Masking these acoustic signals can disturb the behavior of individual animals, groups of animals, or entire populations (Richardson et al. 1995). Individuals may try to minimize masking by changing their behavior, such as producing more calls, producing longer calls, or shifting the frequency of the calls (Parks et al. 2007, Parks et al. 2009). Interruption of normal vocalizing behavior could have significant energetic consequences, particularly if these shifts in vocalizing impact foraging efficiency. The acoustic monitoring in the New York Bight in 2008-2009 and 2017-2020 recorded elevated levels of ambient noise, sometimes over the NOAA-established limit for harassment and behavioral impacts (BRP 2010, Estabrook et al. 2021).

- *Military Activity*

Acute, intermittent noise from military activity, especially from mid-frequency sonar and explosions, is likely to result in significant behavioral disruption and responses, and, at sufficiently high levels, may result in mortality from acoustic trauma for some baleen whale species (Weilgart 2007). Controlled experiments have shown clear behavioral responses to simulated military sonar, including cessation of feeding, increased swimming speed, and travel away from the sound source (Goldbogen et al. 2013, Southall et al. 2014). For decades sperm whales have been exposed to the U.S. Navy's low-, mid-, and high-frequency active sonar systems. It's largely unknown what the consequences of the exposure could be on the longevity and reproductive success of sperm whales (NMFS 2010). Sivle et al. (2012) and Miller et al. (2012) found that low-frequency active sonar (LFAS) caused the most behavior changes while mid-frequency active sonar (MFAS) had no affect. However, sperm whales exposed to sonar may react as if a threat is nearby and rapidly change their dive behavior. This may then cause them to mismanage their nitrogen load and become physiologically impaired when gas bubbles form in the blood and tissue (e.g., decompression sickness, or "the bends") (Hooker 2009, Hooker et al. 2011). In contrast, a 2016 study in the Norwegian Sea found that, compared to playback of killer whale sounds, adult male sperm whales reacted less to naval sonar (Cure et al. 2016). Most studies, however, find significant changes in sperm whale behavior during sonar use. Stanistreet et al. (2022) reported ceased foraging in the vicinity of a multinational naval exercise off eastern Canada in 2016 and sperm whales avoided the affected area.

- *Oil and Gas Exploration*

Seismic surveys, often used for oil and gas exploration, may also impact sperm whale behavior. Seismic operations have also been linked to extended area avoidance and louder vocalization levels by some whale species (Castellote et al. 2012, Nieukirk et al. 2012). The continuous compensation in high-activity areas, such as the east coast of Canada which has been subject to much oil and gas exploration, may have lingering impacts on a sperm whale's overall fitness. Studies have highlighted concerns about the long-term effects of prolonged exposure to air guns (Delarue et al. 2018). Sperm whales seem to respond to seismic survey sounds in some instances yet tolerate them in other instances (Bowles et al. 1994). Some studies have shown that sperm whales continue to call during seismic surveys, while other studies did not report any changes in sperm whale distribution or behavior (Mate et al. 1994, Davis et al. 1995, Johnson and Miller 2002, Madsen et al. 2002, Stone 2003, Weir 2008). It is important to recognize the difficulty of measuring behavior responses in free-ranging whales. For example, Miller et al. (2009) found that eight sperm whales exposed to air gun arrays in the Gulf of Mexico did not exhibit avoidance reactions to the air guns, but the authors suggest the animals were affected at ranges beyond those currently regulated due to more subtle effects on their foraging behavior.

- *Shipping*

Shipping is the main source of low-frequency noise in the oceans (Ruppel et al. 2022). Over the past few decades, the contribution of shipping activities to ambient noise has increased by 12 dB (Hildebrand 2009). Responses of sperm whales to anthropogenic noises are highly variable, but do not appear to result in the death or permanent injury of individual whales. However, the severity of the effects of different noise on sperm whales and the effectiveness of measures that mitigate any adverse effects remains largely unknown (NMFS 2010). Additionally, there is a lack of information on how short-term behavioral responses to noise translate into long-term or population-level effects (NRC 2005). Interestingly, Guerra et al. (2020) investigated the impact of an earthquake on habitat use by sperm whales in an established year-round foraging ground. The authors observed that the earthquake “caused alterations in the foraging patterns of sperm whales over a period of at least 12 months”. Such a large-scale yet natural event resulting in an equally large-scale disturbance brings into question the true physiological and behavioral impacts of anthropogenic sound on sperm whales.

<u>Offshore Energy Development</u>

The effects of other anthropogenic activities, such as offshore energy development and oil spills, are also largely unknown. Pre-construction, construction, operation, and decommissioning encompass a wide range of underwater sound including pile driving noise (Ruppel et al. 2022). In addition, offshore energy development could potentially degrade sperm whale habitat or displace them from common foraging or breeding areas. Studies have found evidence of this in passive acoustic data that showed the Southern New England area is an important area for sperm whales and other endangered cetacean species (Stone et al. 2017, Van Parijs et al. 2023). Development of offshore wind energy areas will also introduce a significant amount of vessel traffic, compounding impacts (Van Parijs et al. 2023). Furthermore, sperm whales are at risk of entanglement in the moorings and associated power cables used to anchor offshore renewable energy, including wind, wave, and tidal energy (Benjamins et al. 2014). Baleen whales were determined to be at the highest risk of entanglement, but sperm whales also had a relatively moderate to high risk based largely on their size and foraging habits (Benjamins et. al. 2014).

- *Oil Spills*

Oil spills that occur while sperm whales are present could result in skin irritation, ingestion of oil, respiratory distress, ingestion of contaminated prey, and displacement from habitat (Geraci 1990). Actual impacts would depend on the extent and duration of contact and the characteristics of the oil. Most likely, the effects would be irritation to the respiratory system and absorption of hydrocarbons into the bloodstream (Geraci 1990). Oil can be ingested if whales attempt to feed while swimming through an oil slick, poisoning them and causing damage to internal systems such as the immune and endocrine systems. Oil spills would likely also have effects down the food chain, potentially causing energetic effects for sperm whales who may have to travel further to forage. Long term ingestion of pollutants, including oil residues, could affect reproductive success, but data is lacking to determine how oil may fit into this scheme for sperm whales. The dispersants used in the Deepwater Horizon oil spill clean-up in 2010 were found to impair organ function in sperm whales (Wise et al 2014a). If the toxicity occurred during pregnancy, mortality or developmental abnormalities in offspring would increase. In addition when testing nickel and chromium levels in Gulf of Mexico sperm whales following the oil spill, levels were higher than the global mean (Wise et al. 2014b). Ackleh et al. (2012) assessed the impact of the oil spill on sperm whales and found that some sperm whales relocated farther away from the spill. More recently, population consequences of Deepwater Horizon were explored using models for three injury metrics (Marques et al. 2023). The authors found that the estimated time to recover to 95% of the pre-spill baseline was 11 years for sperm whales and that the estimated stock decrease was 6.3%.

Climate Change

Climate change has already led to temperature and current shifts throughout the North Atlantic, especially in the Gulf of Maine (Pershing et al. 2021). Poleward and increasing depth shifts in cetacean species have been documented (MacLeod 2009, Sousa et al. 2019). Chavez-Rosales et al. (2022) documented an overall 178 km northeastward spatial distribution shift of the seasonal core habitat of Northwest Atlantic cetaceans that was related to changing habitat and climatic factors. In the study, the weighted centroid of sperm whale core habitat moved farthest during fall (255 km towards the northeast) and least during winter (71 km).

The potential impacts of climate and oceanographic change on sperm whales will likely affect habitat availability and food availability. Site selection for migration, feeding, and breeding for sperm whales may be influenced by factors such as ocean currents and water temperature (NMFS 2010). Any changes in these factors could lower habitat quality with possible long-term impacts to sperm whales or render currently used habitat areas unsuitable. These changes could lead to shifts in distribution of sperm whales as occupied habitats may become unsuitable and previously unsuitable habitats may become occupied. From a management perspective, it’s extremely problematic when endangered species shift their distribution into previously unutilized habitat because there are no existing mitigation measures to protect those animals from threats. Likewise, a novel threat introduced to existing habitat without appropriate mitigation measures will also become problematic. For example, since sperm whale distribution extends into the high latitudes, melting Arctic ice will lead to newly open areas of ocean where vessels and anthropogenic noise will be introduced for the first time (Alter et al. 2010). Simultaneously, decreased sea ice extent will expand sperm whale habitat and increase risk.

Squid, being the primary prey of sperm whales, may be negatively impacted by rising ocean temperatures and subsequently may strongly affect the size and distribution of sperm whale populations (NMFS 2010). There is some evidence from Pacific equatorial waters that sperm whale feeding success and, in turn, calf production rates are negatively affected by increases in sea surface temperature (Smith and Whitehead 1993, Whitehead 1997). This could mean that global climate change will reduce the productivity of at least some sperm whale populations (Whitehead 1997). In addition, sperm whale strandings have been associated with higher temperatures, possibly due to prey moving further inshore, which may become more frequent as sea temperatures rise (Pierce et al. 2007). However, the sperm whale’s immense feeding range may provide some resilience to prey impacts due to climate change (MacLeod 2009). The degree of impact from climate change on sperm whales remains uncertain, so the effects of climate change on both sperm whales and their prey need further research.

Marine Debris

According to the United Nations Global Compact (2025), more than 8 million tons of plastic ends up in the ocean every year, and the amount of plastic in the ocean is expected to quadruple by 2040. Ingestion of marine debris by cetaceans may result in internal injuries or cause complete blockage to the digestive tract leading to malnutrition, starvation, and mortality (Simmonds 2012, Baulch and Perry

2014). Most cetacean ingestion of marine debris is discovered through necropsies of stranded animals and has been documented in more than half of extant cetacean species, with ingestion rates as high as 31% in certain populations (Baulch and Perry 2014). Sperm whales feed primarily at the bottom of the ocean and use suction to ingest prey (Lambertson 1997, NMFS 2010). Previously it was assumed that marine species visually confuse marine debris for prey, but Merrill et al. (2024) found that the acoustic signature of plastic marine debris mimics the acoustic signatures of deep-sea prey items like squid and squid beaks. The long history of marine debris ingestion by deep-diving species confirms this information. In 1989, a necropsy on a sperm whale in the Mediterranean Sea revealed the cause of death to be stomach obstruction by plastic bags and sheets (Viale et al. 1992). Lambertsen (1990) reported that a sperm whale examined in Iceland was killed by an illness believed to be caused by ingested plastic obstructing the gut.

Many additional cases of marine debris ingested by sperm whales, sometimes directly causing the animal to die, have been documented. "Gastric rupture due to compacted debris" was the cause of death for one sperm whale that stranded in Spain and one of two sperm whales that stranded separately in California in 2008; the other California sperm whale starved to death due to "gastric impact" also caused by debris (Jacobsen et al. 2010, De Stephanis et al. 2013). In 2016, necropsies were performed on 22 of 30 sperm whales that stranded over the course of a month in the North Sea (Unger et al. 2016). Nine of the 22 whales had significant amounts of marine debris in their upper digestive system and stomachs including netting, ropes, packaging material, and part of a car. While none of the debris was determined to be the cause of death, the significant risk associated with marine debris ingestion was clear (Unger et al. 2016). In 2018 in Indonesia a sperm whale stranded with 13 pounds of plastic in its stomach (BBC 2018). In 2019 in Scotland, 220 pounds of trash were removed from a dead sperm whale (CBS News 2019). Also in 2019, a dead, pregnant sperm whale was found in Italy with 50 pounds of plastic in its stomach (CNN 2019). In November 2022, a 46-foot sperm whale died just off Nova Scotia. The necropsy revealed 330 pounds of fishing gear, including ropes, nets, and gloves, in the whale's stomach, which caused a blockage and lead to starvation (The Canadian Press 2022). In February 2023, a 56-foot sperm whale washed up in Hawaii and was also found to have a blockage from ingesting fishing traps, nets, and line, plastic bags, and other debris items (State of Hawaii 2023).

From 2017 through 2021, 10 strandings of sperm whales were recorded on the U.S. East Coast. Two of the strandings were documented as human interaction (HI) due to plastic ingestion, which was the cause of death in one of those cases (Hayes et al. 2024). Goold et al. (2002) investigated sperm whale strandings in the North Atlantic and found that strandings had been increasing at a rate "higher than would be expected from a simple increase in sperm whale population size alone". They hypothesized that an increase in reporting occurred alongside increasing anthropogenic impacts, in particular pollution.

Contaminants, Toxins, and Chemical Pollutants

Another source of anthropogenic threat and mortality is pollution in the form of heavy metals and other contaminants such as polychlorobiphenyls (PCBs), chlorinated pesticides (DDT, etc.), and polycyclic aromatic hydrocarbons (PAHs). Metals and other stable pollutants are ubiquitous in the marine ecosystem) and their accumulation in long-lived, high-trophic level animals such as sperm whales is of concern for reproduction and overall health (Hall et al. 2018, Murphy et al. 2018, Wise et al 2011a, Wise et al. 2011b). Research is ongoing to determine the level of bioaccumulation of various stable pollutants and their health effects (Savery et al. 2013a, Savery et al. 2013b, Savery et al. 2014). Holsbeek et al. (1999) suggest that the stable pollutants might affect the health or behavior of North Atlantic sperm whales. Sperm whale tissues have high levels of some contaminants (O'Shea 1999, Nielsen et al. 2000) so while no direct link between contaminant level and stranded sperm whales has been found (Jacques and Lambertsen 1997), the levels of mercury, cadmium and organochlorines have been high enough to be concerning (Bouquegneau et al. 1997, Law et al. 1997). Fossi et al. (2003) state that concentrations in the Mediterranean could influence reproductive rates of sperm whales. Following a stranding of multiple sperm whales in Italy, necropsies found high levels of contaminants including toxins categorized as immunosuppressors (Marsili et al 2014). The cause of death remains unknown, but it's suspected that the contaminant loads lowered the whales' immune systems making them more susceptible to disease. Most studies on sperm whale contaminant levels and toxic load are specific to the Mediterranean Sea, highlighting the need for focus on the western North Atlantic population.

- *Harmful Algal Blooms (HABs)*

There has been a global increase in cases of poisoning in cetaceans due to harmful algal blooms (HABs; Harvell et al. 1999). The algae produce a neurotoxin called saxitoxin, which cetaceans ingest through their prey, and which subsequently causes neurological issues that may be fatal. Sub-lethal effects of HABs may include lower reproductive success and increased susceptibility to other threats (Leandro et al. 2010). Recent analysis of HAB events indicates that there is not as strong a relationship between HAB occurrence and whale injuries and deaths on the east coast as there is on the west coast, but there remains a risk as intensity and frequency of HABs are expected to increase with ocean warming (Gobler et al. 2017, Silber and Silber 2024).

Threat Level 1	Threat Level 2	Threat Level 3	Spatial Extent*	Severity*	Immediacy*	Trend	Certainty
3. Energy Production & Mining	3.1 Oil & Gas Drilling	Choose an item.	Restricted	Slight	Near-term	Unknown	Moderate
3. Energy Production & Mining	3.3 Renewable Energy	3.3.2 Wind farms	Restricted	Slight	Near-term	Intensifying	Moderate
4. Transportation & Service Corridors	4.3 Shipping Lanes	4.3.1 Shipping	Large	Moderate	Immediate	Intensifying	High
5. Biological Resource Use	5.4 Fishing & Harvesting Aquatic Resources	5.4.2 Commercial fishing	Large	Slight	Immediate	Intensifying	Moderate
6. Human Intrusions & Disturbance	6.1 Recreational Activities	6.1.4 Recreational boating	Restricted	Slight	Immediate	Intensifying	High
6. Human Intrusions & Disturbance	6.2 War, Civil Unrest & Military Exercises	6.2.3 Military exercises	Large	Slight	Immediate	Unknown	Low
8. Invasive & Other Problematic Species	8.2 Problematic Native Plants & Animals	8.2.6 Increased predation by large predators	Small	Slight	Immediate	Intensifying	High
8. Invasive & Other Problematic Species	8.2 Problematic Native Plants & Animals	8.2.7 Ectoparasites	Large	Slight	Immediate	Unknown	Low
8. Invasive & Other Problematic Species	8.4 Pathogens	Choose an item.	Large	Slight	Immediate	Unknown	Unknown
9. Pollution	9.2 Industrial & Military Effluents	Choose an item.	Large	Slight	Near-term	Unknown	Low
9. Pollution	9.4 Garbage & Solid Waste	9.4.4 Drifting plastic and entanglement rubbis	Pervasive	Moderate	Immediate	Intensifying	High
9. Pollution	9.6 Excess Energy	9.6.3 Noise pollution	Pervasive	Moderate	Immediate	Intensifying	High
11. Climate Change	11.1 Habitat Shifting & Alteration	11.1.2 Phenological mismatch	Pervasive	Moderate	Near-term	Intensifying	Moderate

11. Climate Change	11.2 Changes in Geological Regimes	Choose an item.	Pervasive	Moderate	Near-term	Intensifying	Moderate
11. Climate Change	11.3 Changes in Temperature Regimes	Choose an item.	Pervasive	Moderate	Near-term	Intensifying	Moderate

Table 2: Threats to sperm whale.

Are there regulatory mechanisms that protect the species or its habitat in New York?

Yes: ✓ **No:** ____ **Unknown:** ____

If yes, describe mechanism and whether adequate to protect species/habitat:

The sperm whale is protected in the United States by its status as a federally endangered species. In addition, the sperm whale receives federal protection under the Marine Mammal Protection Act (MMPA). The sperm whale is protected internationally from commercial hunting under the International Whaling Commission's (IWC) global moratorium on whaling. The moratorium was introduced in 1986 and is voted on by member countries, including the United States, at the IWC's annual meeting. Member countries may choose to object, however, and continue whaling. For example, Japan killed sperm whales as recently as 2013.

Sperm whales are also protected under the Environmental Conservation Law (ECL) of New York. The sperm whale is listed as a state endangered species in New York. Section 11 – 0535 protects all state-listed endangered and threatened species and makes it illegal to take, import, transport, possess or sell any listed species or part of a listed species. In addition, Article 17 of the ECL works to limit water pollution, and Article 14 presents the New York Ocean and Great Lakes Ecosystem Conservation Act. This act is responsible for the conservation and restoration of coastal ecosystems "so that they are healthy, productive and resilient and able to deliver the resources people want and need." Both of these laws help to protect the habitat of the sperm whale.

Whether these mechanisms are adequate to protect sperm whales and their habitat is currently unknown.

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

If it is known where and when sperm whales are occurring in New York waters, more effective management and conservation strategies can be implemented.

The sperm whale would benefit greatly from further research. Little is known about general life history and demography of this species in New York. Monitoring data indicates nursing and possibly mating occur in the New York Bight. To adequately protect sperm whales, it's essential to determine the demographics and behavior when present. Identifying when and where they are utilizing state waters specifically should also be prioritized so management measures can be developed. Additionally, the total impact of threats in state waters are largely unknown. Further research into threats such as climate change is warranted. In addition, education on this species and the importance of reporting ship strikes and entanglements is encouraged.

It's important to note that because of the primarily offshore distribution of sperm whales in New York, their presence in state waters in space and time need to be determined before actions in the B.4 Law Enforcement and Prosecution and B.5 Economic and Other Incentives categories can be pursued. Those categories are integral to successful whale conservation efforts by the State and are widely warranted. It's likely that those efforts will benefit sperm whales to some extent, even if sperm whales are not often utilizing state waters.

Complete Conservation Actions table using IUCN conservation actions taxonomy at link below. Use headings 1-6 for Action Category (e.g., Land/Water Protection) and associated subcategories for Action (e.g., Site/Area Protection):
https://www.iucnredlist.org/resources/conservation-actions-classification-scheme

Action Category	Action	Description
A.1 Direct Habitat Management	A.1.3 Mitigate human environmental impact	
A.2 Direct Species Management	A.2.1 Stewarding wild individuals	Continue funding stranding response
B.3 Outreach	B.3.1 Outreach, communication, and distribution	Encourage responsible human behavior Increase awareness of species
B.4 Law Enforcement and Prosecution	B.4.1 Detection and intervention B.4.2 Prosecution and conviction	Enforce potential regulations and maintain presence in high-use and/or high-risk areas to deter problematic activity
B.5 Economic and Other Incentives	B.5.4 Economic incentives and disincentives	Consider possible incentives and disincentives to support compliance and/or precautionary measures
C.6 Design and Plan Conservation	C.5 Conservation planning	Long-term conservation and management strategies should be developed
C.7 Legislative and Regulatory Framework or Tools	C.7.1 Create, amend, or influence legislation, regulation, or codes C.7.2 Create or amend policies, guidelines, or best practices	Identify potential appropriate regulations, policies, etc.
C.8 Research and Monitoring	C.8.1 Basic research and status monitoring	Conduct research on general life history and demographics of sperm whales in New York Quantify risk of threats in New York Determine sperm whale use of inshore/state waters Monitor presence in New York Bight long-term; prioritize passive acoustics and tagging Assess behavior, especially nursing calves and possible mating

Action Category	Action	Description
C.10 Institutional Development	C.10.3 Alliance and partnership development	Establish and maintain partnerships that bring additional resources to research and/or mitigation Explore opportunities to collaborate on long-term monitoring

Table 3. Recommended conservation actions for sperm whale.

VII. References

Ackleh, A.S., Ioup, G.E., Ioup, J.W., Ma, B., Newcomb, J.J., Pal, N., Sidorovskaia, N.A. and Tiemann, C., 2012. Assessing the Deepwater Horizon oil spill impact on marine mammal population through acoustics: endangered sperm whales. *The Journal of the Acoustical Society of America*, *131*(3), pp.2306-2314.

Aguilar, A. 1985. Further information on the movements of the sperm whale (Physeter macrocephalus) in the North Atlantic. Mammalia 49:421–424.

Alter, S.E., M.P. Simmonds, and J.R. Brandon. 2010. Forecasting the consequences of climatedriven shifts in human behavior on cetaceans. Marine Policy 34:943-954.

Antunes, R., Schulz, T., Gero, S., Whitehead, H., Gordon, J. and Rendell, L., 2011. Individually distinctive acoustic features in sperm whale codas. Animal Behaviour, 81(4), pp.723-730.

Arnbom, T., Papastavrou, V., Weilgart, L.S. and Whitehead, H., 1987. Sperm whales react to an attack by killer whales. Journal of Mammalogy, 68(2), pp.450-453.

Baulch, S. and Perry, C., 2014. Evaluating the impacts of marine debris on cetaceans. Marine pollution bulletin, 80(1-2), pp.210-221.

BBC. 2018. "Dead sperm whale found in Indonesia had ingested '6kg of plastic'". Accessed March 2025. https://www.bbc.com/news/world-asia-46275742

Benjamins, S., Harnois, V., Smith, H.C.M., Johanning, L., Greenhill, L., Carter, C. and Wilson, B. 2014. Understanding the potential for marine megafauna entanglement risk from renewable marine energy developments. Scottish Natural Heritage Commissioned Report No. 791.

Best, P.B. 1974. Biology of the sperm whale. Pages 53–81. In: W. E. Schevill (ed), The whale problem: A status report. Harvard University Press, Cambridge, Massachusetts.

Best, P. B. 1979. Social organization in sperm whales, Physeter macrocephalus. Pp. 227 - 189 In Winn, H. E. and B. L. Olla (eds.), Behavior of Marine Animals, Vol. 3. Plenum, New York.

Best, P.B. and D.S. Butterworth. 1980. Timing of oestrus within sperm whale schools. Report International Whaling Commission (Special Issue 2):137-140.

Best, P. B., P. A. S. Canham, and N. Macleod. 1984. Patterns of reproduction in sperm whales, Physeter macrocephalus. Reports to the International Whaling Commission (Special Issue 8): 51 - 79.

Bioacoustic Research Program [BRP]. 2010. Determining the Seasonal Occurrence of Cetaceans in New York Coastal Waters using Passive Acoustic Monitoring. Final Report prepared for New York State Dept. of Environmental Conservation. Cornell Lab of Ornithology, Cornell University. 60 p.

Bouquegneau, J.M., V. Debacker, S. Govert, and J.P. Nellissen. 1997. Toxicological investigations on four sperm whales stranded on the Belgian coast: inorganic contaminants. Bulletin de 1'Institut Royal des Sciences Naturelles de Belgique, Biologic 67-Suppl.:75–78.

Bowles, A.E., Smultea, M., Würsig, B., DeMaster, D.P. and Palka, D., 1994. Relative abundance and behavior of marine mammals exposed to transmissions from the Heard Island Feasibility Test. The Journal of the Acoustical Society of America, 96(4), pp.2469-2484.

The Canadian Press. 2022. "Sperm whale found dead in Nova Scotia had swallowed 150 kg of fishing gear". Accessed March 2025. https://www.thecanadianpressnews.ca/atlantic/sperm-whale-found-dead-in-nova-scotia-had-swallowed-150-kg-of-fishing-gear/article_1d6644da-c861-5e3c-83a8-fe65f9e5d74d.html

Castellote, M., C.W. Clark, and M.O. Lammers. 2012. Acoustic and behavioural changes by fin whales (Balaenoptera physalus) in response to shipping and airgun noise. Biological Conservation 147:115–122.

CBS News. 2019. "Beached sperm whale found with 220 pounds of trash in his stomach". Accessed March 2025. https://www.cbsnews.com/news/beached-sperm-whale-found-with-220-pounds-of-trash-in-his-stomach/

Cetacean and Turtle Assessment Program [CETAP]. 1982. A characterization of marine mammals and turtles in the mid- and north Atlantic areas of the U.S. outer continental shelf, final report, Cetacean and Turtle Assessment Program, University of Rhode Island. Washington, DC, Bureau of Land Management. #AA551-CT8-48: 576.

Chavez-Rosales, S., Josephson, E., Palka, D., & Garrison, L. 2022. Detection of habitat shifts of cetacean species: A comparison between 2010 and 2017 habitat suitability conditions in the Northwest Atlantic Ocean. Frontiers in Marine Science, 9, 877580.

Chiquet, R. A., B. Ma, A. S. Ackleh, N. Pal and N. Sidorovskaia. 2013. Demographic analysis of sperm whales using matrix population models. Ecological Modelling 248: 71 - 79.

Christal, J. and H. Whitehead. 2001. Social affiliations within sperm whale (Physeter macrocephalus) groups. Ethology 107: 323 - 340.

Christal, J., H. Whitehead, and E. Lettevall. 1998. Sperm whale social units: variation and change. Canadian Journal of Zoology 76:1431–1440.

Clark, C.W., W.T. Ellison, B.L. Southall, L. Hatch, S.M. Van Parijs, A. Frankel, and D. Ponirakis. 2009. Acoustic masking in marine ecosystems: intuitions, analysis, and implication. Marine Ecology Progress Series 395:201–222.

Clarke, M.R., 1979. The head of the sperm whale. Scientific American, 240(1), pp.128-141.

Clarke, R. and Paliza, O., 1988. Intraspecific fighting in sperm whales. Report of the International Whaling Commission, 38, pp.235-241.

CNN. 2019. “Pregnant whale washed up in Italian tourist spot had 22 kilograms of plastic in its stomach”. Accessed March 2025. https://edition.cnn.com/2019/04/01/europe/sperm-whale-plastic-stomach-italy-scli-intl/index.html

Conn, P.B. and Silber, G.K., 2013. Vessel speed restrictions reduce risk of collision-related mortality for North Atlantic right whales. *Ecosphere*, *4*(4), pp.1-16.

Connor, P. F. 1971. The Mammals of Long Island, New York. Bulletin 146. New York State Museum & Science Service, Albany, NY. v + 78 pp.

Cools, P., Haelters, J., dos Santos Santiago, G.L., Claeys, G., Boelens, J., Leroux-Roels, I., Vaneechoutte, M. and Deschaght, P., 2013. Edwardsiella tarda sepsis in a live-stranded sperm whale (Physeter macrocephalus). Veterinary Microbiology, 166(1-2), pp.311-315.

Cranford, T.W., 1992. Functional morphology of the odontocete forehead: implications for sound generation. University of California, Santa Cruz.

Davis, R. W., B. WÜrsig, W. Evans, G. Fargion, R. Benson, J. Norris, and T. Jefferson. 1995. Distribution and Abundance of Marine Mammals in the North–Central and Western Gulf of Mexico: Draft Final Report, vol. 2, Technical Report. OCS Study No. MMS. Prepared by the Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, Louisiana.

DeKay, J.E. 1842. Natural History of New York. Part I, Zoology. Part I, Mammalia. W. & A. White and J. Visscher, Albany, N.Y. 146 p.

Delarue, J., K.A. Kowarski, E.E. Maxner, J.T. MacDonnell, and S.B. Martin. 2018. Acoustic Monitoring Along Canada’s East Coast: August 2015 to July 2017. Document Number 01279, Environmental Studies Research Funds Report Number 215, Version 1.0. Technical report by JASCO Applied Sciences for Environmental Studies Research Fund, Dartmouth, NS, Canada. 120 pp + appendices.

Department of Commerce. 2021. Endangered and Threatened Species; Notice of Initiation of a 5-Year Review of the Sperm Whale, 86 FR 28577 (published May 27, 2021). https://www.federalregister.gov/d/2021-11190

De Stephanis, R., Giménez, J., Carpinelli, E., Gutierrez-Exposito, C. and Cañadas, A., 2013. As main meal for sperm whales: plastics debris. Marine pollution bulletin, 69(1-2), pp.206-214.

Dufault, S., H. Whitehead, M. Dillon. 1999. A Examination of the current knowledge on the stock structure of sperm whales (Physeter macrocephalus) worldwide. Journal of Cetacean Research and Management 1:1–10.

Engelhaupt, D. et al. 2009. Female philopatry in coastal basins and male dispersion across the North Atlantic in a highly mobile marine species, the sperm whale (Physeter macrocephalus). Molecular Ecology 18(20):4193-4205.

Engelhaupt, A., J.M. Aschettino, and D. Engelhaupt. 2018. VACAPES Outer Continental Shelf Cetacean Study, Virginia Beach, Virginia: 2017 Annual Progress Report. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract No. N62470-15-8006, Task Order 35, issued to HDR Inc., Virginia Beach, Virginia. May 2018.

Engelhaupt, A., J.M. Aschettino, D. Engelhaupt, A. DiMatteo, M. Richlen, and M. Cotter. 2019. VACAPES Outer Continental Shelf Cetacean Study, Virginia Beach, Virginia: 2018 Annual Progress Report. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract No. N62470-15-8006, Task Order 18F4082, issued to HDR Inc., Virginia Beach, Virginia. July 2019.

Engelhaupt, A., J.M. Aschettino, D. Engelhaupt, M. Richlen, and M. Cotter. 2020. VACAPES Outer Continental Shelf Cetacean Study, Virginia Beach, Virginia: 2019 Annual Progress Report. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract No. N62470-15-8006, Task Orders 18F4082 and 19F4068, issued to HDR Inc., Virginia Beach, Virginia. April 2020.

Engelhaupt, A., J.M. Aschettino, and D. Engelhaupt. 2023. VACAPES Outer Continental Shelf Cetacean Study, Virginia Beach, Virginia: 2022 Annual Progress Report. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Systems Command Atlantic, Norfolk, Virginia, under Contract No. N62470-15-8006, Task Order 20F4031, issued to HDR Inc., Virginia Beach, Virginia. July 2023.

Estabrook, B.J., Hodge, K.B., Salisbury, D.P., Rahaman, A. Ponirakis, D., Harris, D.V., Zeh, J.M., Parks, S.E., & Rice, A.N. 2021. Final report for New York Bight Whale Monitoring Passive Acoustic Surveys October 2017-October 2020. New York State Department of Environmental Conservation.

Estabrook, B.J., Bonacci-Sullivan, L.A., Harris, D.V., Hodge, K.B., Rahaman, A., Rickard, M.E., Salisbury, D.P., Schlesinger, M.D., Zeh, J.M., Parks, S.E. and Rice, A.N., 2025. Passive acoustic monitoring of baleen whale seasonal presence across the New York Bight. PloS one, 20(2), p.e0314857.

Evans, K., Thresher, R., Warneke, R.M., Bradshaw, C.J.A., Pook, M., Thiele, D. and Hindell, M.A., 2005. Periodic variability in cetacean strandings: links to large-scale climate events. Biology letters, 1(2), pp.147-150.

Farmer, N.A., Noren, D.P., Fougères, E.M., Machernis, A. and Baker, K., 2018. Resilience of the endangered sperm whale Physeter macrocephalus to foraging disturbance in the Gulf of Mexico, USA: a bioenergetic approach. Marine Ecology Progress Series, 589, pp.241-261.

Fernández, M., Morteo, E., Delfín-Alfonso, C.A. and Hernández-Candelario, I., 2022. Harassing Behavior by Short-Finned Pilot Whales (Globicephala macrorhynchus) Towards a Mother and Calf Sperm Whale (Physeter macrocephalus) Pair. Aquatic Mammals, 48(6).

Foote, A.D., Osborne, R.W. and Hoelzel, A.R., 2004. Whale-call response to masking boat noise. Nature, 428(6986), pp.910-910.

Fossi, M. C., L. Marsili, N. Giovanni, A. Natoli, E. Politi and S. Panigada. 2003. The use of a non-lethal tool for evaluating toxicological hazard of organochlorine contaminants in Mediterranean cetaceans: New data 10 years after the first paper published in MPB. Mar. Pollut. Bull. 46, 972–982.

Gambell, R. 1972. Sperm whales off Durban. Discov. Report 35: 199-358.

Garrison, L.P., Lisi, N.E., Gahm, M., Patterson, E.M., Blondin, H. and Good, C.P., 2025. The effects of vessel speed and size on the lethality of strikes of large whales in US waters. *Frontiers in Marine Science*, *11*, p.1467387.

Geraci, J.R. 1990. Physiologic and toxic effects on cetaceans, pp. 167–192. In: Sea mammals and oil: confronting the risks J.R. Geraci and D.J. St. Aubin, Editors. First ed., Academic Press, Inc. San Diego, California: 239 p.

Gero, S., D. Engelhaupt, and H. Whitehead. 2008. Heterogeneous social associates within a sperm whale, Physeter macrocephalus, unit reflect pairwise relatedness. Behavioral Ecology and Sociobiology 63:143-151.

Gero, S., D. Engelhaupt, L. Rendell, and H. Whitehead. 2009. Who Cares? Between-group variation in alloparental caregiving in sperm whales. Behavioral Ecology doi:10.1093/behaco/arp068.

Gero, S., J. Gordon, and H. Whitehead. 2013. Calves as social hubs: dynamics of the social network within sperm whale units. Proceedings of the Royal Society Biological Sciences 280:20131113.

Gobler, C.J., Doherty, O.M., Hattenrath-Lehmann, T.K., Griffith, A.W., Kang, Y. and Litaker, R.W., 2017. Ocean warming since 1982 has expanded the niche of toxic algal blooms in the North Atlantic and North Pacific oceans. Proceedings of the National Academy of Sciences, 114(19), pp.4975-4980.

Goldbogen, J.A., Southall, B.L., DeRuiter, S.L., Calambokidis, J., Friedlaender, A.S., Hazen, E.L., Falcone, E.A., Schorr, G.S., Douglas, A., Moretti, D.J. and Kyburg, C., 2013. Blue whales respond to simulated mid-frequency military sonar. *Proceedings of the Royal Society B: Biological Sciences*, *280*(1765), p.20130657.

Goold, J.C. and Jones, S.E., 1995. Time and frequency domain characteristics of sperm whale clicks. The Journal of the Acoustical Society of America, 98(3), pp.1279-1291.

Goold, J.C., H. Whitehead, and R.J. Reid. 2002. North Atlantic sperm whale, Physeter macrocephalus, strandings on the coastlines of the British Isles and Eastern Canada. Canadian Field Naturalist 116: 371–388.

Gordon, J., Gillespie, D., Potter, J., Frantzis, A., Simmonds, M.P., Swift, R. and Thompson, D. 2004. A review of the effects of seismic surveys on marine mammals. Marine Technology Society Journal, 37: 16–34.

Gordon, J., R. Leaper, F.G. Hartley, and O. Chappell. 1992. Effects of whale-watching vessels on the surface and underwater acoustic behaviour of sperm whales off Kaikoura, New Zealand. Science & Research Series No. 52, Department of Conservation, Wellington, N.Z. 64 pp.

Guerra, M., Dawson, S., Sabadel, A., Slooten, E., Somerford, T., Williams, R., Wing, L. and Rayment, W., 2020. Changes in habitat use by a deep-diving predator in response to a coastal earthquake. *Deep Sea Research Part I: Oceanographic Research Papers*, *158*, p.103226.

Guerra, M., Dawson, S.M., Somerford, T.R., Slooten, E. and Rayment, W.J., 2022. Fine-scale habitat use of foraging sperm whales is driven by seafloor topography and water column structure. *Marine mammal science*, *38*(2), pp.626-652.

Gunnlaugsson, T., G.A. Vikingsson, and D.G. Pike. 2009. Combined line-transect and cuecount estimate of sperm whale abundance in the North Atlantic, from Icelandic NASS-2001 shipboard survey. NAMMCO Sci. Publ. 7:73-80.

Hall, A.J., B.J. McConnell, L.J. Schwacke, G.M. Ylitalo, R. Williams and T.K. Rowles. 2018. Predicting the effects of polychlorinated biphenyls on cetacean populations through impacts on immunity and calf survival. Environ. Poll. 233:407–418.

Halpin, P.N., A.J. Read, E. Fujioka, B.D. Best, B. Donnelly, L.J. Hazen, C. Kot, K. Urian, E. LaBrecque, A. Dimatteo, J. Cleary, C. Good, L.B. Crowder, and K.D. Hyrenbach. 2009. OBIS-SEAMAP: The world data center for marine mammal, sea bird, and sea turtle distributions. Oceanography 22(2):104-115

Harvell, C.D., Kim, K., Burkholder, J.M., Colwell, R.R., Epstein, P.R., Grimes, D.J., Hofmann, E.E., Lipp, E.K., Osterhaus, A.D.M.E., Overstreet, R.M. and Porter, J.W., 1999. Emerging marine diseases--climate links and anthropogenic factors. Science, 285(5433), pp.1505-1510.

Hayes, S. A., Josephson, E. , Maze-Foley, K. , Rosel, P. E. , and McCordic, J. 2024. Sperm whale (Physeter macrocephalus): North Atlantic. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments 2023. NOAA Technical Memorandum NMFS-NE-321. U.S. Department of Commerce, Woods Hole, MA.

Heyning, J.E., and T.D. Lewis. 1990. Entanglements of baleen whales in fishing gear off southern California. Reports to the International Whaling Commission 40:427-431.

Holsbeek L., C. R. Joiris, V . Debacker, I.B. Ali, P. Roose, J-P. Nellissen, S. Gobert, JM. Bouquegneau, and M. Bossicart. 1999. Heavy metals, oganochlorines and polycyclic aromatic hydrocarbons in sperm whales stranded in the southern North Sea during the 1994/1995 winter. Marine Pollution Bulletin 38: 4 304-313.

Hooker, S.K., 2009. Toothed whales, overview. In Encyclopedia of marine mammals (pp. 1173-1179). Academic Press.

Hooker, S.K., Fahlman, A., Moore, M.J., Aguilar de Soto, N., Bernaldo de Quirós, Y., Brubakk, A.O., Costa, D.P., Costidis, A.M., Dennison, S., Falke, K.J. and Fernandez, A., 2012. Deadly diving? Physiological and behavioural management of decompression stress in diving mammals. Proceedings of the Royal Society B: Biological Sciences, 279(1731), pp.1041-1050.

IJsseldijk, L.L., Van Neer, A., Deaville, R., Begeman, L., van de Bildt, M., van den Brand, J.M., Brownlow, A., Czeck, R., Dabin, W., Ten Doeschate, M. and Herder, V., 2018. Beached bachelors: An extensive study on the largest recorded sperm whale Physeter macrocephalus mortality event in the North Sea. *PLoS One*, *13*(8), p.e0201221.

International Whaling Commission [IWC]. 2025a. "Total Catches". Accessed March 2025. https://iwc.int/management-and-conservation/whaling/total-catches

Isojunno, S., P.J. Wensveen, F.A. Lam, P.K. Kvadsheim, A.M. von Benda-Beckmann, L.V.M. Lopez, L. Kleivane, E.M. Siegal and P.J.O. Miller. 2020.When the noise goes on: received sound energy predicts sperm whale responses to both intermittent and continuous navy sonar. Journal of Experimental Biology 223(7): jeb219741

Jacobsen, J.K., L. Massey, and F. Gulland. 2010. Fatal ingestion of floating net debris by two sperm whales (Physeter macrocephalus). Marine Pollution Bulletin 60:765-767.

Jacques, T.G. and R.H. Lambertsen (eds.). 1997. Sperm whale deaths in the North Sea: science and management. Bulletin de 1'Institut Royal des Sciences Naturelles de Belgique, Biologic 67–Suppl.: 133pp.

Jaquet, N., S. Dawson, and E. Slooten. 1998. Diving behaviour of male sperm whales: foraging implications. International Whaling Commission, Scientific Committee Doc. SC/50/CAWS 38:20 pp.

Jensen, A. S., and G. K. Silber. 2004. Large Whale Ship Strike Database. U.S. Department of Commerce, NMFS-OPR-25 37.

Johnson, M. and P. Miller. 2002. Sperm whale diving and vocalization patterns from digital acoustic recording tags and assessing responses of whales to seismic exploration. MMS Information Transfer Meeting, Jan 7–10, 2002. Kenner, LA.

Johnson H, Morrison D, Taggart C. 2021. WhaleMap: a tool to collate and display whale survey results in near real-time. Journal of Open Source Software, 6(62), 3094, https://joss.theoj.org/papers/10.21105/joss.03094

Jonsgard, A. 1977. Tables showing the catch of small whales (including minke whales) caught by Norwegians in the period 1938–75, and large whales caught in different North Atlantic waters in the period 1868–1975. Report of the International Whaling Commission 27:413–426.

Karpouzli, E. and Leaper, R., 2004. Opportunistic observations of interactions between sperm whales and deep-water trawlers based on sightings from fisheries observers in the northwest Atlantic. Aquatic Conservation: Marine and Freshwater Ecosystems, 14(1), pp.95-103.

Katona, S., W. Steiner, and H.E. Winn. 1978. Marine mammals. Pp. XIV-1-65 In: Center for Natural Areas. Summary of Environmental Information: Continental Shelf, Bay of Fundy to Cape Hatteras. Bureau of Land Management, Washington, DC. U550-CT6-45.

Knowlton, A.R. and Kraus, S.D. 2001. Mortality and serious injury of northern right whales (Eubalaena glacialis) in the western North Atlantic ocean. Journal of Cetacean Research and Management (Special Issue) 2: 193-208

Lambertsen, R.H. 1990. Disease biomarkers in large whales of the North Atlantic and other oceans. Pp. 395-417 in J.F. McCarthy and L.R. Shugart (eds.), Biomarkers of environmental contamination. Lewis Publishers, CRC Press, Boca Raton, FL.

Lambertsen, R.H. 1997. Natural disease problems of the sperm whale. Bulletin de 1'Institut Royal des Sciences Naturelles de Belgique, Biologic 67-Suppl.: 105–112.

Law, R.J., R.J. Morris, C.R. Allchin, and B.R. Jones. 1997. Metals and chlorobiphenyls in tissues of sperm whales (Physeter macrocephalus) and other cetacean species exploiting similar diets. Bulletin de 1'Institut Royal des Sciences Naturelles de Belgique, Biologie 67-Suppl.:79– 89.

Leandro, L.F., Rolland, R.M., Roth, P.B., Lundholm, N., Wang, Z. and Doucette, G.J., 2010. Exposure of the North Atlantic right whale Eubalaena glacialis to the marine algal biotoxin, domoic acid. Marine Ecology Progress Series, 398, pp.287-303.

Leatherwood, S., Caldwell, D.K. and Winn, H.E., 1976. Whales, dolphins, and porpoises of the western North Atlantic (Vol. 396). US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service.

Lockyer, G. 1981. Estimates of growth and energy budget for the sperm whale, Physeter catodon. FAOFish. Ser. 5:489–504.

Lydersen, C., Blanchet, M.A., Kovacs, K.M., Similä, T., Freitas, C., Morange, Z., Pedersen, O.M., Vogel, E.F., Bril, M., Christensen, G. and Rikardsen, A.H., 2025. Migration to breeding areas by male sperm whales Physeter macrocephalus from the Northeast Atlantic Arctic. Scientific Reports, 15(1), p.7861.

Lyrholm, T., O. Leimar, B. Johanneson and U. Gyllensten. 1999. Sex-biased dispersal in sperm whales: contrasting mitochondrial and nuclear genetic structure of global populations. Proc. R. Soc. Lond. B 266:347–354.

Lyrholm, T. and U. Gyllensten. 1998. Global matrilineal population structure in sperm whales as indicated by mitochondrial DNA sequences. Proc. R. Soc. Lond. B 265:1679-1684.

MacLeod, C.D. 2009. Global climate change, range changes and potential implications for the conservation of marine cetaceans: a review and synthesis. Endang. Species Res. 7:125–136.

Madsen, P.T., Møhl, B., Nielsen, B.K. and Wahlberg, M., 2002. Male sperm whale behaviour during exposures to distant seismic survey pulses. Aquatic mammals, 28(3), pp.231-240.

Marques, T.A., Thomas, L., Booth, C.G., Garrison, L.P., Rosel, P.E., Takeshita, R., Mullin, K.D. and Schwacke, L., 2023. Population consequences of the Deepwater Horizon oil spill on pelagic cetaceans. *Marine Ecology Progress Series*, *714*, pp.1-14.

Marsili, L., S. Maltese, D. Coppola, L. Carletti, S. Mazzariol, and M.C. Fossi. 2014. Ecotoxicological status of seven sperm whales (Physeter macrocephalus) stranded along the Adriatic coast of Southern Italy. Aquatic Conservation: Marine and Freshwater Ecosystems 24:103-118.

Martin, A.R, 1982. A link between the sperm whales occurring off Iceland and in the Azores. Mammalia 46:259–260.

Martin, A.R. and M.R. Clarke. 1986. The diet of sperm whales (Physeter macrocephalus) between Iceland and Greenland. J. Mar. Biol. Assn UK 66:779–790.

Mate, B. R., K. M. Stafford, and D. K. Ljungblad. 1994. A change in sperm whale (Physeter macrocephalus) distribution correlated to seismic surveys in the Gulf of Mexico. Journal of the Acoustical Society of America 96 Pt.2: 3268–3269.

Merrill, G.B., Swaim, Z.T., Benaka, I.G., Bishop, A.L., Kaney, N.A., Kuhlman, S., Matheson, J.C., Menini, E., Goh, S., Lei, S. and Nowacek, D.P., 2024. Acoustic signature of plastic marine debris mimics the prey items of deep-diving cetaceans. *Marine Pollution Bulletin*, *209*, p.117069.

Mesnick, S.L., 2001. Genetic relatedness in sperm whales: evidence and cultural implications. Behavioral and Brain Sciences, 24(2), pp.346-347.

Mesnick, S., Warner, N., Straley, J., O'Connell, V., Purves, M., Guinet, C., Dyb, J.E., Lunsford, C., Roche, C. and Gasco11, N., 2006. Global sperm whale (Physeter macrocephalus) depredation of demersal longlines. In Symposium on fisheries depredation by killer and sperm whales: Behavioural insights, behavioural solutions.

Meyer-Gutbrod EL, Davies KTA, Johnson CL, Plourde S, Sorochan KA, Kenney RD, Ramp C, Gosselin J, Lawson JW, Greene CH. 2022. Redefining North Atlantic right whale habitat-use patterns under climate change. Limnology & Oceanography lno.12242. doi: 10.1002/lno.12242

Miller, P.J., Johnson, M.P. and Tyack, P.L., 2004. Sperm whale behaviour indicates the use of echolocation click buzzes 'creaks' in prey capture. *Proceedings of the Royal Society of London. Series B: Biological Sciences*, *271*(1554), pp.2239-2247.

Miller, P.J.O., M.P. Johnson, P.T. Madsen, N. Biassoni, M. Quero, and P.L. Tyack. 2009. Using at-sea experiments to study the effects of airguns on the foraging behavior of sperm whales in the Gulf of Mexico. Deep-Sea Research I 56:1168–1181.

Miller, P.J., Kvadsheim, P.H., Lam, F.P.A., Wensveen, P.J., Antunes, R., Alves, A.C., Visser, F., Kleivane, L., Tyack, P.L. and Sivle, L.D., 2012. The severity of behavioral changes observed during experimental exposures of killer (Orcinus orca), long-finned pilot (Globicephala melas), and sperm (Physeter macrocephalus) whales to naval sonar. Aquatic Mammals, 38(4), p.362.

Ministry of Foreign Affairs Japan. 2025. "Japan and the Management of Whales". Last updated 17 Jan 2025. https://www.mofa.go.jp/policy/economy/fishery/whales/japan.html. Accessed March 2025.

Mitchell, E. 1972. Estimates of stock size of the sperm whale (Physeter catodon) in the central and western North Atlantic from shipboard census data. International Whaling Commission, Cambridge, UK. Document SP72/11. (Unpublished)

Mitchell, E. 1975. Progress report on whale research, Canada. Reports to the International Whaling Commission 25:270-272.

Moore, M. J. and G. A. Early. 2005. Cumulative Sperm Whale Bone Damage and the Bends. Science 306(5705): 2215.

Moore, M.J. and Van der Hoop, J.M., 2012. The painful side of trap and fixed net fisheries: chronic entanglement of large whales. Journal of Marine Sciences, 2012(1), p.230653.

Moore, M., J. van der Hoop, S. Barco, A. Costidis, F. Gulland, P. Jepson, K. Moore, S. Raverty and W. McLellan. 2013. Criteria and case definitions for serious injury and death of pinnipeds and cetaceans caused by anthropogenic trauma. Dis. Aquat. Org. 103:229–264.

Muirhead, C. A., Warde, A. M., Biedron, I. S., Nicole Mihnovets, A., Clark, C. W., & Rice, A. N. (2018). Seasonal acoustic occurrence of blue, fin, and North Atlantic right whales in the New York Bight. Aquatic Conservation: Marine and Freshwater Ecosystems, 28(3), 744-753.

Mullins, J., Whitehead, H. and Weilgart, L.S., 1988. Behaviour and vocalizations of two single sperm whales, Physeter macrocephalus, off Nova Scotia. Canadian Journal of Fisheries and Aquatic Sciences, 45(10), pp.1736-1743.

Murphy, R.C. 1918. A sperm whale ashore near New York. Forest and Stream, 88:288.

Murphy, S., R.J. Law, R. Deaville, J. Barnett, M W. Perkins, A. Brownlow, R. Penrose, N.J. Davison, J.L. Barber P.D. Jepson. 2018. Organochlorine contaminants and reproductive implication in cetaceans: A case study of the common dolphin. Pages 3–38 in M.C. Fossi and C. Panti, (eds.) Marine mammal ecotoxicology: Impacts of multiple stressors on population health. Academic Press, New York, New York.

National Marine Fisheries Service [NMFS]. 2010. Recovery plan for the sperm whale (Physeter macrocephalus). National Marine Fisheries Service, Silver Spring, MD. 165pp.

National Marine Fisheries Service [NMFS]. 2013. Sperm whale (Physeter macrocephalus): North Atlantic stock. NOAA Fisheries Draft Marine Mammal Stock Assessment Reports. National Marine Fisheries Service, Silver Spring, MD. 15 pp.

National Marine Fisheries Service [NMFS]. 2015. Sperm Whale (Physeter macrocephalus) 5-Year Review: Summary and Evaluation. National Marine Fisheries Service, Office of Protected Resources, Silver Spring, MD.

National Marine Fisheries Service [NMFS]. 2025a. "Atlantic Marine Assessment Program for Protected Species". Accessed March 2025. https://www.fisheries.noaa.gov/new-england-mid-atlantic/population-assessments/atlantic-marine-assessment-program-protected

National Marine Fisheries Service [NMFS]. 2025b. "Marine Mammal Health and Stranding Response Program". https://mmhsrp.nmfs.noaa.gov/mmhsrp/

National Research Council [NRC]. 2003. Ocean Noise and Marine Mammals. National Academic Press, Washington, D.C.

National Research Council [NRC]. 2005 . *Marine Mammal Populations and Ocean Noise: Determining When Noise Causes Biologically Significant Effects.* Washington, D.C. : National Academy Press.

New York State Energy Research and Development Authority [NYSERDA]. 2021. “Digital Aerial Baseline Survey of Marine Wildlife in Support of Offshore Wind Energy: Spatial and Temporal Marine Wildlife Distributions in the New York Offshore Planning Area, Summer 2016–Spring 2019,” NYSERDA Report Number 21-07d. Prepared by Normandeau Associates, Inc., Gainesville, FL, and APEM, Ltd., Stockport, UK. nyserda.ny.gov/publications.

Nielsen, J. B., Nielsen, F., Joergensen, P.-J. and Grandjean, P. 2000. Toxic metals and selenium in blood from pilot whales (Globecephala melas) and sperm whales (Physeter catodon). Marine Pollution Bulletin 40: 348-351.

Nieukirk et al 2012

Ortega-Ortiz, J. G., D. Engelhaupt, M. Winsor, B. R. Mate and A. R. Hoelzel. 2012. Kinship of long-term associates in the highly social sperm whale. Molecular Ecology 21(3): 732 - 744.

O'Shea, T. J. (ed.). 1999. Environmental contaminants and marine mammals. In: J. E. Reynolds III and S. A. Rommel (eds), Biology of Marine Mammals, pp. 485-564. Smithsonian University Press.

Pace, D.S., A. Miragliulolo, M. Mariani, C. Vivaldi, and B. Mussi. 2014. Sociality of sperm whale off Ischia Island (Tyrrhenian Sea, Italy). Aquatic Conservation: Marine and Freshwater Ecosystems 24:71-82.

Palacios, D.M. and B.R. Mate. 1996. Attack by false killer whales (Pseudorca crassidens) on sperm whales (Physeter macrocephalus) in the Galapagos Islands. Marine Mammal Science 12:582– 587.

Palka, D., Aichinger Dias, L., Broughton, E., Chavez-Rosales, S., Cholewiak, D., Davis, G., DeAngelis, A., Garrison, L., Hass, H., Hatch, J., Hyde, K., Jech, M., Josephson, E., Mueller-Brennan, L., Orphanides, C., Pegg, N., Sigourney, D., Soldevilla, M., & Walsh, H. (2021). Atlantic

Marine Assessment Program for Protected Species: FY15-FY19. US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2021-051. U.S. Department of the Interior, Bureau of Ocean Energy Management, Washington, DC

Parks, S.E., Clark, C.W. and Tyack, P. 2007. Short- and long-term changes in right whale calling behavior: The potential effects of noise on acoustic communication. Journal of the Acoustical Society of America, 122: 3725–3731.

Parks, S.E., Urazghildiiev, I. and Clark, C.W., 2009. Variability in ambient noise levels and call parameters of North Atlantic right whales in three habitat areas. The Journal of the Acoustical Society of America, 125(2), pp.1230-1239.

Passive Acoustic Cetacean Map [PACM]. 2025. Passive acoustic cetacean map, v1.1.10, accessed 17 Feb 2025. NOAA Northeast Fisheries Science Center, Woods Hole, MA.

Pershing, A.J., Alexander, M.A., Brady, D.C., Brickman, D., Curchitser, E.N., Diamond, A.W., McClenachan, L., Mills, K.E., Nichols, O.C., Pendleton, D.E. and Record, N.R., 2021. Climate impacts on the Gulf of Maine ecosystem: a review of observed and expected changes in 2050 from rising temperatures. Elem Sci Anth, 9(1), p.00076.

Pierce, G.J., M.B. Santos, C. Smeenk, A. Saveliev, and A.F. Zuur. 2007. Historical trends in the incidence of strandings of sperm whales (Physeter macrocephalus) on North Sea coasts: an association with positive temperature anomalies. Fisheries Research 87:219-228.

Pitman, R.L. and S.J. Chivers. 1998. Terror in black and white. Natural History 07(10):26–29

Pitman, R. L., L. T. Ballance, S. L. Mesnick, and S. J. Chivers. 2001. Killer whale predation on sperm whales: observations and implications. Marine Mammal Science 17:494–507.

Raven, H. C. and Gregory, W. K. 1933. The spermaceti organ and nasal passages of the sperm whale (Physeter catadon) and other odontocetes. Amer. Mus. Novitates, 667:1-18.

Redfern, J.V., Becker, E.A. and Moore, T.J., 2020. Effects of variability in ship traffic and whale distributions on the risk of ships striking whales. Frontiers in Marine Science, 6, p.793.

Reeves R. and G. Notarbartolo di Sciara. 2006. The status and distribution of cetaceans in the Black Sea and Mediterranean Sea. IUCN Centre for Mediterranean Cooperation, Malaga, Spain. 137 pp.

Reeves, R.R. and H. Whitehead. 1997. Status of sperm whale, Physeter macrocephalus, in Canada. Canadian Field Naturalist 111:293-307.

Reeves, R.R., J.N. Lund, T.D. Smith and E.A. Josephson. 2011. Insights from whaling logbooks on whales, dolphins, and whaling in the Gulf of Mexico. Gulf of Mexico Science (1):41-67.

Rendell, L., Mesnick, S.L., Dalebout, M.L., Burtenshaw, J. and Whitehead, H., 2012. Can genetic differences explain vocal dialect variation in sperm whales, Physeter macrocephalus?. Behavior genetics, 42, pp.332-343.

Rice, D.W. 1989. Sperm whale Physeter macrocephalus Linnaeus, 1758. Pp. 177–233 in S.H. Ridgway and R. Harrison (eds.), Handbook of Marine Mammals, Vol. 4. Academic Press, London.

Richardson, W. J., C. R. Greene, Jr., C. I. Malme and D. H. Thomson. 1995. Marine Mammals and Noise. Academic Press, San Diego, California.

Rickard, M.E., Lomac-MacNair, K.S., Ireland, D.S., Leiter, S.M., Poster, M.D. and Zoidis, A.M., 2022. Evidence of Large Whale Socio-Sexual Behavior in the New York Bight. Aquatic Mammals, 48(5).

Ritter, F. 2012. Collisions of sailing vessels with cetaceans worldwide: first insights into a seemingly growing problem. Journal of Cetacean Research and Management 12:119-127.

Roberts JJ, Yack TM, Cañadas A, Fujioka E, Halpin PN, Barco SG, Boisseau O, Chavez-Rosales S, Cole TVN, Cotter MP, Cummings EW, Davis GE, DiGiovanni Jr. RA, Garrison LP, Gowan TA, Jackson KA, Kenney RD, Khan CB, Lockhart GG, Lomac-MacNair KS, McAlarney RJ, McLellan WA, Mullin KD, Nowacek DP, O'Brien O, Pabst DA, Palka DL, Quintana-Rizzo E, Redfern JV, Rickard ME, White M, Whitt AD, Zoidis AM. 2022. Density Model for Sperm Whale (Physeter macrocephalus) for the U.S. East Coast, Version 8.1, 2023-05-27, and Supplementary Report. Marine Geospatial Ecology Laboratory, Duke University, Durham, North Carolina.

Ruppel, C.D., Weber, T.C., Staaterman, E.R., Labak, S.J. and Hart, P.E., 2022. Categorizing active marine acoustic sources based on their potential to affect marine animals. Journal of Marine Science and Engineering, 10(9), p.1278.

Sadove, S. S. and P. Cardinale. 1993. Species composition and distribution of marine mammals and sea turtles in the New York Bight. Final Report to U.S. Dept. of the Interior, Fish and Wildlife Service Southern New England-New York Bight Coastal Fisheries Project. Charlestown, RI.

Sardain, A., Sardain, E. and Leung, B., 2019. Global forecasts of shipping traffic and biological invasions to 2050. *Nature Sustainability*, *2*(4), pp.274-282.

Savery, L.C., 2013a. Global assessment of ocean pollution using sperm whales as an indicator species. The University of Maine.

Savery, L.C., Evers, D.C., Wise, S.S., Falank, C., Wise, J., Gianios Jr, C., Kerr, I., Payne, R., Thompson, W.D., Perkins, C. and Zheng, T., 2013b. Global mercury and selenium concentrations in skin from free-ranging sperm whales (Physeter macrocephalus). Science of the total environment, 450, pp.59-71.

Savery, L.C., Wise, S.S., Falank, C., Wise, J., Gianios Jr, C., Thompson, W.D., Perkins, C., Zheng, T., Zhu, C. and Wise Sr, J.P., 2014. Global assessment of oceanic lead pollution using sperm whales (Physeter macrocephalus) as an indicator species. Marine pollution bulletin, 79(1-2), pp.236-244.

Schulz, T.M., 2008. The production and exchange of sperm whale coda vocalizations. Library and Archives Canada, Ottawa.

Schulz, T.M., Whitehead, H., Gero, S. and Rendell, L., 2011. Individual vocal production in a sperm whale (Physeter macrocephalus) social unit. Marine Mammal Science, 27(1), pp.149-166.

Scott, T. M. and S. S. Sadove. 1997. Sperm whale, Physeter macrocephalus, sightings in the shallow shelf waters off Long Island, New York. Marine Mammal Science 13: 317 - 321.

Silber, G.K. and Silber, K.M., 2024. Co-occurrence of harmful algal blooms and whale deaths. Frontiers in Marine Science, 11, p.1454656.

Simmonds, M.P., 2012. Cetaceans and marine debris: the great unknown. *Journal of Marine Sciences*, *2012*(1), p.684279.

Sivle, L.D., Kvadsheim, P.H., Fahlman, A., Lam, F.P.A., Tyack, P.L. and Miller, P.J.O., 2012. Changes in dive behavior during naval sonar exposure in killer whales, long-finned pilot whales, and sperm whales. Frontiers in Physiology, 3, p.400.

Smith, S.C. and H. Whitehead. 1993. Variations in the feeding success and behaviour of Galapagos sperm whales (Physeter macrocephalus) as they relate to oceanographic conditions. Canadian Journal of Zoology 71:1991–1996.

Sousa, A., F. Alves, A. Dinis, J. Bentz, M.J. Cruz and J.P. Nunes. 2019. How vulnerable are cetaceans to climate change? Developing and testing a new index. Ecol. Indic. 98:9–18.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas, and P.L. Tyack. 2007. Marine mammal noise exposure criteria: Initial scientific recommendations. Aquatic Mammals 33(4):411–521.

Southall, B., Calambokidis, J., Barlow, J., Moretti, D., Friedlaender, A., Stimpert, A., Douglas, A., Southall, K., Arranz, P., DeRuiter, S. and Goldbogen, J., 2014. Biological and behavioral response studies of marine mammals in Southern California, 2013.("SOCAL-13"). Final Project Report.

Southall, B.L., Finneran, J.J., Reichmuth, C., Nachtigall, P.E., Ketten, D.R., Bowles, A.E., Ellison, W.T., Nowacek, D.P. and Tyack, P.L., 2019. Marine mammal noise exposure criteria: Updated scientific recommendations for residual hearing effects. Aquatic Mammals, 45(2), pp.125-232.

Stanistreet, J.E., Nowacek, D.P., Bell, J.T., Cholewiak, D.M., Hildebrand, J.A., Hodge, L. E. W., Van Parijs, S.M., & Read, A.J. 2018. Spatial and seasonal patterns in acoustic detections of sperm whales Physeter macrocephalus along the continental slope in the western North Atlantic Ocean. Endangered Species Research, 35, 1-13. https://doi.org/10.3354/esr00867

Stanistreet, J.E., W.A.M. Beslin, K. Kowarski, S.B. Martin, A. Westell and H.B. Moors-Murphy 2022. Changes in the acoustic activity of beaked whales and sperm whales recorded during a naval training exercise off eastern Canada. Scientific Reports 12(1): 1973."

Starbuck, A. (1878). History of the American Whale Fishery, from its Earliest Inception to the Year 1876. New York: Argosy-Antiquarian Ltd.

State of Hawaii. 2023. "Researchers are surprised and sad to find marine debris in 60-ton sperm whale's stomach". Office of the Governor. Accessed March 2025. https://governor.hawaii.gov/newsroom/researchers-are-surprised-and-sad-to-find-marine-debris-in-60-ton-sperm-whales-stomach/

Stone, C. J. 2003. The effect of seismic activity on marine mammals in UK waters, 1998–2000. Report No. 323 of the Joint Nature Conservation Committee, Dunnet House, 7 Thistle Place, Aberdeen, Scotland.

Stone KM, Leiter SM, Kenney RD, Wikgren BC, Thompson JL, Taylor JKD, Kraus SD. 2017. Distribution and abundance of cetaceans in a wind energy development area offshore of Massachusetts and Rhode Island. J Coast Conserv 21:527–543.doi: 10.1007/s11852-017-0526-4

Sutcliffe, W.H. and Brodie, P.F., 1977. Whale distribution in Nova Scotia waters. Fisheries and Marine Service, Bedford Institute of Oceanography.

Taylor, B.L., Baird, R., Barlow, J., Dawson, S.M., Ford, J., Mead, J.G., Notarbartolo di Sciara, G., Wade, P. & Pitman, R.L. 2019. Physeter macrocephalus (amended version of 2008 assessment). The IUCN Red List of Threatened Species 2019: e.T41755A160983555. http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T41755A160983555.en

Tetra Tech and LGL. 2020. Final Comprehensive Report for New York Bight Whale Monitoring Aerial Surveys, March 2017 – February 2020. Technical report prepared by Tetra Tech, Inc. and LGL Ecological Research Associates, Inc. 211 pp. + appendices. Prepared for New York State Department of Environmental Conservation, Division of Marine Resources, East Setauket, NY. May 18, 2020.

Townsend, C.H. 1935. The distribution of certain whales as shown by logbook records of American whaleships. Zoologica 19(1):1–50 plus maps.

Unger, B., Rebolledo, E.L.B., Deaville, R., Gröne, A., IJsseldijk, L.L., Leopold, M.F., Siebert, U., Spitz, J., Wohlsein, P. and Herr, H., 2016. Large amounts of marine debris found in sperm whales stranded along the North Sea coast in early 2016. Marine pollution bulletin, 112(1-2), pp.134-141.

United Nations Global Impact. 2025. "End Waste Entering the Ocean". Accessed March 2025. https://unglobalcompact.org/take-action/ocean/communication/end-waste-entering-the-ocean

Van Der Hoop, J.M., Moore, M.J., Barco, S.G., Cole, T.V., DAOUST, P.Y., Henry, A.G., Mcalpine, D.F., McLellan, W.A., Wimmer, T. and Solow, A.R., 2013. Assessment of management to mitigate anthropogenic effects on large whales. Conservation Biology, 27(1), pp.121-133.

van der Linde, M.L. and Eriksson, I.K., 2020. An assessment of sperm whale occurrence and social structure off São Miguel Island, Azores using fluke and dorsal identification photographs. Marine Mammal Science, 36(1), pp.47-65.

Van Parijs, S.M., DeAngelis, A.I., Aldrich, T., Gordon, R., Holdman, A., McCordic, J.A., Mouy, X., Rowell, T.J., Tennant, S., Westell, A. and Davis, G.E., 2023. Establishing baselines for predicting change in ambient sound metrics, marine mammal, and vessel occurrence within a US offshore wind energy area. ICES Journal of Marine Science, p.fsad148

Vanderlaan, A.S., Corbett, J.J., Green, S.L., Callahan, J.A., Wang, C., Kenney, R.D., Taggart, C.T. and Firestone, J., 2009. Probability and mitigation of vessel encounters with North Atlantic right whales. *Endangered Species Research*, *6*(3), pp.273-285.

Vanderlaan, A.S. and Taggart, C.T., 2007. Vessel collisions with whales: the probability of lethal injury based on vessel speed. *Marine mammal science*, *23*(1), pp.144-156.

Vanselow, K.H., K. Ricklefs. 2005. Are solar activity and sperm whale Physeter macrocephalus strandings around the North Sea related? Journal of Sea Research 53: 319–327.

Vanselow, K.H., Ricklefs, K. and Colijn, F., 2009. Solar driven geomagnetic anomalies and sperm whale (Physeter macrocephalus) strandings around the North Sea: an analysis of long term datasets. The Open Marine Biology Journal, 3, pp.89-94.

Viale, D. N. Verneau and Y. Tison. 1992. Stomach obstruction in a sperm whale beached on the Lavezzi islands: Macropollution in the Mediterranean. J. Res. Oceanogr. 16(3–4): 100–102.

Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1993. Sperm whales associated with Gulf Stream features off the northeastern USA shelf. Fisheries Oceanography 2:101-105.

Waring, G.T., T. Hamazaki, D. Sheehan, G. Wood, and S. Baker. 2001. Characterization of beaked whale (Ziphiidae) and sperm whale (Physeter macrocephalus) summer habitat in shelf-edge and deeper waters off the northeast U.S. Marine Mammal Science 17(4):703-717.Waring, G.T., E. Josephson, C.P. Fairfield-Walsh, K. Maze-Foley. 2009. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments—2008. NOAA Tech. Memo. NMFS-NE-210. 440 pp.

Waring, G.T., E. Josephson, C.P. Fairfield-Walsh, K. Maze-Foley. 2009. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments—2008. NOAA Tech. Memo. NMFS-NE-210. 440 pp

Watkins, W.A. and W.E. Schevill. 1975. Sperm whales (Physeter catodon) react to pingers. Deep-sea Research 22:123–129.

Watkins, W.A., K.E. Moore, and P. Tyack. 1985. Sperm whale acoustic behavior in the southeast Caribbean. Cetology 49:1–15.

Weilgart, L.S., 2007. The impacts of anthropogenic ocean noise on cetaceans and implications for management. Canadian journal of zoology, 85(11), pp.1091-1116.

Weilgart, L. and H. Whitehead. 1988. Distinctive vocalizations from mature male sperm whales (Physeter macrocephalus). Canadian Journal of Zoology 66:931–937.

Weilgart, L. and H. Whitehead. 1993. Coda communication by sperm whales (Physeter macrocephalus) off the Galapagos Islands. Canadian Journal of Zoology 71:744–752.

Weilgart, L. and H. Whitehead. 1997. Group-specific dialects and geographical variation in coda repertoire in South Pacific sperm whales. Behavioral Ecology and Sociobiology 40:277–285.

Weir, C.R., 2008. Overt responses of humpback whales (Megaptera novaeangliae), sperm whales (Physeter macrocephalus), and Atlantic spotted dolphins (Stenella frontalis) to seismic exploration off Angola. Aquatic Mammals, 34(1), p.71.

Weller, D.W., B. Wursig, H. Whitehead, J.C. Norris, S.K. Lynn, R.W. Davis, N. Clauss, and P. Brown. 1996. Observations of an interaction between sperm whales and short-finned pilot whales in the Gulf of Mexico. Marine Mammal Science 12:588–593.

Westell, A., Sakai, T., Valtierra, R., Van Parijs, S.M., Cholewiak, D. and DeAngelis, A., 2022. Sperm whale acoustic abundance and dive behaviour in the western North Atlantic. Scientific Reports, 12(1), p.16821.

Whitehead, H. 1990. Assessing sperm whale populations using natural markings: recent progress. Rep. Int. Whal. Commn. (Spec. Iss. 12):377–382.

Whitehead, H. 1997. Sea surface temperature and the abundance of sperm whale calves off the Galapagos Islands: implications for the effects of global warming. Reports to the International Whaling Commission 47:941–944.

Whitehead, H. 1998. Cultural selection and genetic diversity in matrilineal whales. Science 282: 1708 - 1711.

Whitehead, H. 2002. Estimates of the current global population size and historical trajectory for sperm whales. Marine Ecology Progress Series 242: 295 - 304.

Whitehead, H. 2003. Sperm whales: social evolution in the ocean. Univ. of Chicago Press, Chicago, IL.

Whitehead, H. and Kahn, B., 1992. Temporal and geographic variation in the social structure of female sperm whales. Canadian Journal of Zoology, 70(11), pp.2145-2149.

Whitehead, H. and Shin, M., 2022. Current global population size, post-whaling trend and historical trajectory of sperm whales. Scientific Reports, 12(1), p.19468.

Whitehead, H. and L. Weilgart. 1991. Patterns of visual observable behaviour and vocalizations in groups of female sperm whales. Behaviour 118:275–296.

Whitehead, H., Brennan, S. and Grover, D., 1992. Distribution and behaviour of male sperm whales on the Scotian Shelf, Canada. Canadian Journal of Zoology, 70(5), pp.912-918.

Whitehead, H., Christal, J. and Dufault, S., 1997. Past and distant whaling and the rapid decline of sperm whales off the Galápagos Islands. Conservation Biology, 11(6), pp.1387-1396.

Whitehead, H. A. Coakes, N. Jaquet, and S. Lusseau. 2008. Movements of sperm whales in the tropical Pacific. Mar. Ecol. Prog. Ser. 361:291-300.

Whitehead, H., Antunes, R., Gero, S., Wong, S.N.P., & Engelhaupt, D. 2012. Multilevel societies of female sperm whales (Physeter macrocephalus) in the Atlantic and Pacific: Why are they so different? International Journal of Primatology, 33, 1142-1164. https://doi-org.esf.idm.oclc.org/10.1007/s10764-012-9598-z

Williams, R., Gero, S., Bejder, L., Calambokidis, J., Kraus, S.D., Lusseau, D., Read, A.J. and Robbins, J., 2011. Underestimating the damage: interpreting cetacean carcass recoveries in the context of the Deepwater Horizon/BP incident. Conservation Letters, 4(3), pp.228-233.

Wise Sr. J.P., W.D. Thompson, S.S. Wise, C. LaCerte, J. Wise, C. Gianios Jr., C. Perkins, T. Zheng, L. Benedict, M.D. Mason, R. Payne, and I. Kerr. 2011a. A global assessment of gold, titanium, strontium and barium pollution using sperm whales (Physeter macrocephalus) as an indicator species. Journal of Ecosystem and Ecography. 1: 101. doi:10.4172/2157-7625.1000101.

Wise Sr. J.P., S.S. Wise, C. LaCerte, J.P. Wise Jr., A.M. Aboueissa. 2011b. The genotoxicity of particulate and soluble chromate in sperm whale (Physeter macrocephalus) skin fibroblasts. Environmental and Molecular Mutagenesis. 52:43-49.

Wise, C.F., J.T.F. Wise, S.S. Wise, W.D. Thompson, J.P. Wise Jr., and J.P Wise Sr. 2014a. Chemical dispersants used in the Gulf of Mexico oil crisis are cytotoxic and genotoxic to sperm whale skin cells. Aquatic Toxicology. 152:335-340.

Wise, C.F., J.T.F. Wise, C.F.Wise, S.S. Wise, C. Gianios, Jr., H. Xie, W.D. Thompson, C. Perkins, C. Falank, and J.P Wise Sr. 2014b. Concentrations of the genotoxic metals, chromium and nickel, in whales, tar balls, oil slicks, and released oil from the Gulf of Mexico in the immediate aftermath of the Deepwater Horizon oil crisis: is genotoxic metal exposure part of the Deepwater Horizon Legacy? Environmental Science and Technology. 48:2997-3006.

Wong, S.N. and Whitehead, H., 2014. Seasonal occurrence of sperm whales (Physeter macrocephalus) around Kelvin Seamount in the Sargasso Sea in relation to oceanographic processes. Deep Sea Research Part I: Oceanographic Research Papers, 91, pp.10-16.

Womersley, F.C., Loveridge, A. and Sims, D.W., 2023. Four steps to curb ‘ocean roadkill’. *Nature*, *621*(7977), pp.34-38.

Woods Hole Oceanographic Institute [WHOI]. 2025. Robots4Whales. https://robots4whales.whoi.edu/

World Wildlife Fund [WWF]. 2024. "WWF condemns Iceland's decision to conduct commercial whaling". Accessed March 2025. https://wwfwhales.org/news-stories/wwf-condemns-icelands-decision-2024

Wright, A. 2005. Lunar cycles and sperm whales (Physeter macrocephalus) strandings on the North Atlantic coastlines of the British Isles and eastern Canada. Marine Mammal Science 21:145–149.

Zoidis, A.M., Lomac-MacNair, K.S., Ireland, D.S., Rickard, M.E., McKown, K.A., & Schlesinger, M.D. (2021). Large whale distribution and density in the New York Bight from monthly aerial surveys 2017-2020. Continental Shelf Research, 230, 104572. https://doi.org/10.1016/j.csr.2021.104572

Zoidis, A.M., Lomac-MacNair, K.S., Blees, M.K. and Rickard, M.E., 2023. Sperm Whale (Physeter macrocephalus) Behavioral Events Observed During Aerial Surveys in the New York Bight, 2017-2020. Aquatic Mammals, 49(3), pp.308-319.