

**Summary of marine mammal
observations during 2009 surveys**

Massachusetts Water Resources Authority
Environmental Quality Department
Report 2010-08



Citation

Wu, D. 2010. **Summary of marine mammal observations during 2009 surveys.** Boston: Massachusetts Water Resources Authority. Report 2010-08. 18 pp.

SUMMARY OF MARINE MAMMAL OBSERVATIONS DURING 2009 SURVEYS

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Technical Report No: 2010-08

Acknowledgements

Marine mammal observers were individually contracted to assist Battelle in collecting the data contained in this report. The dedication and professionalism of David Silvia is appreciated.

Thanks and appreciation are also extended to the captains, crews, and scientific personnel of all the research vessels involved with the surveys of Boston Harbor and Massachusetts Bay.

Thanks to Matt Fitzpatrick of Battelle for compiling the mammal data.

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1.0 Introduction

At least five endangered species of whales are known to visit or inhabit the Massachusetts and Cape Cod Bay area (Environmental Protection Agency [EPA] 1993): the right whale, humpback whale, finback whale, sei whale (rarely observed) and blue whale (rarely observed). Several non-endangered marine mammal species are also found: minke whales, harbor porpoise, several dolphin species, gray seals, and harbor seals.

Since 1995, Massachusetts Water Resources Authority (MWRA) has included marine mammal observers on monitoring surveys. The MWRA surveys are being conducted as part of the long-term Harbor and Outfall Monitoring Project designed to verify compliance with the discharge permit and to assess the potential environmental impact of treated sewage effluent discharge into Massachusetts Bay. These observers were included in response to a National Marine Fisheries Service (NMFS) request that MWRA provide observational data and set a positive example by using observers to minimize the chances of collision with a right whale. In addition to looking for right whales, observers conducted observations for other marine mammals. On surveys where observers were not present, the chief scientist and field crew documented any incidental sightings of marine mammals.

Marine mammal observers were present on most, but not all, nearfield and farfield water quality surveys during 2009. Observers were not present on Boston Harbor surveys and bacteria surveys for shellfish water quality monitoring.

2.0 Background

A brief description of when marine mammals are expected to be found in Massachusetts and Cape Cod Bays is presented and discussed below.

The right whale (*Eubalaena glacialis*) is critically endangered. Based on historical sightings, right whales can be expected to visit Massachusetts and Cape Cod Bays throughout the year (Brown *et al.* 2002), with peak abundance in February, March and early April (Hamilton and Mayo 1990). Over the past four decades 72% of the catalogued population of right whales has visited Cape Cod Bay and Massachusetts Bay (Brown *et al.* 2002). For the period of 1978 through 1986, using photographed sightings of right whales collected from whale watch boats and research cruises, the total number of individually identified right whales in Cape Cod Bay ranged from a single animal in 1978 to 47 individuals in 1986 (Hamilton and Mayo 1990). The use of the eastern portion of Stellwagen Bank/Wildcat Knoll by right whales has been noted during extended surveys by the Center for Coastal Studies (Brown *et al.* 2002).

The humpback whale (*Megaptera novaeangliae*) is an endangered species of whale known to feed within the Gulf of Maine in the spring, summer and fall (Waring *et al.* 1999). Historic records indicate that humpbacks have been documented on Stellwagen Bank from April through December (CeTap 1982; Geraci *et al.* 1989; NMFS 1991). However, distribution appears to correlate with prey densities (Waring *et al.* 1999). The amount of humpback whale use of the Stellwagen area varies periodically most likely based on the availability of sand lance as prey (Payne *et al.* 1986; Payne *et al.* 1990; Weinrich *et al.* 1997).

The finback whale (*Balaenoptera physalus*) is considered to be an endangered species and is the most abundant and frequently sighted of the endangered whales that visit Massachusetts and Cape Cod Bays (EPA 1993). Finbacks are sighted year round in the Stellwagen Bank area with a peak abundance occurring between the spring and fall (Pett and McKay 1990).

The sei whale (*Balaenoptera borealis*) and blue whale (*Balaenoptera musculus*) are both endangered species (EPA 1993). The sei whale is uncommon but is regularly sighted (Schilling *et al.* 1992), while the blue whale is rarely sighted in Massachusetts and Cape Cod Bays (EPA 1993). Both blue and sei whales typically remain in deeper water (more than 100 meters) and further offshore (CeTap 1982). However, sightings of these species in coastal areas may correspond to changes in prey distribution (Payne *et al.* 1990, Wenzel *et al.* 1988).

The minke whale (*Balaenoptera acutorostrata*) is a non-endangered species typically seen in the Stellwagen Bank area during the spring, summer and fall (CeTap 1982; Pett and McKay 1990). During the winter, minke whale sightings in New England appear to decline dramatically (Waring *et al.* 1999).

The Atlantic white-sided dolphin (*Lagenorhynchus acutus*) is a species of dolphin found from central west Greenland to North Carolina (Waring *et al.* 1999). The Gulf of Maine stock of Atlantic white-sided dolphins is classified as strategic by the National Marine Fisheries Service (Waring *et al.* 1999). Sightings of these dolphins in the Stellwagen Bank and Cape Cod Bay areas are common in the spring, summer (Weinrich *et al.* 2001), and, to a lesser extent, the fall (Pett and McKay 1990).

The Atlantic pilot whale or long-finned pilot whale (*Globicephala melaena*) is the largest species of dolphin found in cool temperate waters off Labrador, Newfoundland, and in the St. Lawrence River with sporadic sightings as far south as Maryland and Virginia (Bulloch 1993). Pilot whales form schools of a few to many hundreds of individuals and are mainly found relatively close to shore. Pilot whale distribution and abundance appear to be linked to the topography of the sea floor and the abundance of their primary food source, squid (Harrison and Bryden 1989).

The gray seal (*Halichoerus grypus*) is a non-endangered species of pinniped found from Maine to Long Island Sound (Rough 1995). A small, year round breeding population is known to occur on outer Cape Cod and Nantucket Island (Waring *et al.* 1999). The majority of gray seal sightings in Cape Cod Bay and the Stellwagen Bank area occur during the winter and spring, although periodic sightings have been recorded in the summer (Center for Coastal studies unpublished data).

Harbor porpoises (*Phocoena phocoena*) of the Gulf of Maine/Bay of Fundy stock are classified as strategic by the National Marine Fisheries Service (Waring *et al.* 1999). Historic data indicate that harbor porpoises can be found in the Stellwagen Bank area and Cape Cod Bay from December through June (Pett and McKay 1990).

The harbor seal (*Phoca vitulina*) is a non-endangered species of pinniped commonly found in the near shore waters around New England (Katona *et al.* 1993). Harbor seals are most frequently seen in the Stellwagen Bank and Cape Cod Bay areas in the winter and early spring with sightings beginning in late September (Pett and McKay 1990).

3.0 Methods

Figure 1 shows a map of MWRA sampling stations, nearfield and farfield. Marine mammal observations were performed during all daylight hours while transiting during nearfield water column surveys, and while the vessel was on-station for sampling operations. During vessel transits, the observer continuously scanned the sea surface from directly ahead to 90 degrees abeam on either side of the vessel. Initial sightings were made by eye with confirmation and identification aided by binoculars. While on-station, the observer scanned 360 degrees around the vessel. The observer was typically positioned at the highest and most secure vantage point of the survey vessel. Weather conditions, safety of the observer, and limiting interference with the operation of the vessel and sampling team were all factors that influenced the position of the observer on board the vessel. Three survey vessels were used as observation platforms during the course of the year.

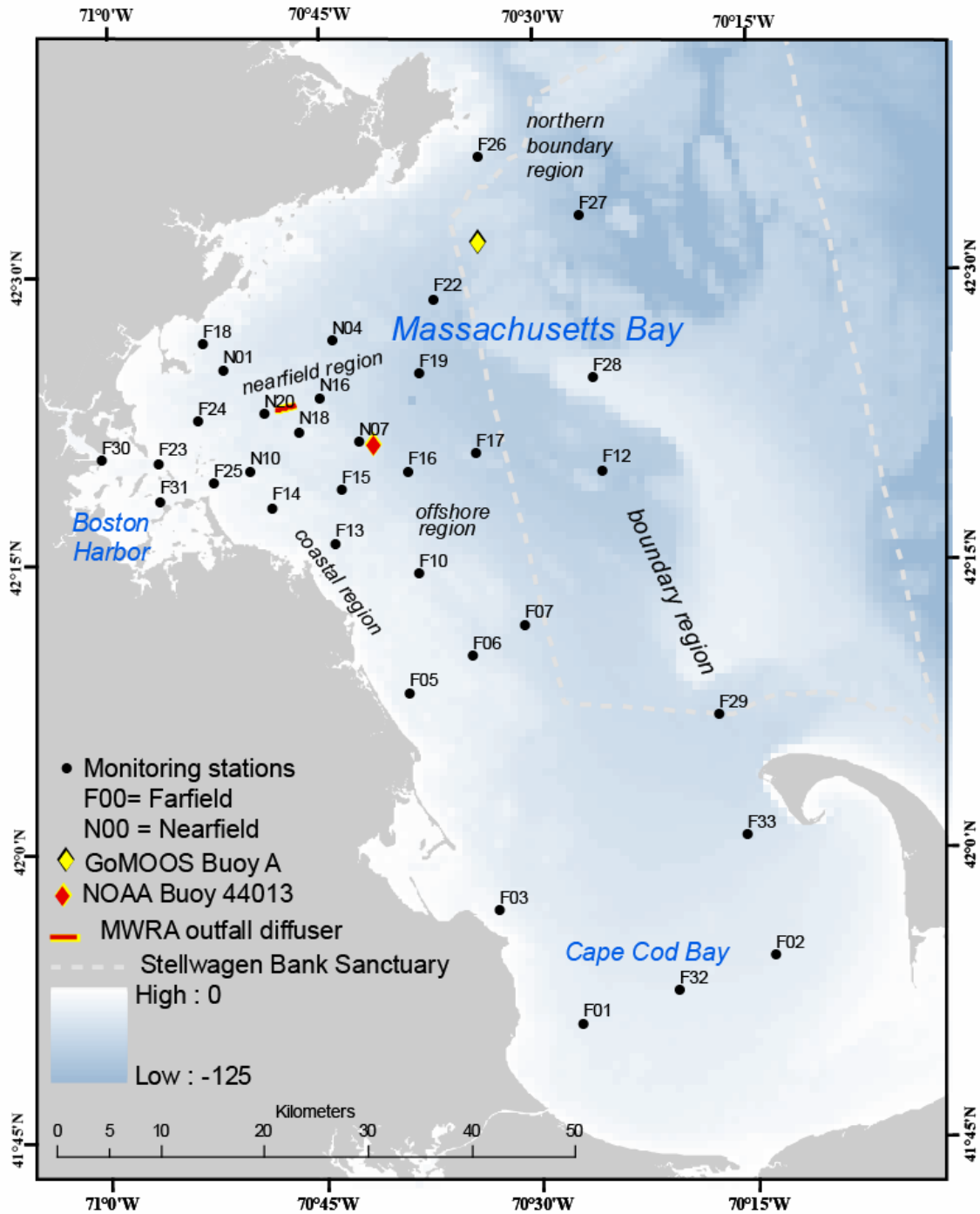


Figure 1. Location of Nearfield and Farfield Stations

The observer's eye-height above the sea surface was approximately 4 meters on the R/V *Tioga* and R/V *Andy Lynn VI* and 2.5 meters aboard the R/V *Aquamonitor*. Observations were conducted 40 minutes out of every hour and were suspended when visibility was reduced to zero or when darkness occurred. The vessels R/V *Auk* and R/V *Tioga* were also used for surveys with onboard marine mammal observers.

For some surveys, marine mammal observers were not present. The scientific crew on board the R/V *Merganser* and R/V *Aquamonitor* observed marine mammals while on these surveys. These vessels were used to conduct MWRA Boston Harbor surveys and some other nearfield, farfield, and *Alexandrium* rapid response surveys (Figure 2). Similar to the previous year, data from those surveys are included in this report.

Vessel track, station sequence, and number of stations varied among cruises, due to the constraints of weather, special survey requirements, or both.

4.0 Results

Observation of marine mammals on surveys designed and operated for the collection of water quality data places limitations and constraints on the method of observation and on the conclusions that may be drawn from the data. Standard line transect methodology is not possible on such surveys, and different vessels (which vary the characteristics of the survey platform) were used during the year. Therefore it is not appropriate to use these opportunistic sightings to estimate animal abundance. The data provide useful qualitative information concerning seasonal patterns and relative abundance within the same study area.

During the 2009 monitoring year, the marine mammal observers, Battelle survey team members, and MWRA survey team members counted between 38-39 individual whales, 6-7 Atlantic white-sided dolphin, two unidentified dolphins, and nine harbor porpoises. Included in the whale count were one right whale, ten humpback whales, ten minke whales, and between 17-18 unidentified whales (of which 11-12 were baleen whales). Whale sightings in 2009 were concentrated in the Stellwagen Bank National Marine Sanctuary (25-26 whales) followed by the nearfield area (six whales). Four and three whales were sighted in the farfield and Cape Cod Bay, respectively (Figure 3). The total number of whales (38-39) sighted during 2009 was slightly less than 2008 (44-45 sightings). Tables 1 and 2 summarize all the sightings of whales by survey staff in 2009. Additionally, all other sighting of marine mammals such as pinnipeds and dolphins are also included in those tables. In addition to the whales, approximately 140 harbor seals, 12 seals, a single grey seal, 6-7 Atlantic white-sided dolphins, two unidentified dolphins, and nine harbor porpoises were also sighted during the year. The geographic distribution of whale sightings is presented in Figure 3.

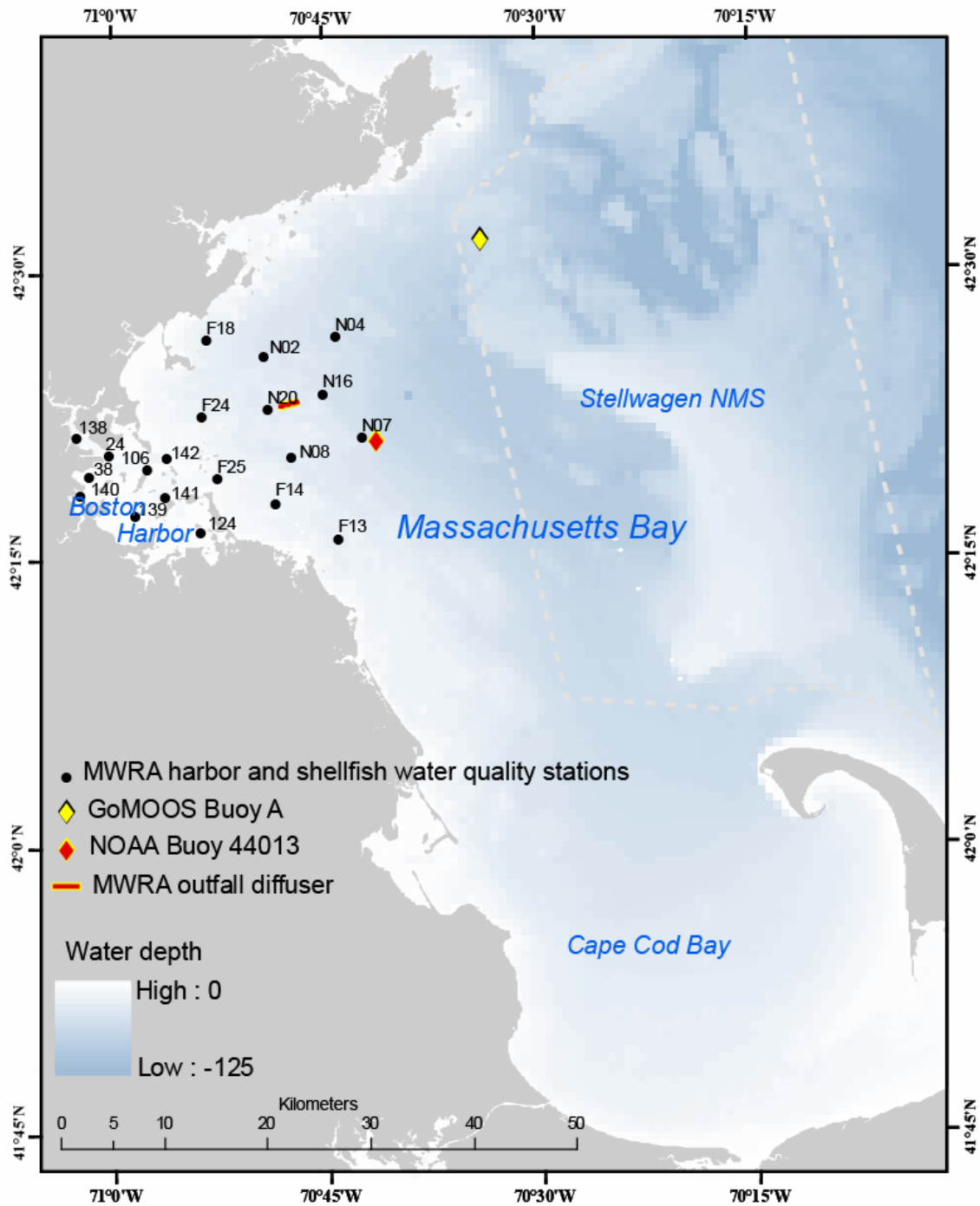


Figure 2. Location of MWRA Surveys for Division of Marine Fisheries Shellfish Bed Monitoring

Table 1. Marine Mammal Sightings on 2009 MWRA Boston Harbor and Shellfish Water Quality Surveys.

Survey ID	Date/Time	Number	Mammal	Location	Sighting Comments	Observer Present
WQM2009 R/V <i>Merganser</i>	1/6/09	1	Harbor Seal	42.324217, -71.001133	Off Thompson Island	No
PC092 R/V <i>Merganser</i>	2/2/09 0815	6	Harbor Seals	42.339667, -70.930167	Off E side of Lovell's Island	No
	2/2/09 0830	15	Harbor Seals	42.338333, -70.883000	Off Outer Brewster Island	No
WQM2009 R/V <i>Merganser</i>	2/25/08 0825	1	Harbor Seal	42.385867, -71.054383	Off site 137	No
WQM2009 R/V <i>Merganser</i>	3/19/09 0915	1	Harbor Seal	42.336767, -70.963183	Off site 138	No
	3/19/09 1200	2	Harbor Seals	42.339167, -70.931500	100m E of site 142	
WQM2009 R/V <i>Merganser</i>	4/1/09 1127	2	Harbor Seals	42.324500, -71.001417	On a rock off Thompson Island	No
PC094 R/V <i>Merganser</i>	4/2/09 0930	4	Harbor Seals	42.321167, -70.923000	Off E side of George's Island	No
	4/2/09 1059	1	Minke Whale	42.305900, -70.721500	Between F13 and N07	
PC095 R/V <i>Merganser</i>	5/4/09	3	Harbor Porpoise	42.3226333, -70.7982	Between F14 and N09	No
		1	Harbor Seal	42.3226333, -70.7982	Between F14 and N09	
		2	Harbor Porpoise	42.33503333, -70.78773333	Between N09 and N13	
CSO2009 R/V <i>Merganser</i>	5/28/09 0818	1	Harbor Seal	42.330117, -70.975417	Between Spectacle Island and Long Island	No
PC099 R/V <i>Merganser</i>	9/8/09 0926	2	Dolphins	42.262183, -70.765700	Between N09 and F13	No
	9/8/09 1225	1	Minke Whale	42.416950, -70.820233	Between N20 and N02	No
CSO2009 R/V <i>Merganser</i>	9/29/09 0905	1	Seal	42.2996505, -71.0434765	Off site 041	No
WQM2009 R/V <i>Merganser</i>	10/9/09 1009	1	Harbor Seal	42.305833, -71.040500	Off site 140	No
	10/9/09 1218	1	Harbor Seal	42.3325, -70.959	Off site 106	
PC09A R/V <i>Merganser</i>	10/13/09 0757	1	Harbor Porpoise	42.32091667, -70.90865	SE of George's Island in Nantasket Roads	No
CSO2009 R/V <i>Merganser</i>	10/14/09 0900	1	Harbor Seal	42.28503, -71.03881	Between sites 054 and 042.	No
WQM2009 R/V <i>Merganser</i>	11/09/09 0840	1	Harbor Seal	42.3867631, -71.06282	Off site 137	No
WQM2009 R/V <i>Merganser</i>	11/19/09 1022	1	Harbor Seal	42.357933, -71.042633	Inner harbor, Long Wharf	No
	11/19/09 1032	1	Harbor Seal	42.357933, -71.042633	Inner Harbor, near the airport.	
	11/19/09 1258	1	Harbor Seal	42.339855, -70.954465	Near the Deer Island Light	
PC09C R/V <i>Merganser</i>	12/7/09 0855	11	Seals	42.342030, -70.877190	West side of Outer Brewster Island	No
WQM2009 R/V <i>Merganser</i>	12/21/09 1000	1	Harbor Seal	42.3867631, -71.062828	Off site 137	No

Table 2. Marine Mammal Sightings on 2009 Nearfield and Farfield Surveys.

Survey ID	Date/Time	Number	Mammal	Location	Sighting Comments	Observer Present
WF091/WN091 R/V <i>Auk</i>	2/6/09 1120	1	Unidentified Baleen Whale	41.9085, -70.2285	Station F02	Yes
	2/7/09 1015	1	Unidentified Baleen Whale	42.38783333, -70.42966667	Single “blow” seen	Yes
	2/10/09 0725	1	Harbor Seal	41.9865, -70.639		Yes
	2/10/09 0845	1	Unidentified Baleen Whale	42.3805, -70.46383333		Yes
	2/10/09 0845	1	Minke Whale	42.3805, -70.46383333		Yes
	2/10/09 1445	1	Harbor Seal	42.33633333, -70.96433333		Yes
	2/10/09 1645	1	Harbor Seal	42.31833333, -70.9005	On rocks S side of George’s Island	Yes
	2/10/09 1645	3	Harbor Seal	42.31833333, -70.9005	On rocks S side of George’s Island	Yes
WF092/WN092 R/V <i>Tioga</i>	2/25/09 0745	1	Harbor Seal	41.60516667, -70.50233333		Yes
	2/25/09 1103	1	Unidentified Whale	42.09266667, -70.28233333	Footprint from whale observed but no whale seen S of station F29	Yes
	2/25/09 1140	1	Gray Seal	42.19816667, -70.34083333		Yes
	2/25/09 1202	1	Harbor Seal	42.30133333, -70.40516667		Yes
	2/26/09 0720	1	Harbor Seal	42.271, -70.93066667	N side of Grape Island on rocks	Yes
	2/26/09 0730	1	Harbor Seal	42.3145, -70.91416667	S side of George’s Island	Yes
	2/26/09 0730	7	Harbor Seal	42.3145, -70.91416667	N side of Hull on Toddy Rocks	Yes
WN093 R/V <i>Tioga</i>	3/18/09 1200	11	Harbor Seal	42.32466667, -70.9	On Toddy Rocks and S side of George’s Island	Yes
	3/18/09 1210	1	Harbor Seal	42.26683333, -70.932	On rock on the N side of Grape Island	Yes
WF094/WN094 R/V <i>Aquamonitor</i>	4/8/09 1155	4-5	Atlantic White-Sided Dolphin	42.1165, -70.29016667	Station F29	Yes
	4/8/09 1155	1	Unidentified Baleen Whale	42.1165, -70.29016667	Station F29, only spout seen	Yes
	4/8/09 1215	1	North Atlantic Right Whale	42.11883333, -70.2915	Between stations F29 and F07	Yes
	4/8/09 1215	1	Unidentified Baleen Whale	42.11883333, -70.2915	Between stations F29 and F07	Yes
	4/8/09 1252	2	Atlantic White-Sided Dolphin	42.1685, -70.433	Between stations F29 and F07	Yes
	4/8/09 1252	2-3	Unidentified Baleen Whale	42.1685, -70.433	Between stations F29 and F07	Yes
	4/8/09 1255	1	Unidentified Baleen Whale	42.17333333, -70.44983333	Between stations F29 and F07	Yes
	4/8/09 1305	1	Unidentified Baleen Whale	42.18133333, -70.47666667	Between stations F29 and F07	Yes
	4/8/09 1700	10	Harbor Seal	42.31283333, -70.90866667	On Toddy Rocks	Yes

Survey ID	Date/Time	Number	Mammal	Location	Sighting Comments	Observer Present
WF094/WN094 R/V Aquamonitor	4/8/09 1700	2	Harbor Seal	42.31283333, -70.90866667	S side of George's Island on rocks	Yes
	4/9/09 0725	11	Harbor Seal	42.306, -70.92233333	On Toddy Rocks	Yes
	4/9/09 1045	1	Minke Whale	42.35616667, -70.70583333	Station N07	Yes
	4/10/09 0730	1	Harbor Seal	42.29333333, -70.9255	Swimming, seen in transit to station F31	Yes
	4/10/09 0742	1	Harbor Seal	42.32666667, -70.94783333	On rocks at station F31	Yes
	4/10/09 0835	1	Harbor Seal	42.35866667, -70.91816667	Swimming, between stations F30 and F24	Yes
	4/10/09 0915	2	Humpback Whale	42.39416667, -70.76583333	Near station N16	Yes
	4/10/09 1315	1	Humpback Whale	42.42216667, -70.44016667	Near station F28	Yes
	4/10/09 1320	1	Humpback Whale	42.42083333, -70.4305	Near station F28	Yes
	4/10/09 1325	2	Humpback Whale	42.4105, -70.43333333	At station F28	Yes
	4/10/09 1345	1	Harbor Porpoise	42.36566667, -70.42733333	Between stations F28 and F12	Yes
	4/10/09 1345	1	Humpback Whale	42.36566667, -70.42733333	Logging at surface, between stations F28 and F12	Yes
WN096 R/V Aquamonitor	5/12/09	1	Harbor Seal	42.31383333, -70.908		Yes
AF091 R/V Aquamonitor	5/20/09 1151	1	Unidentified Baleen Whale	42.41393333, -70.51596667	Near AF6	Unknown
AF093 R/V Aquamonitor	6/8/09 1043	2	Minke Whale	42.57516667, -70.58736667	Between AF9 and AF8	Unknown
	6/8/09 1155	2	Minke Whale	42.37996667, -70.5723	Near AF6	Unknown
WF097/WN097 R/V Aquamonitor	6/15/09 1312	1	Unidentified Baleen Whale	42.43391667, -70.43333333	N of station F28, probably finback based on dorsal fin shape and size	No
	6/17/09 1055	1	Minke Whale	42.41433333, -70.7255	Between station N07 and N04	Yes
WF09B/WN09B R/V Aquamonitor	8/17/09 1314	2	Unidentified Whale	42.48823333, -70.44026667	In transit from F27 to F28, probably humpback due to fluke sighting	No
	8/19/09 0932	1	Unidentified Whale	42.2076, -70.60733333	In transit from F10 to F06	No
	8/19/09 1034	2	Humpback Whale	42.16768333, -70.43503333	In transit from F07 to F29	No
WF09E/WN09E R/V Aquamonitor	10/20/09 1245	2	Unidentified Whale	42.05985, -70.27206667	Breaching about 3 miles from boat, in transit from F29 to F02.	No
	10/20/09 1800	10	Harbor Seal	42.32466667, -70.9	On Toddy Rocks	No
	10/21/09 1234	2	Harbor Porpoise	42.48835, -70.44078333	Between stations F27 and F28	No
	10/21/09 1255	1	Humpback Whale	42.4127, -70.4339	At station F28	No

Survey ID	Date/Time	Number	Mammal	Location	Sighting Comments	Observer Present
WF09E/WN09E R/V Aquamonitor	10/22/09 0745	14	Harbor Seal	42.31333333, -70.9065	3 on the N side of Hull on Toddy Rocks and 11 of the S side of George's Island on rocks	Yes
	10/22/09 1240	1	Harbor Seal	42.34366667, -70.912	In the water	Yes
WN09F R/V Aquamonitor	11/10/09 1030	1	Minke Whale	42.42733333, -70.72333333		Yes
	11/10/09 1148	1	Harbor Seal	42.33933333, -70.844		Yes
	11/10/09 1200	16	Harbor Seal	42.31233333, -70.9125	12 on the N side of Hull on Toddy Rocks and 4 on the S side of George's Island on rocks	Yes

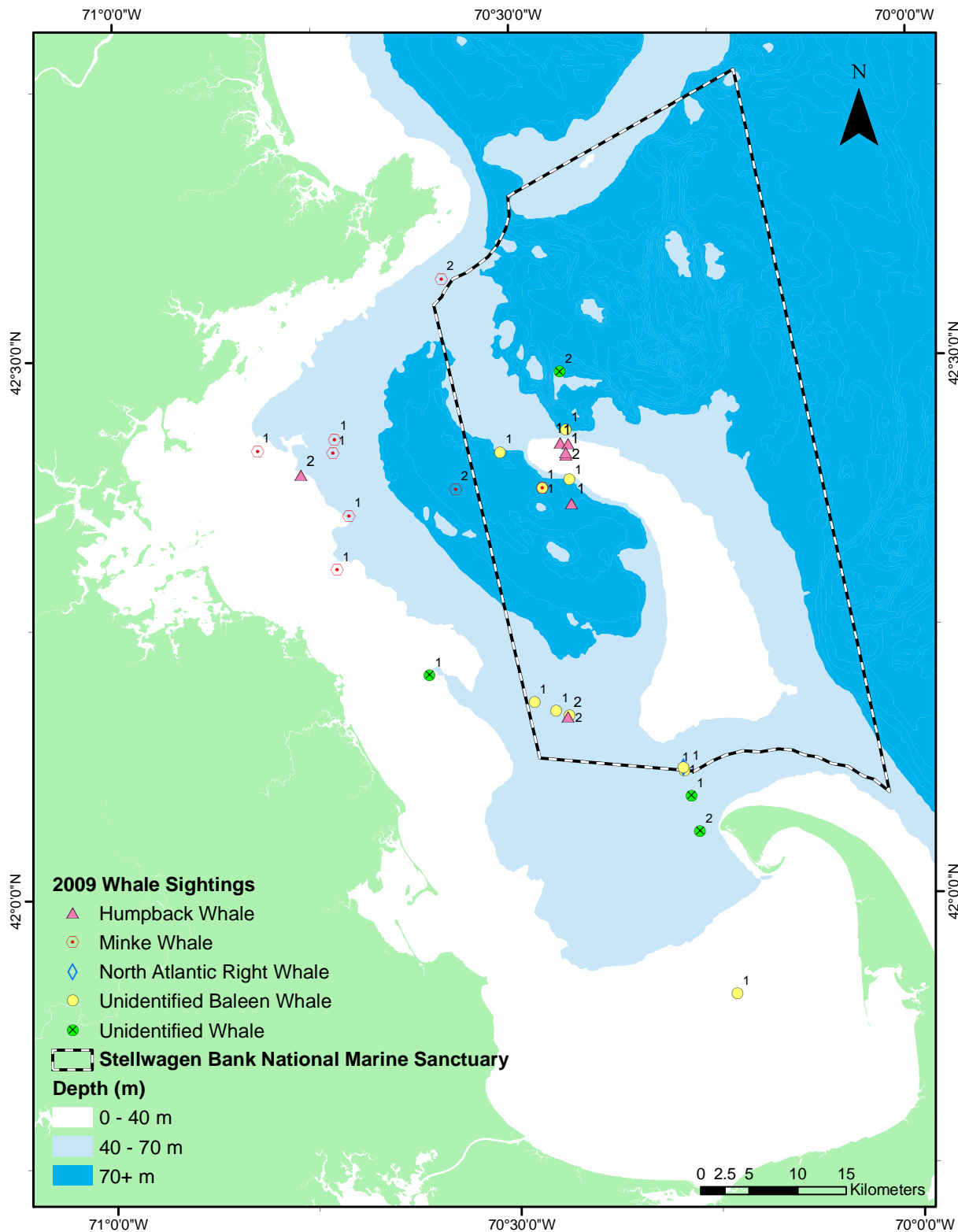


Figure 3. Approximate Locations of Whale Sightings during 2009 Surveys

Note: The data displayed in this figure come from Tables 1 and 2 of this report.

5.0 Discussion

Unlike statistically-based programs or programs that are specifically designed to search for whales, the MWRA sightings are opportunistic and do not follow dedicated and systematic line transect methodology (as mentioned in Section 4.0), therefore, observations are descriptive, not a statistically robust population census.

During 2009, 153 pinnipeds were sighted. 140 of these were harbor seals and one was a grey seal. The remaining 12 were seals of an unidentified species. These sightings were an increase from 2007 when 96 pinnipeds were reported, and comparable with 2006 and 2008 when 136 and 142 pinnipeds, respectively, were seen. For comparison, the numbers for 2005 to 2001 were 76, 303, 105, 138, and 138, respectively. Furthermore, in years prior to 2001, only 20 to 60 pinniped sightings were made throughout the survey area. Most observations of pinnipeds are when the vessel is transiting to and from the survey area; the pinnipeds were typically resting upon rocks.

6-7 Atlantic white sided dolphins were seen in 2009. Also, surveys spotted nine harbor porpoises and two dolphins which were not able to be identified to the species level in 2009. To put these numbers into a historical context, in 2008 one Atlantic white-sided dolphin and eight porpoises were sighted. In 2007, about 19-26 dolphins were sighted, similar to 2006 (24-31 dolphins), 2004 (27+ dolphins), and 1998 (32 dolphins). However, 2007 had an increase in dolphin sightings compared to both 2005, when a small pod was observed, and 2002 when 10-13 dolphins were sighted. For the years 1999, 2000, 2001, and 2003, dolphin sightings averaged between 50 and 112+, with 2003 recording the highest number of dolphins ever sighted for these surveys.

Since 1998, the Provincetown Center for Coastal Studies (PCCS) has conducted systematic surveys of Cape Cod Bay from January through mid-May. In 2009, surveys by PCCS determined right whales were resident in the Cape Cod Bay area for 92 days. In comparison, right whales were resident in Cape Cod Bay for 125 days in 2008 – according to PCCS, this was considerably longer than the 2004-2007 period (92, 100, 97, and 90 days for 2007, 2006, 2005, and 2004 respectively). It appears that Cape Cod Bay right whale residence time in 2009 is more comparable to the earlier 2004-2007 period. However, through photographic identification, 187 different right whales were sighted, comprising 49% of the entire known right whale population. This number is higher than the 148 and 161 unique individuals sighted in 2008 and 2007, respectively, and represents the second highest number of unique individuals ever sighted in a year. Half the individuals sighted in 2007 were seen again in the 2008 surveys, and 61% of the individuals seen in 2008 were spotted in 2009. These observations suggest that the Cape Cod Bay area is becoming an important habitat for right whales (Leeney *et al.*, 2008, Leeney *et al.*, 2009).

6.0 Summary of Whale Sightings 1998 through 2009

For the past 15 years, MWRA has collected and reported on the yearly sightings of marine mammals made during program surveys. The same methods have been used to collect whale sighting data over the years, but other factors such as vessels used, areas surveyed and time at each site prevent the data from being used for quantitative statements regarding whale populations in Massachusetts and Cape Cod Bays. The most consistent aspect of the program is that stations were surveyed around the same time of the year for approximately the same number of days. The following text provides a summary and comparison of the MWRA whale sighting data over the last eleven years (1998 through 2009). Data prior to 1998 have not been included in this report due to possible differences in data collection methods, changes in survey teams, and variations in time spent in each area. Data for Boston Harbor collected by MWRA was not available prior to 2005; therefore, the data are not included in this comparison.

For this comparison, the whale sightings were grouped into four areas:

- Nearfield (NF; all nearfield stations),
- Stellwagen Bank National Marine Sanctuary (SBNMS; SW1, SW2, SW3, and SW4; stations F12, F27, F28, and F29),
- Cape Cod Bay (CCB; F01, F02, F03, F32, and F33), and
- Farfield (FF; F05, F06, F07, F10, F13, F14, F15, F16, F17, F18, F19, F22, F23, F24, F25, F30, and F31).

During 2009, approximately 29 survey days were spent in Massachusetts and Cape Cod Bays. The Nearfield area was visited at least 12 times during 2009 with a total of seven stations sampled on each survey. Each survey was for one day with vessel time about eight hours per day (approximately 232 hours/year for all the surveys). Additionally, there were three full day rapid response surveys that examined an *Alexandrium fundyense* bloom in Massachusetts Bay.

During the MWRA surveys from 1998 to 2009, 385-397+ whales of at least four identified species and unidentified species were seen over the past twelve years (Table 3). The highest number of whales (59) was sighted in 1999, due in part to 24-27 finback whales being observed on Stellwagen Bank. There was one humpback whale spotted in Boston Harbor in 2005 which accounts for the one whale discrepancy in the total number of whales sighted between the figure cited above (385-397+) and the numbers in Table 3 (total of 384-396+), which are for areas outside of the harbor.

Table 3. Whale Sightings by Area, Species, and Year.

Area	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total Sightings
Right Whale Observations													
SBNMS	2	1			2					1	1	1	8
FF	1												1
CCB	1	1		7			3		1		12		25
NF													0
Totals	4	2	0	7	2	0	3	0	1	1	13	1	34
Humpback Whale Observations													
SBNMS	4	12	29+	1	2-5			1	24-27	6	8	8	95-101+
FF				3	4			3	2-3	1			13-14
CCB					1	2			5		2		10
NF	1											2	3
Totals	5	12	29+	4	7-10	2	0	4	31-35	7	10	10	121-128+
Finback Whale Observations													
SBNMS		27	4		1			1	7		1		41
FF					1		2			1	1		5
CCB							1		2				3
NF					1	1					3		5
Totals	0	27	4	0	3	1	3	1	9	1	5	0	54
Minke Whale Observations													
SBNMS	3		1					1	6+	3		3	17+
FF	1	3		3		1			1		1	3	13
CCB			1					15					16
NF	2	1	1	1	1	5	2	1		1	3	4	22
Totals	6	4	3	4	1	6	2	17	7+	4	4	10	68+
Unidentified Whale Observations													
SBNMS	5	7	5-6	1	1	2	1	4-6	4+	1	7-8	13-14	51-56+
FF	1	2	1	1	2			1		2		1	11
CCB	1	4	11	3		2		1	1	1	4	3	31
NF	5+	1				2	2	3			1		14+
Totals	12+	14	17-18	5	3	6	3	9-11	5+	4	12-13	17-18	107-112+
Year Totals	27+	59	53-54+	20	16-19	15	11	31-33	53-57+	17	44-45	38-39	384-396+

Note: Blank cell denotes no whales observed.

Over half of the overall sightings (55% of the 384-396+) were made within the boundary of Stellwagen Bank (Figures 4 and 5). The area with the second highest whale sightings from 1998 to 2008 was Cape Cod Bay (22% of the 384-396+). Cape Cod Bay had the highest number of right whale sightings (25 out of 34), with the highest concentration of sightings occurring in April 2008 when ten were noted. An additional 11% of whales were sighted just outside Stellwagen Bank western boundary (listed as Farfield). The Nearfield area, which lies over and around the outfall, had just over 11% of the total whale sightings, with minke whales being the dominant species, followed by unidentified whale species.

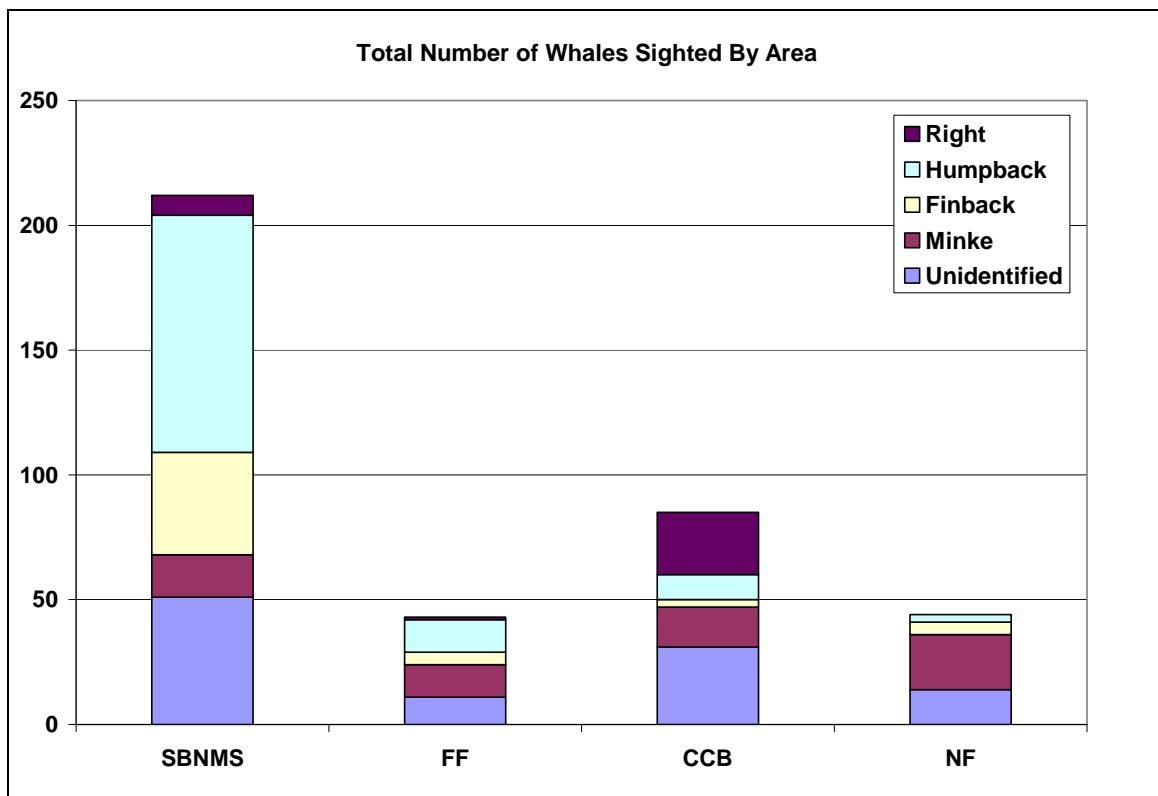


Figure 4. Distribution of Sightings by Species and Area, 1998-2009.

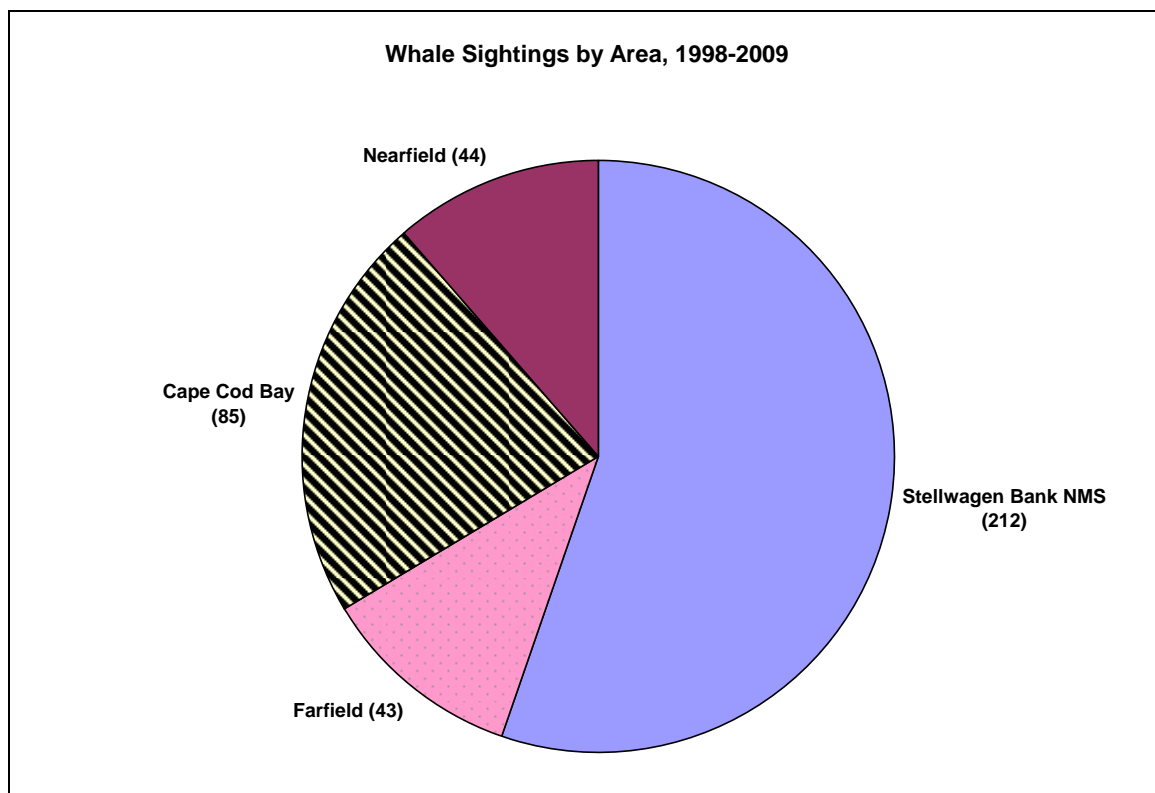


Figure 5. Total Sightings of Whales by Area, 1998-2009.

The most abundant identified whale species noted during the surveys was the humpback whale (121) (Figure 6). The total number of humpback whales represents 32% of the sightings of all whales throughout all of the areas over the years. Furthermore, 79% of humpback whale sightings occurred in the area of Stellwagen Bank. The second most abundant identified whales were the minke and the finback whales, with 18% and 14% of the total sightings, respectively. It should be noted that 28% of the whales sighted from 1998 to 2009 were of unidentified species.

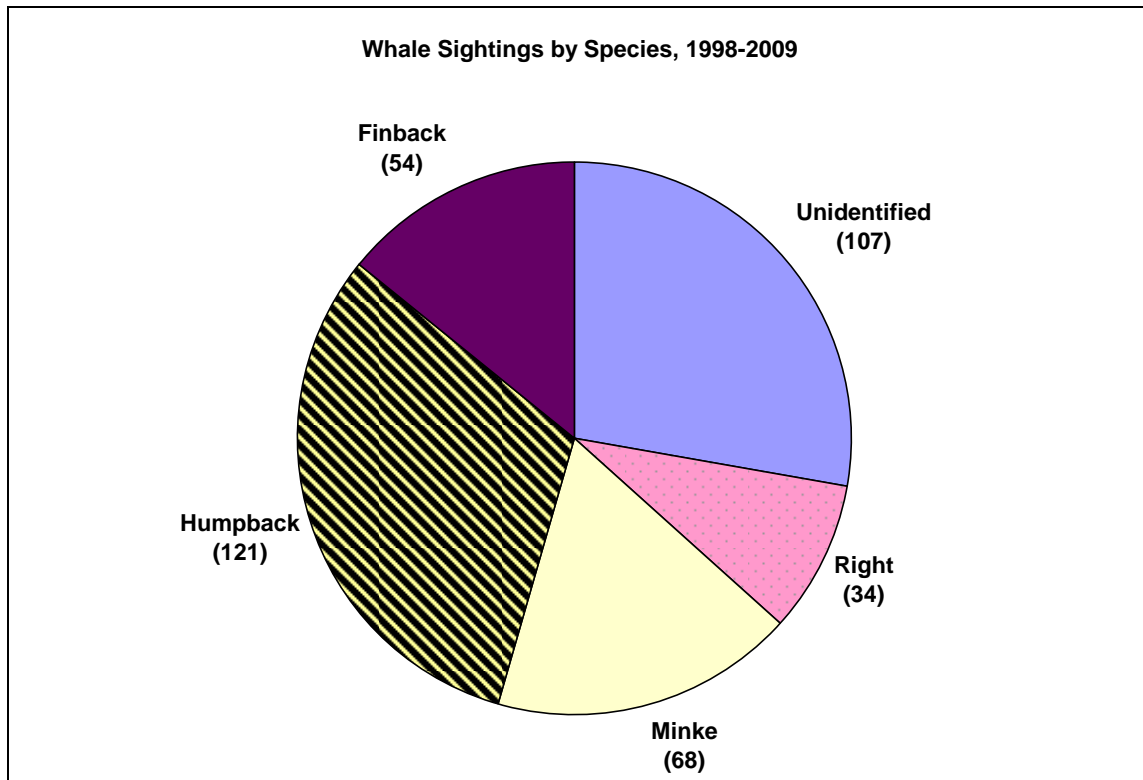


Figure 6. Distribution of Whale Sightings by Species, 1998-2009.

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