

**Summary of marine mammal  
observations during 2007 surveys**

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Massachusetts Water Resources Authority  
Environmental Quality Department  
Report 2008-04



## **Citation**

Wisneski, C., M. Weinrich, and N. Jaquet. 2008. **Summary of marine mammal observations during 2007 surveys.** Boston: Massachusetts Water Resources Authority. Report ENQUAD 2008-04. 17p.

## **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 the R/V *Aquamonitor*, R/V *Tioga*, R/V *Merganser*, F/V *First Light*, F/V *Key Largo*, and F/V *Shanna Rose*.



# **SUMMARY OF MARINE MAMMAL OBSERVATIONS DURING 2007 SURVEYS**

*Submitted to:*

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Charlestown Navy Yard  
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Boston, MA 02129**

**Contract No. OP-44A  
Task 11**

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**Technical Report No: 2008-04**

**Battelle**  
*The Business of Innovation*

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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 (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 15 water quality surveys during 2007. Throughout the year, observers were present on all of the Nearfield water column surveys (n=12) and on three (WF071, WF072, and WF074) of the six Farfield water column surveys.

## 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). Within the last five years, 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).

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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

Marine mammal observations were performed during all daylight hours while transiting during Nearfield water column surveys (Figure 1), and while the vessel was on-station for sampling operations. Additionally, marine mammal observers were present during three winter/spring Farfield surveys (Figure 2) during the 2007 survey year. 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. Two

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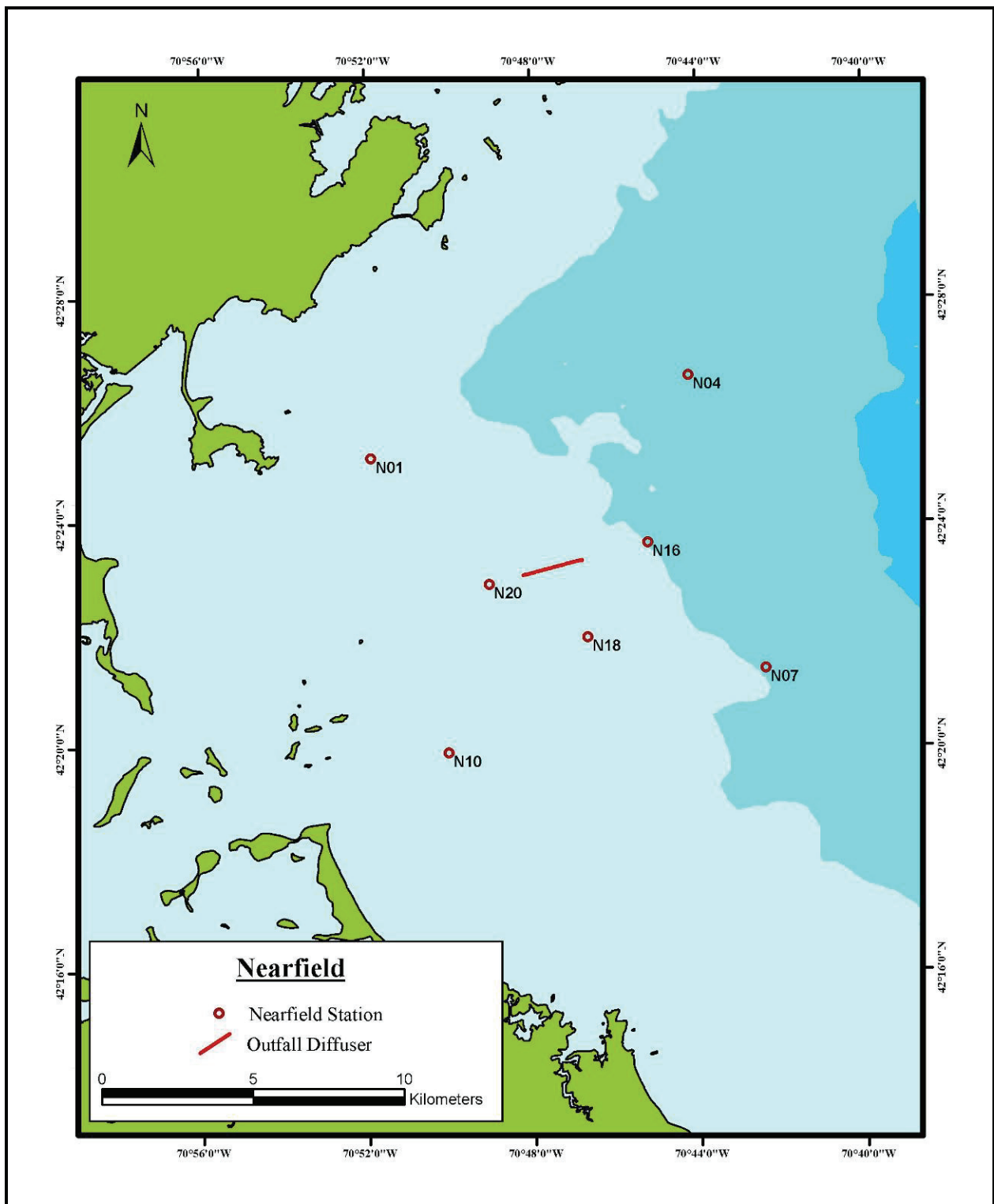


Figure 1. Location of Nearfield Stations

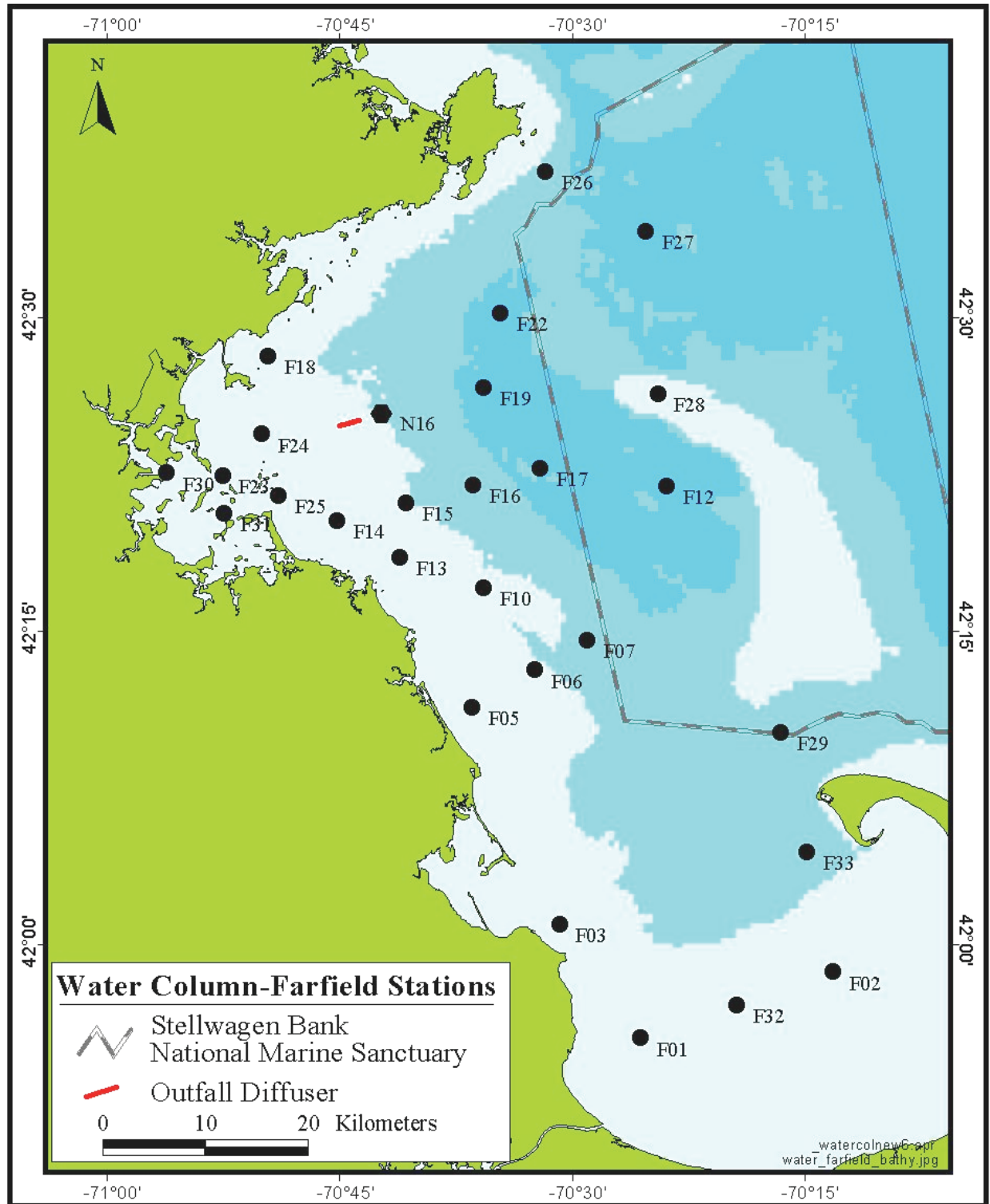


Figure 2. Location of Farfield Stations

survey vessels were used as observation platforms during the course of the year. The observer's eye-height above the sea surface was approximately 5 meters on the R/V *Tioga* 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.

Several other vessels were also used to conduct surveys where marine mammal observers were not present. The scientific crew on board the R/V *Merganser*, F/V *Key Largo*, F/V *First Light*, and the F/V *Shanna Rose* observed marine mammals while on surveys. These vessels were used to conduct MWRA Boston Harbor surveys and the Fecal Coliform Surveys in the Nearfield and Farfield areas (Figure 3). Similar to the previous year, data from Boston Harbor 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. Based on these factors, the ability to extrapolate from observation data to abundance estimates is severely limited and is not advisable. The utility of this data set is thus limited to documentation of the time, location and particulars for each individual occurrence of a sighting and provides useful qualitative information concerning seasonal patterns and relative abundance within the same study area.

During the 2007 monitoring year, the marine mammal observers, Battelle survey team members, and MWRA survey team members counted 17 individual whales, between 13-18 Atlantic white-sided dolphins, and approximately 6 unidentified dolphins or porpoises. Included in the whale count were one right whale, seven humpback whales, one finback whale, four minke whales, and four unidentified whales. Whale sightings in 2007 were concentrated mainly in the Stellwagen Bank National Marine Sanctuary, with several whales sighted in the vicinity of the Nearfield and one sighted in Cape Cod Bay (Figure 4). The total number of whales (53-57+) sighted during 2006 was the most since 2005 (32 sightings). The sightings of 2007 were comparable to the sightings of 2002 and 2003, which had 16-19 and 15 sightings, respectively. It should also be noted that whales were observed on other types of surveys in addition to the water column surveys and these sightings are also included in Table 1, along with the Boston Harbor surveys conducted by MWRA. In addition to the whales, approximately 96 harbor seals were also sighted during the year. All sightings recorded by a dedicated marine mammal observer or other survey personnel are summarized in Table 1. Whale sighting distribution is presented in Figure 4.

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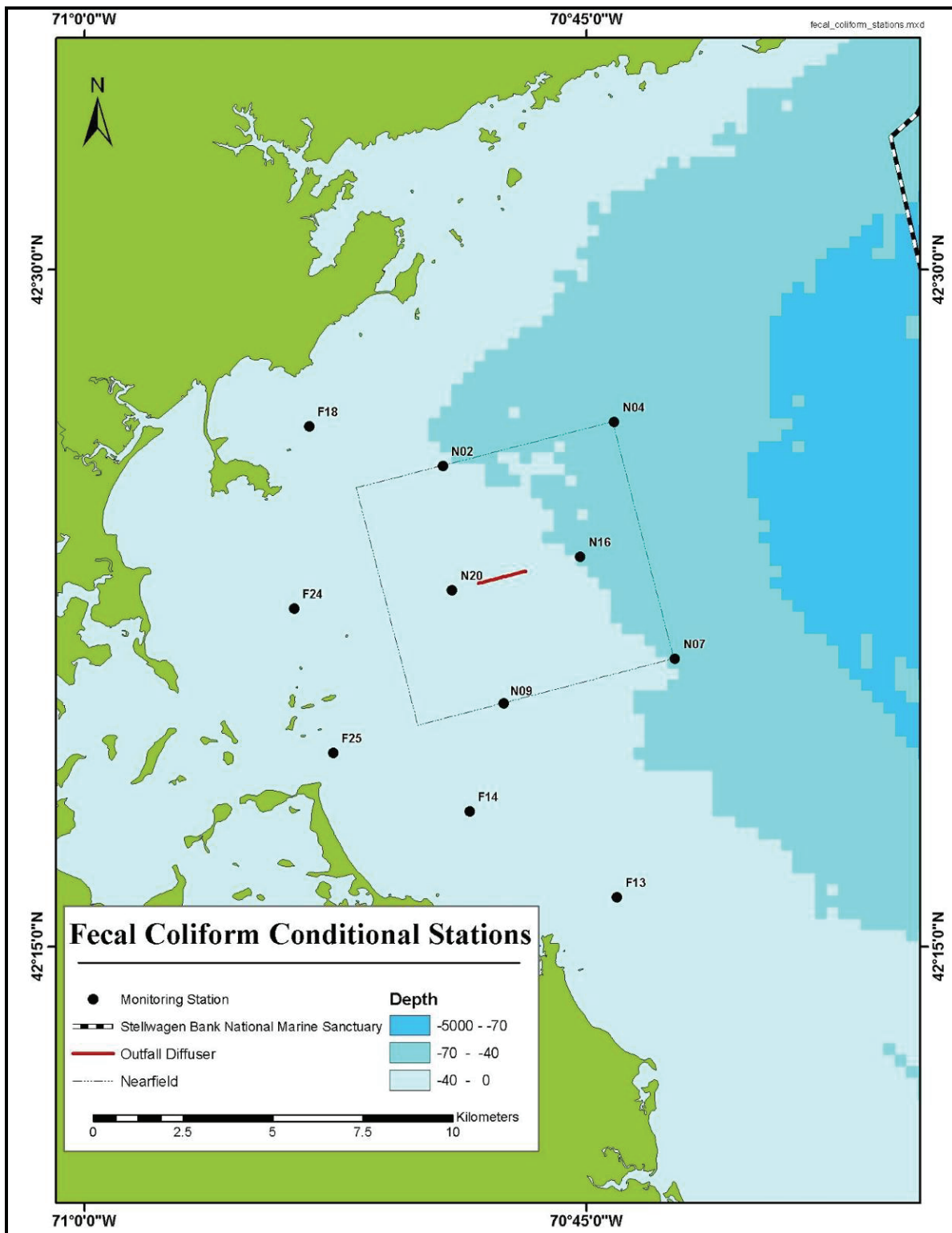


Figure 3. Location of Fecal Coliform/ Adverse Conditional Stations

Table 1. Marine Mammal Observer Sightings on 2007 MWRA Surveys.

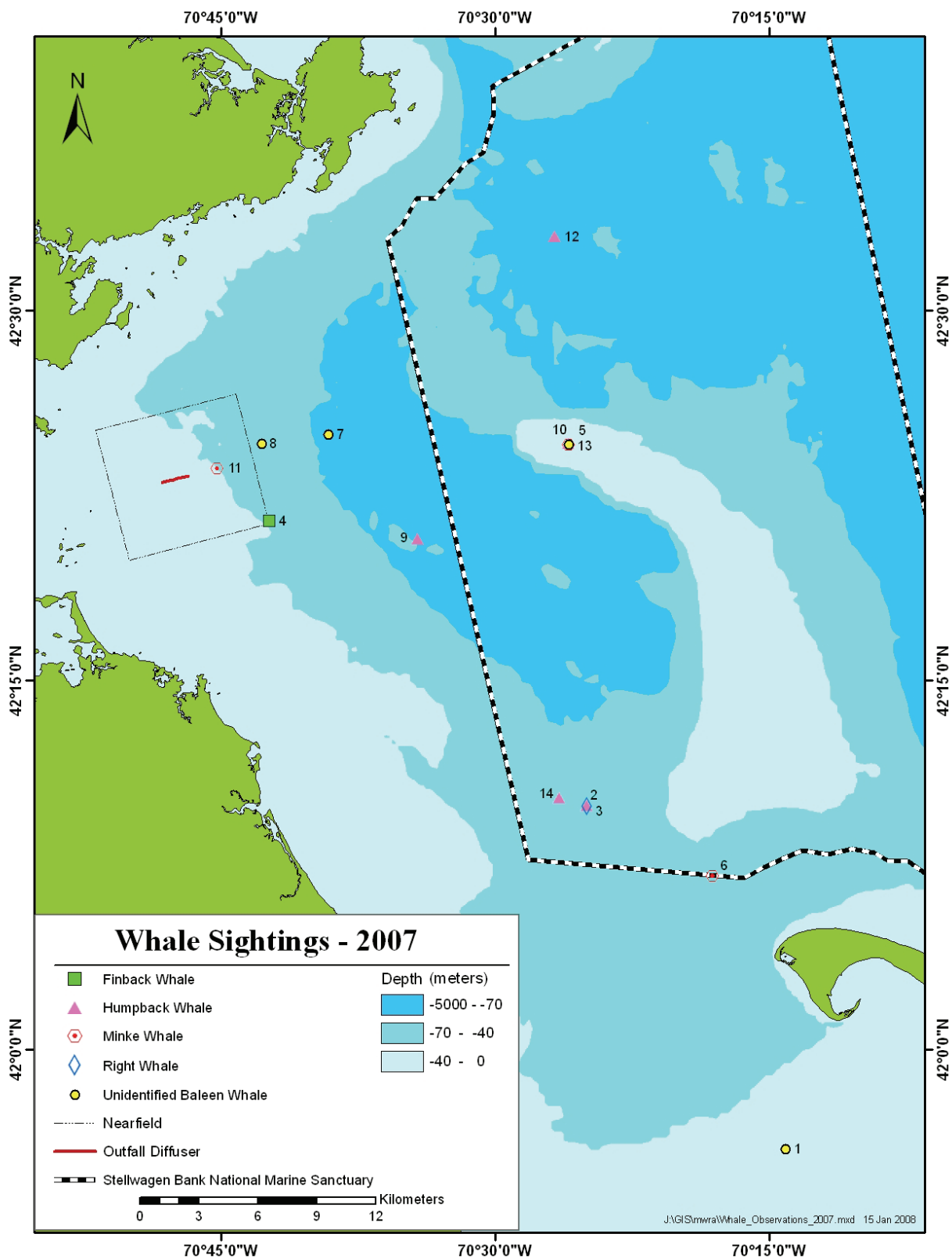
Survey ID	Figure 4 Location	Date/Time	Number Sighted	Mammal	Location	Sighting Comments	Observer Present
PC071 <i>R/V Merganser</i>		01/22/07	0	--	--	No sightings	No
WQM2007 <i>R/V Merganser</i>		01/24/07 0851	2	Harbor Seals	42°23.20 N 71°03.80 W	Mystic River mouth/Upper Inner Harbor, BHWQM harbor survey	No
		01/24/07 0846	1	Harbor Seal	42°22.95 N 71°02.70 W		
WN071/WF071 <i>R/V Tioga</i>		02/07/07	0	--	--	No sightings	Yes
		02/10/07 1330	~4	Unidentified dolphins	42°33.11 N 70°27.14 W	Either common or Atlantic white-sided dolphins	Yes
		02/11/07 1110	~4	Atlantic white-sided dolphins	42°17.53 N 70°33.04 W	Sighted under bow while underway	Yes
		02/12/07 1235	6	Harbor Seals	42°18.15 N 70°55.46 W	Hauled out on rocks on south shore of George's Island	Yes
PC072 <i>F/V First Light</i>		02/22/07 0803	8	Harbor Seals	42°18.72 N 70°54.36 W	Sighted near Toddy Rocks, Hull	No
WN072/WF072 <i>R/V Tioga</i>		02/26/07 1155	1	Atlantic white-sided dolphin	42°09.79 N 70°25.91 W		Yes
		02/27/07 1255	12*	Harbor Seals	42°20.55 N 70°55.83 W	East side Lovell's Island	Yes
		02/27/07 1300	12*	Harbor Seals	42°20.38 N 70°56.52 W	Station F23	Yes
		02/27/07 1320	2	Harbor Seals	42°19.78 N 70°56.13 W	On rock, north side Paddock's Island	Yes
		02/27/07 1325	2	Harbor Seals	42°18.76 N 70°55.64 W	On rock, south side of George's Island	Yes
		02/27/07 1325	2	Harbor Seals	42°18.76 N 70°55.64 W	Toddy Rocks	Yes
		02/27/07 1420	1	Harbor Seal	Not given	North side, Paddock's Island	Yes
		02/27/07 1425	12*	Harbor Seals	42°20.78 N 70°55.03 W	East side, Lovell's Island	Yes
		02/28/07 1345	8	Harbor Seals	42°18.92 N 70°54.72 W	Toddy Rocks	Yes
		02/28/07 1345	2	Harbor Seals	42°18.92 N 70°54.72 W	South side George's Island	Yes
PC073 <i>R/V Merganser</i>		03/12/07	0	--	--	No sightings	No
WN073 <i>R/V Aquamonitor</i>		03/21/2007	0	--	--	No sightings	Yes
WN074/WF074 <i>R/V Aquamonitor</i>	1	04/10/07 1040	1	Unidentified baleen whale	41°55.93 N 70°14.13 W	Saw single blow	Yes
	2	04/10/07 1250	1	Humpback whale	42°09.90 N 70°24.99 W	Breaching, spy hop, deep dive	Yes
	3	04/10/07 1250	1	Right whale	42°09.90 N 70°24.99 W	Same place as humpback, fluke photographed	Yes
		04/11/07 1250	8	Harbor Seals	42°19.02 N 70°55.14 W	Hauled out on Toddy Rocks	Yes
		04/21/07 0725	1	Harbor Seal	42°16.69 N 70°55.82 W	North side of Grape Island	Yes
		04/21/07 0735	14	Harbor Seals	42°18.69 N 70°54.79 W		Yes

Survey ID	Figure 4 Location	Date\Time	Number Sighted	Mammal	Location	Sighting Comments	Observer Present
	4	04/21/07 1035	1	Finback whale	42°21.49 N 70°42.39 W		Yes
		04/22/07 0730	1	Harbor Seal	42°18.60 N 70°55.05 W	In water in vicinity of Toddy Rocks	Yes
		04/22/07 1140	~3	Atlantic white-sided dolphins	42°24.59 N 70°26.00 W		Yes
	5	04/22/07 1140	1	Minke whale	42°24.59 N 70°26.00 W		Yes
PC074 R/V <i>Merganser</i>		04/26/07	0	--	--	No sightings	No
CSO2007 R/V <i>Merganser</i>		05/01/07 0910	1	Harbor Seal	42°22.09 N 71°02.90 W	Upper Inner Harbor, en route to Charles River CSO survey	No
PC075 R/V <i>Merganser</i>		05/07/07	0	--	--	No sightings	No
WN076 R/V <i>Aquamonitor</i>		05/23/07	0	--	--	No sightings	Yes
WN077/WF077 R/V <i>Aquamonitor</i>	6	06/18/07 1250	2	Minke whales	42°7.082N 70° 18.118W	Sighted while in transit from Station F29 to F02	Yes
		06/19/07 0940	2	Unidentified odontocetes	42°23.10 N 70°47.85 W	Surfing in crew boat wake	Yes
PC076 R/V <i>Merganser</i>		06/19/07	0	--	--	No sightings	No
PC077 R/V <i>Merganser</i>		07/13/07	0	--	--	No sightings	No
WN079 R/V/ <i>Aquamonitor</i>		07/24/07	0	--	--	No sightings	Yes
PC078 R/V <i>Merganser</i>		08/10/07	0	--	--	No sightings	No
NC073 R/V <i>Aquamonitor</i>	7	08/13/07 1127	1	Unidentified whale	42°25.00 N 70°39.14 W	Sighted 400 yards off stern	No
	8	08/13/07 1213	1	Unidentified whale	42°24.64 N 70°42.80 W		No
		08/13/07 1213	5-10	Atlantic white-sided dolphins	42°24.64 N 70°42.80 W		No
WN07B/WF07 B R/V <i>Aquamonitor</i>	9	08/20/07 1115	1	Humpback whale	42°20.75 N 70°34.25 W	Whale approached boat while stationary and stayed in close proximity for an hour. Whale was later identified from video taken as 9-year-old "Cajun".	No
	10	08/20/07 1415	2	Humpback whales	42°24.62 N 70°26.00 W	Sighted 1/3 of a mile from Station F28	No
		08/22/07	0	--	--	No sightings (obscured visibility due to fog and spray)	Yes
WN07C R/V <i>Aquamonitor</i>		09/04/07	0	--	--	No sightings	Yes
PC079 R/V <i>Merganser</i>		09/20/07	0	--	--	No sightings	No

Survey ID	Figure 4 Location	Date\Time	Number Sighted	Mammal	Location	Sighting Comments	Observer Present
WN07D R/V <i>Aquamonitor</i>		10/02/07	0	--	--	No sightings	Yes
PC07A R/V <i>Merganser</i>		10/17/07	0	--	--	No sightings	No
WN07E/WF07E R/V <i>Aquamonitor</i>	11	10/22/07 0838	1	Minke whale	42°23.63 N 70°45.21 W	Sighted 5 km southwest of Station N16	No
	12	10/22/07 1202	1	Humpback whale	42°32.99 N 70°26.77 W	Sighted 4 km south of Station F27	No
	13	10/22/07 1230	1	Unidentified whale	42°24.61 N 70°25.98 W	Sighted 4.1 km north of Station F28	No
	14	10/23/07 1010	2	Humpback whales	42°10.228' N 70°26.482' W	Sighted while in transit to Station F29	No
		10/30/07 0725	5	Harbor Seals	42°17.87 N 70°55.23 W	Hauled out on Toddy Rocks, Hull	Yes
		10/30/07 0845	1	Harbor Seal	42°25.16 N 70°51.85 W	Station N01	Yes
CSO2007 R/V <i>Key Largo</i>		11/05/07 1245	2	Harbor Seals	42°18.22 N 71°01.15 W	Dorchester Bay, CSO survey	No
WN07F R/V <i>Aquamonitor</i>		11/13/07 0745	7	Harbor Seals	42°18.87 N 70°54.20 W	Hauled out on Toddy Rocks	Yes
PC07B F/V <i>Shanna Rose</i>		11/26/07	0	--	--	No sightings	No
CSO2007 R/V <i>Merganser</i>		12/07/07 0914	1	Harbor Seal	42°21.06 N 71°01.55 W	En route to Dorchester Bay CSO survey	No
		12/07/07 1020	1	Harbor Seal	42°19.59 N 71°01.85 W		
		12/11/07 0929	1	Harbor Seal	42°20.83 N 71°00.66 W	Inner Harbor mouth/Reserved Channel, en route to Mystic River CSO survey	No
		12/11/07 0945	1	Harbor Seal	42°20.53 N 71°01.41 W		
		12/11/07 0953	1	Harbor Seal	42°21.26 N 71°02.28 W		
		12/11/07 0957	2	Harbor Seals	42°21.58 N 71°02.73 W		
		12/13/07 0845	1	Harbor Seal	42°20.53 N 71°01.41 W	Inner Harbor mouth, en route to Inner Mystic River CSO survey	No
		12/13/07 0858	2	Harbor Seals	42°21.26 N 71°02.28 W		
PC07C R/V <i>Merganser</i>		12/19/07	0	--	--	No sightings	No

\* The same 12 harbor seals were sighted on 02/27/07 at 1255, 1300, and 1425.





**Figure 4. Approximate Locations of Whale Sightings during 2007 MWRA Water Quality Surveys**

Note: The data displayed in this figure come from Table 1 of this report. Numbers in the Figure correspond to “Figure 4 Location” of Table 1.



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## 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). However, some generalizations can be made.

Of the 17 whales sighted on the 2007 surveys, 7 were sighted by a dedicated observer, which was similar to the number sighted in recent past years: 2005 (n=6), 2004 (n=7), and 2002 (n=6).

During 2007, about 96 pinnipeds were sighted, a decrease from 2006 when more than 136 were reported, but an increase from 2005 (n = 76). However, a count of 96 pinnipeds is low compared to the years from 2004 to 2001 when pinniped counts were 303, 105, 138, and 138, respectively. Furthermore, in years prior to 2001, only 20 to 60 pinniped sightings were made throughout the survey area. It should be noted that most observations of pinnipeds are when the vessel is transiting to and from the survey area, with the pinnipeds typically resting upon rocks.

About 19-26 dolphins were sighted in 2007, 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.

Whale Center of New England sighting records for the season show that whales observed in Massachusetts Bay and Stellwagen Bank showed high use for the second straight year. Many adult humpback and fin whales were seen surface feeding on abundant sand lance (*Ammodytes* spp.) schools over the shallow waters of the Bank itself for much of the year. Humpback whale mother-calf pairs were also abundant. In general, whale use was slightly higher on the southern portion of Stellwagen than the northern portion, although whales were not scarce on either half of the Bank. North Atlantic right whales were present in higher than usual numbers both over the shallow waters of Stellwagen Bank and in the deeper waters of Massachusetts Bay during April and the first half of May, but were not seen with any consistency during summer (as had been the case from 2003-2005). As was the case for each year since 2001, humpback whales were also numerous relatively close to shore west and northwest of Stellwagen during September and October. At times up to 15 humpbacks, primarily young juveniles, were seen feeding (apparently on some kind of plankton), often within five miles of the end of the outfall tunnel. Several times whales were seen very close to the sites of Northeast Gateway's LNG port construction. However, the amount of use in the area was appeared lower than in the past two years; individual whales used the area less consistently than in the previous two years, and the number of whales seen there appeared to decrease. Fin whale use of the area was low, despite high levels in the past several seasons. The Whale Center's sightings database comes from a variety of platforms, including whale watch boats operating out of Provincetown, Boston, and Gloucester, MA, and a dedicated research vessel operating out of Gloucester, MA. Their sightings are generally a result of dedicated searches with some survey effort as well (Whale Center of New England, unpublished data).

Over the last ten years, the Provincetown Center for Coastal Studies (PCCS) has conducted systematic surveys of Cape Cod Bay from January through mid-May. In 2007, right whales were observed in Cape Cod Bay and adjacent waters for at least 92 days between February 11 and May 13 (Jaquet *et al.*, 2007). This period of occupation of the area was similar to previous years (100 days in 2006; 97 days in 2005; 90 days in 2004 (Jaquet *et al.*, 2006). However a much larger number of individuals were identified in Cape Cod Bay and adjacent waters than in any previous years of the project. In 2007, 161 different individuals were identified in the area, which is twice the average for the years between 1998 and 2006;

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up to 35 different individuals were identified in a single day. Furthermore, 27 right whales that had never before been identified in the area were observed in Cape Cod Bay and adjacent waters in 2007. This may imply that the Bay is becoming more attractive to right whales, but further research is needed. There was an average of 18.4 days between the first and last sighting of individual right whales. This is substantially longer than what was found in 2006 (average of 7.4 days) and in 2005 (average of 13.2 days), suggesting that not only more whales than usual visited Cape Cod Bay and adjacent water in 2007, but that their residency time was also longer than in recent years (Jaquet *et al.*, 2007).

In 2007, three mother and calf pairs were sighted in Cape Cod Bay and adjacent waters. The residency time of mother and calf pairs was substantially longer than that of single females which, in turn, was substantially longer than that of single males. This result was consistent with that of previous years (1998-2006) suggesting that Cape Cod Bay is an important nursery area and that the habitat is more intensively used by females than by males.

In 2007, a large proportion of right whales were observed in the middle of the Bay, between Provincetown and Barnstable. This distribution is similar to what was found in 2004, but contrasts with the 2005 distribution when most whales were in the south of the bay, and with the 2006 distribution when a large proportion of individuals were observed in the west of the bay. However, similarly to 2006, large aggregations of right whales were observed off Race Point in late April 2007. These results suggest that right whale distribution in Cape Cod Bay varies considerably between years

## 6.0 Summary of Whale Sightings 1998 through 2007

For the past 13 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 platforms 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 ten years (1998 through 2007). 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. Observations were made in Boston Harbor by MWRA. However, the data for Boston Harbor was not available prior to 2005 and 2006; therefore, the data are not included in the 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 2007, approximately 70 survey days were spent in Massachusetts and Cape Cod Bays. The Nearfield area was visited at least 12 times during 2007 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 96 hours/year).

During the MWRA surveys from 1998 to 2007, 301-311+ whales of at least four identified species and unidentified species were seen over the past ten years (Table 2). The highest number of whales (59) was sighted in 1999, due in part to 27 finback whales being observed on Stellwagen Bank.

**Table 2. Whale Sightings by Area, Species, and Year.**

Area	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Total Sightings
<b>Right Whale Observations</b>											
SBNMS	2	1			2					1	6
FF	1										1
CCB	1	1		7			3		1		13
NF											
<b>Totals</b>	<b>4</b>	<b>2</b>		<b>7</b>	<b>2</b>		<b>3</b>		<b>1</b>	<b>1</b>	<b>20</b>
<b>Humpback Whale Observations</b>											
SBNMS	4	12	29+	1	2-5			1	24-27+	6	79-85+
FF				3	4			3	2-3	1	13-14
CCB					1	2			5		8
NF	1										1
<b>Totals</b>	<b>5</b>	<b>12</b>	<b>29+</b>	<b>4</b>	<b>7-10</b>	<b>2</b>		<b>4</b>	<b>31-35+</b>	<b>7</b>	<b>101-108+</b>
<b>Finback Whale Observations</b>											
SBNMS		27	4		1			1	7		40
FF					1		2			1	4
CCB							1		2		3
NF					1	1					2
<b>Totals</b>		<b>27</b>	<b>4</b>		<b>3</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>9</b>	<b>1</b>	<b>49</b>
<b>Minke Whale Observations</b>											
SBNMS	3		1					1	6+	3	14+
FF	1	3		3		1			1		9
CCB			1					15			16
NF	2	1	1	1	1	5	2	1		1	15
<b>Totals</b>	<b>6</b>	<b>4</b>	<b>3</b>	<b>4</b>	<b>1</b>	<b>6</b>	<b>2</b>	<b>17</b>	<b>7+</b>	<b>4</b>	<b>54+</b>
<b>Unidentified Whale Observations</b>											
SBNMS	5	7	5-6	1	1	2	1	4-6	4+	1	31-34+
FF	1	2	1	1	2			1		2	10
CCB	1	4	11	3		2		1	1	1	24
NF	5+	1				2	2	3			13+
<b>Totals</b>	<b>12+</b>	<b>14</b>	<b>17-18</b>	<b>5</b>	<b>3</b>	<b>6</b>	<b>3</b>	<b>9-11</b>	<b>5+</b>	<b>4</b>	<b>78-81+</b>
<b>Year Totals</b>	<b>27+</b>	<b>59</b>	<b>53-54+</b>	<b>20</b>	<b>16-19</b>	<b>15</b>	<b>11</b>	<b>31-33</b>	<b>53-57+</b>	<b>17</b>	<b>302-312+</b>

Note: Blank cell denotes no whales observed.

Over half of the overall sightings (56% of the 301-311+) were made within the boundary of Stellwagen Bank (Figures 5 and 6). The area with the second highest whale sightings from 1998 to 2007 was Cape Cod Bay (21% of the 301-311+). Cape Cod Bay had the highest number of right whale sightings (13 out of 20), with the highest concentration of sightings occurring in April 2001 when seven were noted. An additional 12% 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 10% of the total whale sightings, with minke whales being the dominant species.

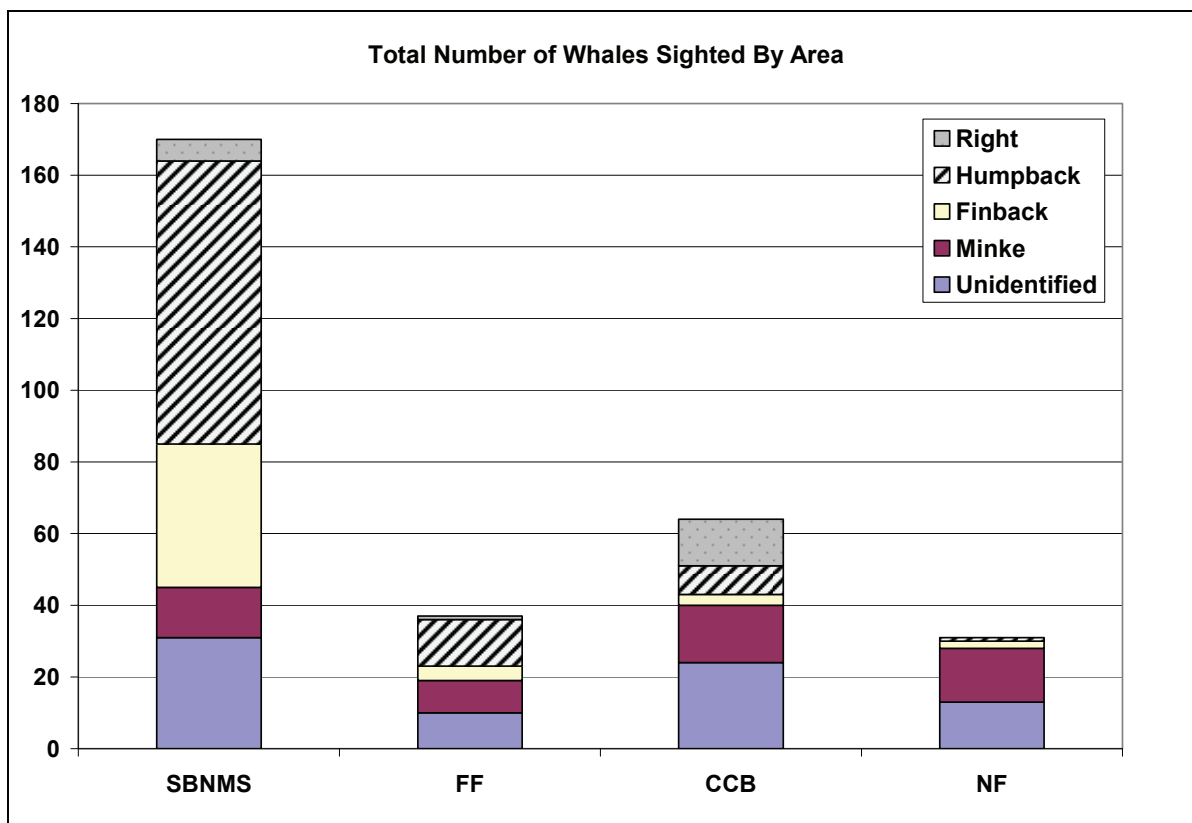


Figure 5. Distribution of Sightings by Species and Area, 1998-2007.

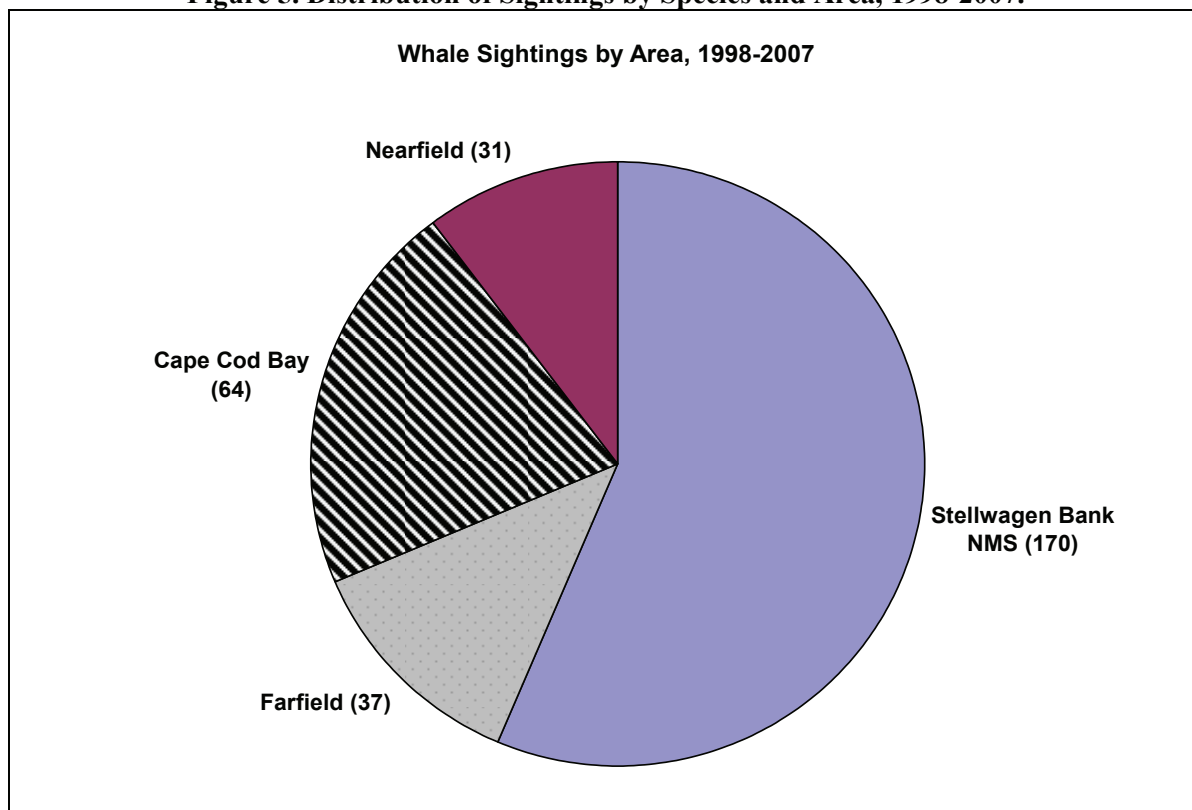


Figure 6. Total Sightings of Whales by Area, 1998-2007.

The most abundant identified whale species noted during the surveys was the humpback whale (101) (Figure 7). The total number of humpback whales represents over 33% of the sightings of all whales throughout all of the areas over the years. Furthermore, 78% 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 17% and 16% of the total sightings, respectively. It should be noted that 25% of the whales sighted from 1998 to 2007 were of unidentified species.

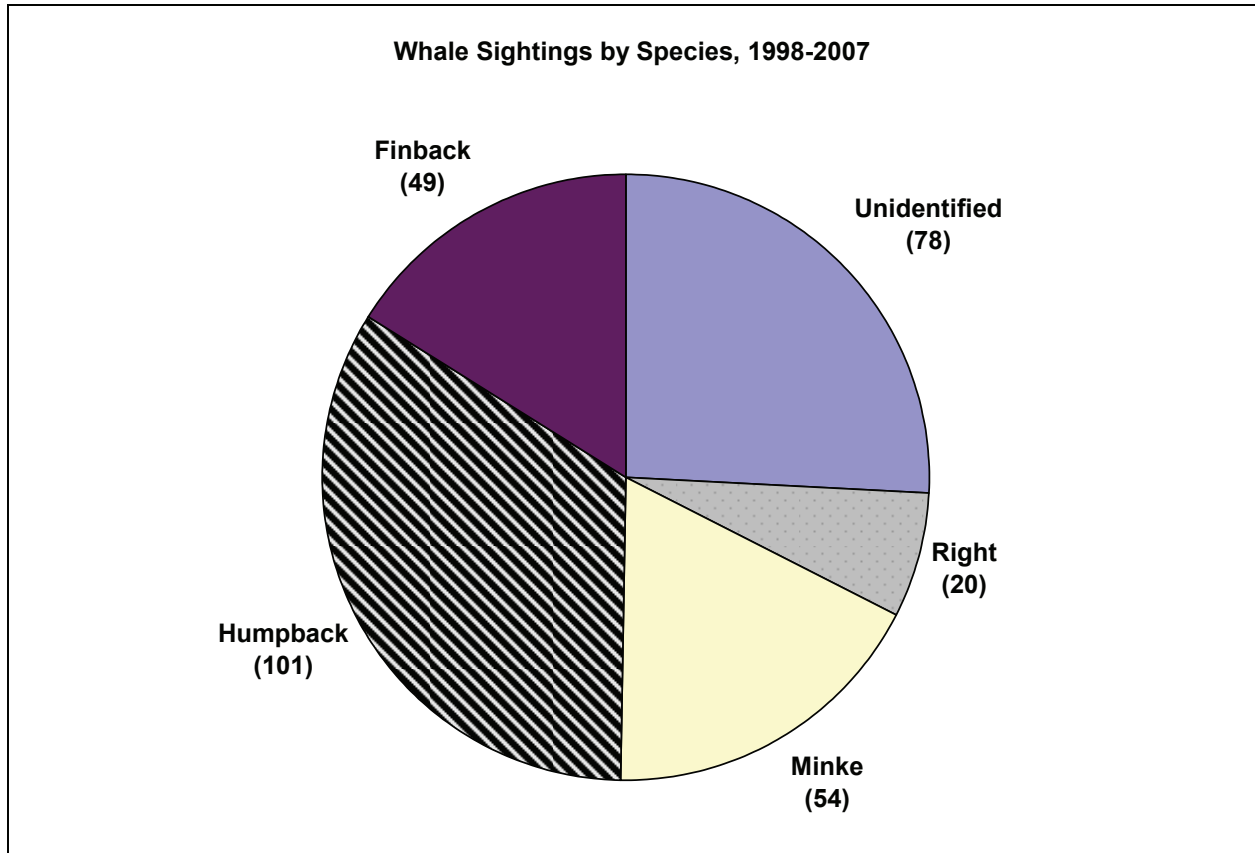


Figure 7. Distribution of Whale Sightings by Species, 1998-2007.

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