NOAA Technical Memorandum NMFS-NE-231

US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2014

US DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
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US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2014

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EXECUTIVE SUMMARY

Under the 1994 amendments of the Marine Mammal Protection Act (MMPA), the National Marine Fisheries Service (NMFS) and the United States Fish and Wildlife Service (USFWS) were required to generate stock assessment reports (SARs) for all marine mammal stocks in waters within the U.S. Exclusive Economic Zone (EEZ). The first reports for the Atlantic (includes the Gulf of Mexico) were published in July 1995 (Blaylock *et al.* 1995). The MMPA requires NMFS and USFWS to review these reports annually for strategic stocks of marine mammals and at least every 3 years for stocks determined to be non-strategic. Included in this report as appendices are: 1) a summary of serious injury/mortality estimates of marine mammals in observed U.S. fisheries (Appendix I), 2) a summary of NMFS records of large whale human-caused serious injury and mortality (Appendix II), 3) detailed fisheries information (Appendix III), 4) summary tables of abundance estimates generated over recent years and the surveys from which they are derived (Appendix IV), and a list of reports not updated in the current year (Appendix V).

Table 1 contains a summary, by species, of the information included in the stock assessments, and also indicates those that have been revised since the 2013 publication. Most of the changes incorporate new information into sections on population size and/or mortality estimates. A total of 30 of the Atlantic and Gulf of Mexico stock assessment reports were revised for 2014. The revised SARs include 12 strategic and 18 non-strategic stocks.

This report was prepared by staff of the Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). NMFS staff presented the reports at the February 2013 meeting of the Atlantic Scientific Review Group (ASRG), and subsequent revisions were based on their contributions and constructive criticism. This is a working document and individual stock assessment reports will be updated as new information becomes available and as changes to marine mammal stocks and fisheries occur. The authors solicit any new information or comments which would improve future stock assessment reports.

INTRODUCTION

Section 117 of the 1994 amendments to the Marine Mammal Protection Act (MMPA) requires that an annual stock assessment report (SAR) for each stock of marine mammals that occurs in waters under USA jurisdiction, be prepared by the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS), in consultation with regional Scientific Review Groups (SRGs). The SRGs are a broad representation of marine mammal and fishery scientists and members of the commercial fishing industry mandated to review the marine mammal stock assessments and provide advice to the NOAA Assistant Administrator for Fisheries. The reports are then made available on the *Federal Register* for public review and comment before final publication.

The MMPA requires that each SAR contain several items, including: (1) a description of the stock, including its geographic range; (2) a minimum population estimate, a maximum net productivity rate, and a description of current population trend, including a description of the information upon which these are based; (3) an estimate of the annual human-caused mortality and serious injury of the stock, and, for a strategic stock, other factors that may be causing a decline or impeding recovery of the stock, including effects on marine mammal habitat and prey; (4) a description of the commercial fisheries that interact with the stock, including the estimated number of vessels actively participating in the fishery and the level of incidental mortality and serious injury of the stock by each fishery on an annual basis; (5) a statement categorizing the stock as strategic or not, and why; and (6) an estimate of the potential biological removal (PBR) level for the stock, describing the information used to calculate it. The MMPA also requires that SARs be updated annually for stocks which are specified as strategic stocks, or for which significant new information is available, and once every three years for non-strategic stocks.

Following enactment of the 1994 amendments, the NMFS and USFWS held a series of workshops to develop guidelines for preparing the SARs. The first set of stock assessments for the Atlantic Coast (including the Gulf of Mexico) were published in July 1995 in the *NOAA Technical Memorandum* series (Blaylock *et al.* 1995). In April 1996, the NMFS held a workshop to review proposed additions and revisions to the guidelines for preparing SARs (Wade and Angliss 1997). Guidelines developed at the workshop were followed in preparing the 1996 through 2012 SARs. In 1997 and 2004 SARs were not produced.

In this document, major revisions and updating of the SARs were completed for stocks for which significant new information was available. These are identified by the May 2015 date-stamp at the top right corner at the beginning of each report. Stocks not updated in 2014 are listed in Appendix V.

REFERENCES

Blaylock, R.A., J.W. Hain, L.J. Hansen, D.L. Palka and G.T. Waring 1995. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments. NOAA Tech. Memo. NMFS-SEFSC-363, 211 pp.

Wade, P.R. and R.P. Angliss 1997. Guidelines for assessing marine mammal stocks: Report of the GAMMS workshop April 3-5, 1996, Seattle, Washington. NOAA Tech. Memo. NMFS-OPR-12, 93 pp.

TABLE 1. A SUMMARY (including footnotes) OF ATLANTIC MARINE MAMMAL STOCK ASSESSMENT REPORTS FOR STOCKS OF MARINE MAMMALS UNDER NMFS AUTHORITY THAT OCCUPY WATERS UNDER USA JURISDICTION.

Total Annual S.I. (serious injury) and Mortality and Annual Fisheries S.I. and Mortality are mean annual figures for the period 2008-2012. The “SAR revised” column indicates 2014 stock assessment reports that have been revised relative to the 2013 reports (Y=yes, N=no). If abundance, mortality, PBR or status have been revised, they are indicated with the letters “a”, “m”, “p” and “status” respectively. For those species not updated in this edition, the year of last revision is indicated. Unk = unknown and undet=undetermined (PBR for species with outdated abundance estimates is considered "undetermined").

Species	Stock Area	NMFS Ctr.	Nbest	Nbest CV	Nmin	Rmax	Fr	PBR	Total Annual S.I and Mort.	Annual Fish. S.I. and Mort. (cv)	Strategic Status	SAR Revised
North Atlantic right whale	Western North Atlantic	NEC	465	0	465	0.04[a]	0.1	0.9	4.55[a]	3.65[a]	Y	Y (a, m)
Humpback whale	Gulf of Maine	NEC	823	0	823	0.065	0.1	2.7	10.3[b]	8.90[b]	Y	Y m
Fin whale	Western North Atlantic	NEC	1,618	0.33	1,234	0.04	0.1	2.5	3.35[c]	1.55[c]	Y	Y a, m, p
Sei whale	Nova Scotia	NEC	357	0.52	236	0.04	0.1	0.5	0.8[d]	0.4[d]	Y	Y m
Minke whale	Canadian east coast	NEC	20,741	0.30	16,199	0.04	0.5	162	9.9[e]	8.7[e]	N	Y m
Blue whale	Western North Atlantic	NEC	unk	unk	440	0.04	0.1	0.9	unk	unk	Y	N (2010)
Sperm whale	North Atlantic	NEC	2,288	0.28	1,815	0.04	0.1	3.6	0.8	0.8	Y	Y m
Dwarf sperm whale	Western North Atlantic	SEC	3,785[k]	0.47[k]	2,598[k]	0.04	0.5	26	3.4	3.4 (1.0)	N	N (2013)
Pygmy sperm whale	Western North Atlantic	SEC	3,785[k]	0.47[k]	2,598[k]	0.04	0.5	26	3.4	3.4 (1.0)	N	N (2013)
Killer whale	Western North Atlantic	NEC	unk	unk	unk	0.04	0.5	unk	0	0	N	Y
Pygmy killer whale	Western North Atlantic	SEC	unk	unk	unk	0.04	0.5	unk	0	0	N	N (2007)
False killer whale	Western North Atlantic	SEC	442	1.06	212	0.04	0.5	2.1	unk	unk	Y	Y (new report)
Northern bottlenose whale	Western North Atlantic	NEC	unk	unk	unk	0.04	0.5	unk	0	0	N	Y
Cuvier's beaked whale	Western North Atlantic	NEC	6,532	0.32	5,021	0.04	0.5	50	0.4	0.2	N	N (2013)
Blainville’s beaked whale	Western North Atlantic	NEC	7,092[j]	0.54	4,632[j]	0.04	0.5	46	0.2	0.2	N	N (2013)
Gervais beaked whale	Western North Atlantic	NEC	7,092[j]	0.54	4,632[j]	0.04	0.5	46	0	0	N	N (2013)
Sowerby’s beaked whale	Western North Atlantic	NEC	7,092[j]	0.54	4,632[j]	0.04	0.5	46	0	0	N	Y
True’s beaked whale	Western North Atlantic	NEC	7,092[j]	0.54	4,632[j]	0.04	0.5	46	0	0	N	N (2013)

Melon-headed whale	Western North Atlantic	SEC	unk	unk	unk	0.04	0.5	unk	0	0	N	N (2007)
Risso's dolphin	Western North Atlantic	NEC	18,250	0.46	12,619	0.04	0.48	126	51	51 (0.27)	N	Y m
Pilot whale, long-finned	Western North Atlantic	NEC	26,535	0.35	19,930	0.04	0.5	199	35 [f]	35 (0.15)	N	Y m
Pilot whale, short-finned	Western North Atlantic	SEC	21,515	0.37	15,913	0.04	0.5	159	140[f]	140 (0.21)	N	Y (m)
Atlantic white-sided dolphin	Western North Atlantic	NEC	48,819	0.61	30,403	0.04	0.5	304	116	116 (0.17)	N	Y m
White-beaked dolphin	Western North Atlantic	NEC	2,003	0.94	1,023	0.04	0.5	10	0	0	N	N (2007)
Short-beaked common dolphin	Western North Atlantic	NEC	173,486	0.55	112,531	0.04	0.5	1,125	289	289 (0.12)	N	Y m
Atlantic spotted dolphin	Western North Atlantic	SEC	44.715	0.43	31,610	0.04	0.5	316	0	0	N	N (2013)
Pantropical spotted dolphin	Western North Atlantic	SEC	3,333	0.91	1,733	0.04	0.5	17	0	0	N	N (2013)
Striped dolphin	Western North Atlantic	NEC	54,807	0.3	42,804	0.04	0.5	428	0	0	N	N (2013)
Fraser's dolphin	Western North Atlantic	SEC	unk	unk	unk	0.04	0.5	unk	0	0	N	N (2007)
Rough-toothed dolphin	Western North Atlantic	SEC	271	1.0	134	0.04	0.5	1.3	0	0	N	N (2013)
Clymene dolphin	Western North Atlantic	SEC	unk	unk	unk	0.04	0.5	undet	0	0	N	N (2013)
Spinner dolphin	Western North Atlantic	SEC	unk	unk	unk	0.04	0.5	unk	0	0	N	N (2013)
Common bottlenose dolphin	Western North Atlantic, offshore	SEC	77,532 [g]	0.40	56,053[g]	0.04	0.5	561	45.1	45.1 (0.24)	N	Y (m)
Common bottlenose dolphin	Western North Atlantic, northern migratory coastal	SEC	11,548	0.36	8,620	0.04	0.5	86	3.8-5.8	3.8-5.8	Y	N (2013)
Common bottlenose dolphin	Western North Atlantic, southern migratory coastal	SEC	9,173	0.46	6,326	0.04	0.5	63	2.6-16.5	2.6-16.5	Y	N (2013)
Common bottlenose dolphin	Western North Atlantic, S. Carolina/Georgia coastal	SEC	4,377	0.43	3,097	0.04	0.5	31	unk	unk	Y	N (2013)
Common bottlenose dolphin	Western North Atlantic, northern Florida coastal	SEC	1,219	0.67	730	0.04	0.5	7	unk	unk	Y	N (2013)
Common bottlenose dolphin	Western North Atlantic, central Florida coastal	SEC	4,895	0.71	2,851	0.04	0.5	29	unk	unk	Y	N (2013)
Common bottlenose dolphin	Northern North Carolina Estuarine System	SEC	950	0.23	785	0.04	0.5	7.9	1.9-9.1	1.9-9.1	Y	N (2013)

Common bottlenose dolphin	Southern North Carolina Estuarine System	SEC	188	0.19	160	0.04	0.5	1.6	0.2-0.8	0.2-0.8	Y	N (2013)
Common bottlenose dolphin	Northern South Carolina Estuarine System	SEC	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	N (2013)
Common bottlenose dolphin	Charleston Estuarine System	SEC	289	0.03	281	0.04	0.5	2.8	unk	unk	Y	N (2013)
Common bottlenose dolphin	Northern Georgia/ Southern South Carolina Estuarine System	SEC	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	N (2013)
Common bottlenose dolphin	Central Georgia Estuarine System	SEC	192	0.04	185	0.04	0.5	1.9	unk	unk	Y	Y (new report)
Common bottlenose dolphin	Southern Georgia Estuarine System	SEC	194	0.05	185	0.04	0.5	1.9	unk	unk	Y	N (2013)
Common bottlenose dolphin	Jacksonville Estuarine System	SEC	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	N (2013)
Common bottlenose dolphin	Indian River Lagoon Estuarine System	SEC	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	N (2013)
Common bottlenose dolphin	Biscayne Bay	SEC	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	N (2013)
Common bottlenose dolphin	Florida Bay	SEC	unk	unk	unk	0.04	0.5	undet	unk	unk	N	N (2013)
Harbor porpoise	Gulf of Maine/Bay of Fundy	NEC	79,833	0.32	61,415	0.046	0.5	706	683	683	N	Y (m, status)
Harbor seal	Western North Atlantic	NEC	75,834	0.15	66,884	0.12	0.5	2,006	441	431 (0.12)	N	Y a, m, p
Gray seal	Western North Atlantic	NEC	unk	unk	unk	0.12	1.0	unk	4,533	1,086 (0.11)	N	Y m
Harp seal	Western North Atlantic	NEC	unk	unk	unk	0.12	1.0	unk	306,082[h]	271 (0.19)	N	N (2013)
Hooded seal	Western North Atlantic	NEC	unk	unk	unk	0.12	0.75	unk	5,199[i]	25(0.82)	N	N (2007)
Sperm whale	Gulf of Mexico	SEC	763	0.38	560	0.04	0.1	1.1	0.2	0	Y	N (2012)
Bryde's whale	Gulf of Mexico	SEC	33	1.07	16	0.04	0.5	0.1	0.2	0	Y	N (2012)
Cuvier's beaked whale	Gulf of Mexico	SEC	74	1.04	36	0.04	0.5	0.4	0	0	N	N (2012)
Blainville's beaked whale	Gulf of Mexico	SEC	149[j]	0.91	77	0.04	0.5	0.8	0	0	N	N (2012)
Gervais' beaked whale	Gulf of Mexico	SEC	149[j]	0.91	77	0.04	0.5	0.8	0	0	N	N (2012)
Common bottlenose dolphin	Gulf of Mexico, Continental shelf	SEC	51,192	0.10	46,926	0.04	0.5	469	unk	unk	N	Y (a, p)
Common bottlenose dolphin	Gulf of Mexico, eastern coastal	SEC	12,388	0.13	11,110	0.04	0.5	111	unk	unk	N	Y (a, p)
Common bottlenose dolphin	Gulf of Mexico, northern coastal	SEC	7,185	0.21	6,044	0.04	0.5	60	unk	unk	Y	Y (a, p)

Common bottlenose dolphin	Gulf of Mexico, western coastal	SEC	20,161	0.17	17,491	0.04	0.5	175	unk	unk	Y	Y (a, p)
Common bottlenose dolphin	Gulf of Mexico, Oceanic	SEC	5,806	0.39	4,230	0.04	0.5	42	6.5	6.5 (0.65)	N	Y m
Common bottlenose dolphin	Gulf of Mexico, bay, sound and estuary (27 stocks)	SEC	unk for all but 4 stocks	unk	unk for all but 4 stocks	0.04	0.5	undet for all but 4 stocks	unk	unk	Y for all	Y stranding and fishery data
Common bottlenose dolphin	Barataria Bay	SEC	unk	unk	unk	0.04	0.5	undet	unk	unk	Y	Y stranding and fishery data, habitat issues
Common bottlenose dolphin	Mississippi Sound, Lake Borgne, Bay Boudreau	SEC	901	0.63	551	0.04	0.5	5.6	unk	unk	Y	Y (new report)
Common bottlenose dolphin	St. Joseph Bay	SEC	146	0.18	126	0.04	0.5	1.3	unk	unk	Y	N (2012)
Common bottlenose dolphin	Choctawhatchee Bay	SEC	179	0.04	173	0.04	0.5	1.7	unk	unk	Y	N (2012)
Atlantic spotted dolphin	Gulf of Mexico	SEC	unk	unk	unk	0.04	0.5	undet	unk	unk	N	N (2012)
Pantropical spotted dolphin	Gulf of Mexico	SEC	50,880	0.27	40,699	0.04	0.5	407	3.4	3.4 (0.65)	N	Y (m)
Striped dolphin	Gulf of Mexico	SEC	1,849	0.77	1,041	0.04	0.5	10	0	0	N	N (2012)
Spinner dolphin	Gulf of Mexico	SEC	11,441	0.83	6,221	0.04	0.5	62	0	0	N	N (2012)
Rough-toothed dolphin	Gulf of Mexico	SEC	624	0.99	311	0.04	0.5	3	0	0	N	N (2012)
Clymene dolphin	Gulf of Mexico	SEC	129	1.00	64	0.04	0.5	0.6	0	0	N	N (2012)
Fraser's dolphin	Gulf of Mexico	SEC	unk	unk	unk	0.04	0.5	undet	0	0	N	N (2012)
Killer whale	Gulf of Mexico	SEC	28	1.02	14	0.04	0.5	0.1	0	0	N	N (2012)
False killer whale	Gulf of Mexico	SEC	unk	unk	unk	0.04	0.5	undet	0	0	N	N (2012)
Pygmy killer whale	Gulf of Mexico	SEC	152	1.02	75	0.04	0.5	0.8	0	0	N	N (2012)
Dwarf sperm whale	Gulf of Mexico	SEC	186[k]	1.04	90	0.04	0.5	0.9	0	0	N	N (2012)
Pygmy sperm whale	Gulf of Mexico	SEC	186[k]	1.04	90	0.04	0.5	0.9	0.3	0.3 (1.0)	N	N (2012)
Melon-headed whale	Gulf of Mexico	SEC	2,235	0.75	1,274	0.04	0.5	13	0	0	N	N (2012)
Risso's dolphin	Gulf of Mexico	SEC	2,442	0.57	1,563	0.04	0.5	16	7.9	7.9 (0.76)	N	Y m
Pilot whale, short-finned[l]	Gulf of Mexico	SEC	2,415	0.66	1456	0.04	0.5	15	0	0	N	N (2012)
Sperm Whale	Puerto Rico and US Virgin Islands	SEC	unk	unk	unk	0.04	0.1	unk	unk	unk	Y	N (2010)
Common bottlenose dolphin	Puerto Rico and US Virgin Islands	SEC	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	N (2011)
Cuvier's beaked whale	Puerto Rico and US Virgin Islands	SEC	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	N (2011)
Pilot whale, short-finned	Puerto Rico and US Virgin Islands	SEC	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	N (2011)

Spinner dolphin	Puerto Rico and US Virgin Islands	SEC	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	N (2011)
Atlantic spotted dolphin	Puerto Rico and US Virgin Islands	SEC	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	N (2011)

a. The R given for right whales is the default Rmax of 0.04. The total estimated human-caused mortality and serious injury to right whales is estimated at 4.55 per year. This is derived from two components: 1) non-observed fishery entanglement records at 3.65 per year, and 2) ship strike records at 0.9 per year.

b. The total estimated human-caused mortality and serious injury to the Gulf of Maine humpback whale stock is estimated as 10.3 per year. This average is derived from two components: 1) incidental fishery interaction records 8.9; 2) records of vessel collisions, 1.4.

c. The total estimated human-caused mortality and serious injury to the Western North Atlantic fin whale stock is estimated as 3.35 per year . This average is derived from two components: 1) incidental fishery interaction records 1.55; 2) records of vessel collisions, 1.8.

d. The total estimated human-caused mortality and serious injury to the Nova Scotia sei whale stock is estimated as 0.8 per year. This average is derived from two components: 1) incidental fishery interaction records 0.4; 2) records of vessel collisions, 0.4 .

e. The total estimated human-caused mortality and serious injury to the Canadian East Coast minke whale stock is estimated as 9.9 per year. This average is derived from three components: 1) 1.6 (0.69) minke whales per year from observed U.S. fisheries; 2) 7.1 minke whales per year (unknown CV) from U.S. and Canadian fisheries using strandings and entanglement data; and 3) 1.2 per year from U.S. ship strikes

f. While abundance estimates have been attributed to each stock, the bycatch estimate for trawl fisheries includes both long-finned and short-finned pilot whales, and for the pelagic longline fishery has been assigned to the short-finned pilot whale stock.

g. Estimates may include sightings of the coastal form.

h. The total estimated human caused annual mortality and serious injury to harp seals is 306,082. Estimated annual human caused mortality in US waters is 271 harp seals (CV=0.19) from the observed US fisheries. The remaining mortality is derived from five components: 1) 2007-2011 average catches of Northwest Atlantic harp seals by Canada, 125,751; 2) 2007-2011 average Greenland Catch, 79,181; 3) 1,000 average catches in the Canadian Arctic; 4) 12,330 average bycatches in the Newfoundland lumpfish fishery; and 5) 87,546 average struck and lost animals.

i. This is derived from three components: 1) 5,173 from 2001-2005 (2001 = 3,960; 2002 = 7,341; 2003 = 5,446, 2004=5,270; and 2005=3,846) average catches of Northwest Atlantic population of hooded seals by Canada and Greenland; 2) 25 hooded seals (CV=0.82) from the observed U.S. fisheries; and 3) one hooded seal from average 2001-2005 stranding mortalities resulting from non-fishery human interactions.

j. This estimate includes Gervais' beaked whales and Blainville's beaked whales for the Gulf of Mexico stocks, and all species of *Mesoplodon* in the Atlantic.

k. This estimate includes both the dwarf and pygmy sperm whales.

l. This estimate includes all *Globicephala sp.*, though it is presumed that only short-finned pilot whales are present in the Gulf of Mexico.

NORTH ATLANTIC RIGHT WHALE (*Eubalaena glacialis*): Western Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The western North Atlantic right whale population ranges primarily from calving grounds in coastal waters of the southeastern United States to feeding grounds in New England waters and the Canadian Bay of Fundy, Scotian Shelf, and Gulf of St. Lawrence. Mellinger *et al.* (2011) reported acoustic detections of right whales near the nineteenth-century whaling grounds east of southern Greenland, but the number of whales and their origin is unknown. However, Knowlton *et al.* (1992) reported several long-distance movements as far north as Newfoundland, the Labrador Basin, and southeast of Greenland. In addition, resightings of photographically identified individuals have been made off Iceland, in the old Cape Farewell whaling ground east of Greenland (Hamilton *et al.* 2007), northern Norway (Jacobsen *et al.* 2004), and the Azores (Silva *et al.* 2012). The September 1999 Norwegian sighting represents one of only two published sightings in the 20th century of a right whale in Norwegian waters, and the first since 1926. Together, these long-range matches indicate an extended range for at least some individuals and perhaps the existence of important habitat areas not presently well described. A few published records from the Gulf of Mexico (Moore and Clark 1963; Schmidly *et al.* 1972; Ward-Geiger *et al.* 2011) likely represent occasional wanderings of individual animals beyond the sole known calving and wintering ground in the waters of the southeastern United States. Whatever the case, the location of much of the population is unknown during the winter. Offshore (greater than 30 miles) surveys flown off the coast of northeastern Florida and southeastern Georgia from 1996 to 2001 had 3 sightings in 1996, 1 in 1997, 13 in 1998, 6 in 1999, 11 in 2000 and 6 in 2001 (within each year, some were repeat sightings of previously recorded individuals). An offshore survey in March 2010 observed the birth of a right whale in waters 40 miles off Jacksonville, Florida (Foley *et al.* 2011). Several of the years that offshore surveys were flown were some of the lowest count years for calves and for numbers of right whales in the Southeast recorded since comprehensive surveys began in the calving grounds. Therefore, the frequency with which right whales occur in offshore waters in the southeastern U.S. remains unclear.

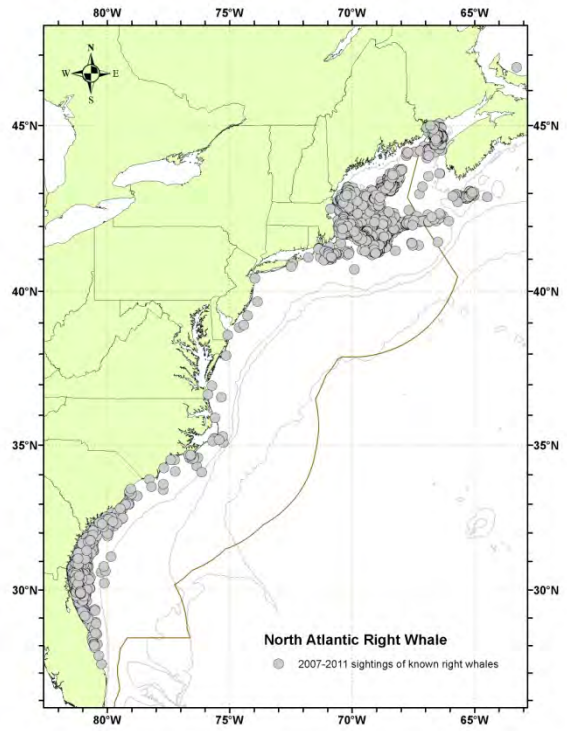

Figure 1. *Distribution of sightings of known North Atlantic right whales, 2007-2011. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

Surveys have demonstrated the existence of seven areas where western North Atlantic right whales congregate seasonally: the coastal waters of the southeastern United States; the Great South Channel; Jordan Basin (Cole *et al.* 2013); Georges Basin along the northeastern edge of Georges Bank; Cape Cod and Massachusetts Bays; the Bay of Fundy; and the Roseway Basin on the Scotian Shelf. However, movements within and between habitats are extensive and the area off the mid-Atlantic states is an important migratory corridor. In 2000, one whale was photographed in Florida waters on 12 January, then again eleven days later (23 January) in Cape Cod Bay, less than a month later off Georgia (16 February), and back in Cape Cod Bay on 23 March, effectively making the round-trip migration to the Southeast and back at least twice during the winter season (Brown and Marx 2000). Results from satellite tags clearly indicate that sightings separated by perhaps two weeks should not necessarily be assumed to indicate a stationary or resident animal. Instead, telemetry data have shown rather lengthy and somewhat distant excursions, including into deep water off the continental shelf (Mate *et al.* 1997; Baumgartner and Mate 2005). Systematic surveys conducted off the coast of North Carolina during the winters of 2001 and 2002 sighted 8 calves,

suggesting the calving grounds may extend as far north as Cape Fear. Four of the calves were not sighted by surveys conducted further south. One of the females photographed was new to researchers, having effectively eluded identification over the period of its maturation (McLellan *et al.* 2003). There is also at least one recent case of a calf apparently being born in the Gulf of Maine (Patrician *et al*. 2009) and another newborn recently detected in Cape Cod Bay.

New England waters are important feeding habitats for right whales, which feed in this area primarily on copepods (largely of the genera *Calanus* and *Pseudocalanus*). Research suggests that right whales must locate and exploit extremely dense patches of zooplankton to feed efficiently (Mayo and Marx 1990). These dense zooplankton patches are likely a primary characteristic of the spring, summer, and fall right whale habitats (Kenney *et al.* 1986, 1995). While feeding in the coastal waters off Massachusetts has been better studied than in other areas, right whale feeding has also been observed on the margins of Georges Bank, in the Great South Channel, in the Gulf of Maine, in the Bay of Fundy, and over the Scotian Shelf. The characteristics of acceptable prey distribution in these areas are beginning to emerge (Baumgartner *et al.* 2003; Baumgartner and Mate 2003). NMFS (National Marine Fisheries Service) and Provincetown Center for Coastal Studies aerial surveys during springs of 1999-2006 found right whales along the Northern Edge of Georges Bank, in the Great South Channel, in Georges Basin, and in various locations in the Gulf of Maine including Cashes Ledge, Platts Bank, and Wilkinson Basin. Analysis of the sightings data has shown that utilization of these areas has a strong seasonal component (Pace and Merrick 2008). The consistency with which right whales occur in such locations is relatively high, but these studies also highlight the high interannual variability in right whale use of some habitats (Pendleton *et al*. 2009). Right whale calls have been detected by autonomous passive acoustic sensors deployed between 2005 and 2010 at three sites (Massachusetts Bay, Stellwagen Bank, and Jeffreys Ledge) in the southern Gulf of Maine (Morano *et al*. 2012, Mussoline *et al*. 2012). Acoustic detections demonstrate that right whales are present more than aerial survey observations indicate. Comparisons between detections from passive acoustic recorders with observations from aerial surveys in Cape Cod Bay between 2001 and 2005 demonstrated that aerial surveys found whales on approximately two-thirds of the days during which acoustic monitoring detected whales. (Clark *et al*. 2010). Passive acoustic monitoring is demonstrating that the current understanding of the distribution and movements of right whales in the Gulf of Maine and surrounding waters is incomplete.

Genetic analyses based upon direct sequencing of mitochondrial DNA (mtDNA) have identified 7 mtDNA haplotypes in the western North Atlantic right whale, including hetroplasmy that led to the declaration of the 7th haplotype (Malik *et al.* 1999, McLeod and White 2010). Schaeff *et al.* (1997) compared the genetic variability of North Atlantic and southern right whales (*E. australis*), and found the former to be significantly less diverse, a finding broadly replicated by Malik *et al.* (2000). The low diversity in North Atlantic right whales might be indicative of inbreeding, but no definitive conclusion can be reached using current data. Additional work comparing modern and historic genetic population structure, using DNA extracted from museum and archaeological specimens of baleen and bone, has suggested that the eastern and western North Atlantic populations were not genetically distinct (Rosenbaum *et al.* 1997; 2000). However, the virtual extirpation of the eastern stock and its lack of recovery in the last hundred years strongly suggest population subdivision over a protracted (but not evolutionary) timescale. Genetic studies concluded that the principal loss of genetic diversity occurred prior to the 18th century (Waldick *et al.* 2002). However, revised conclusions that nearly all the remains in the North American Basque whaling archaeological sites were bowhead whales and not right whales (Rastogi *et al.* 2004) contradict the previously held belief that Basque whaling during the 16th and 17th centuries was principally responsible for the loss of genetic diversity.

High-resolution (i.e., using 35 microsatellite loci) genetic profiling has been completed for 66% of all North Atlantic right whales identified through 2001. This work has improved our understanding of genetic variability, number of reproductively active individuals, reproductive fitness, parentage, and relatedness of individuals (Frasier *et al.* 2007).

One emerging result of the genetic studies is the importance of obtaining biopsy samples from calves on the calving grounds. Only 60% of all known calves are seen with their mothers in summering areas, when their callosity patterns are stable enough to reliably make a photo-ID match later in life. The remaining 40% are not seen on a known summering ground. Because the calf's genetic profile is the only reliable way to establish parentage, if the calf is not sampled when associated with its mother early on, then it is not possible to link it with a calving event or to its mother, and information such as age and familial relationships is lost. From 1980 to 2001, there were 64 calves born that were not sighted later with their mothers and thus unavailable to provide age-specific mortality information (Frasier *et al.* 2007). An additional interpretation of paternity analyses is that the population size may be larger than was previously thought. Fathers for only 45% of known calves have been genetically determined. However, genetic profiles were available for 69% of all photo-identified males (Frasier 2005). The conclusion was

that the majority of these calves must have different fathers that cannot be accounted for by the unsampled males and the population of males must be larger (Frasier 2005). This inference of additional animals that have never been captured photographically and/or genetically suggests the existence of habitats of potentially significant use that remain unknown.

POPULATION SIZE

The western North Atlantic minimum stock size is based on a census of individual whales identified using photo-identification techniques. A review of the photo-ID recapture database as it existed on 25 October 2013 indicated that 465 individually recognized whales in the catalog were known to be alive during 2011. This number represents a minimum population size. This is a direct count and has no associated coefficient of variation.

Previous estimates using the same method with the added assumption that whales seen within the previous seven years were still alive have resulted in counts of 295 animals in 1992 (Knowlton *et al.* 1994) and 299 animals in 1998 (Kraus *et al.* 2001). An International Whaling Commission (IWC) workshop on status and trends of western North Atlantic right whales gave a minimum direct-count estimate of 263 right whales alive in 1996 and noted that the true population was unlikely to be substantially greater than this (Best *et al.* 2001).

Historical Abundance

An estimate of pre-exploitation population size is not available. Basque whalers were thought to have taken right whales during the 1500s in the Strait of Belle Isle region (Aguilar 1986), however, genetic analysis has shown that nearly all of the remains found in that area are, in fact, those of bowhead whales (Rastogi *et al.* 2004; Frasier *et al.* 2007). The stock of right whales may have already been substantially reduced by the time whaling was begun by colonists in the Plymouth area in the 1600s (Reeves *et al.* 2001; Reeves *et al.* 2007). A modest but persistent whaling effort along the coast of the eastern U.S. lasted three centuries, and the records include one report of 29 whales killed in Cape Cod Bay in a single day during January 1700. Reeves *et al.* (2007) calculated that a minimum of 5500 right whales were taken in the western North Atlantic between 1634 and 1950, with nearly 80% taken in a 50-year period between 1680 and 1730. They concluded, “there were at least a few thousand whales present in the mid-1600s.” The authors cautioned, however, that the record of removals is incomplete, the results were preliminary, and refinements are required. Based on back calculations using the present population size and growth rate, the population may have numbered fewer than 100 individuals by 1935 when international protection for right whales came into effect (Hain 1975; Reeves *et al.* 1992; Kenney *et al.* 1995). However, little is known about the population dynamics of right whales in the intervening years.

Minimum Population Estimate

The western North Atlantic population size was estimated to be at least 465 individuals in 2011 (457 cataloged whales plus 8 not cataloged calves at the time the data were received) based on a census of individual whales identified using photo-identification techniques. This value is a minimum, and does not include animals that were alive prior to 2008 but not recorded in the individual sightings database as seen during 1 December 2008 to 25 October 2013 (note that matching of photos taken during 2011-2013 was not considered complete at the time these data were received, P. Hamilton, New England Aquarium, pers. com).

Current Population Trend

The population growth rate reported for the period 1986–1992 by Knowlton *et al.* (1994) was 2.5% (CV=0.12), suggesting that the stock was showing signs of slow recovery, but that number may have been influenced by discovery phenomenon as existing whales were recruited to the catalog. Work by Caswell *et al.* (1999) suggested that crude survival probability declined from about 0.99 in the early 1980s to about 0.94 in the late 1990s. The decline was statistically significant. Additional work conducted in 1999 was reviewed by the IWC workshop on status and trends in this population (Best *et al.* 2001); the workshop concluded based on several analytical approaches that survival had indeed declined in the 1990s. Although capture heterogeneity could negatively bias survival estimates, the workshop concluded that this factor could not account for the entire observed decline, which appeared to be particularly marked in adult females. Another workshop was convened by NMFS in September 2002, and it reached similar conclusions regarding the decline in the population (Clapham 2002). At the time, no one examined the early part of the recapture series for excessive retrospective recaptures which had the potential to positively bias survival as the catalog was being developed.

An increase in mortality in 2004 and 2005 was cause for serious concern (Kraus *et al.* 2005). Calculations based on demographic data through 1999 (Fujiwara and Caswell 2001) indicated that this mortality rate increase would

reduce population growth by approximately 10% per year (Kraus *et al.* 2005). Of those mortalities, six were adult females, three of which were carrying near-term fetuses. Furthermore, four of these females were just starting to bear calves, losing their complete lifetime reproduction potential. Strong evidence for flat or negative growth exists in the time series of minimum number alive during 1998-2000, which coincided with very low calf production in 2004. However, the population has continued to grow since that apparent interval of decline (Figure 1).

Examination of the minimum number alive population index calculated from the individual sightings database, as it existed on 25 October 2013, for the years 1990-2010 (Figure 1) suggests a positive and slowly accelerating trend in population size. These data reveal a significant increase in the number of catalogued whales with a geometric mean growth rate for the period of 2.6%.

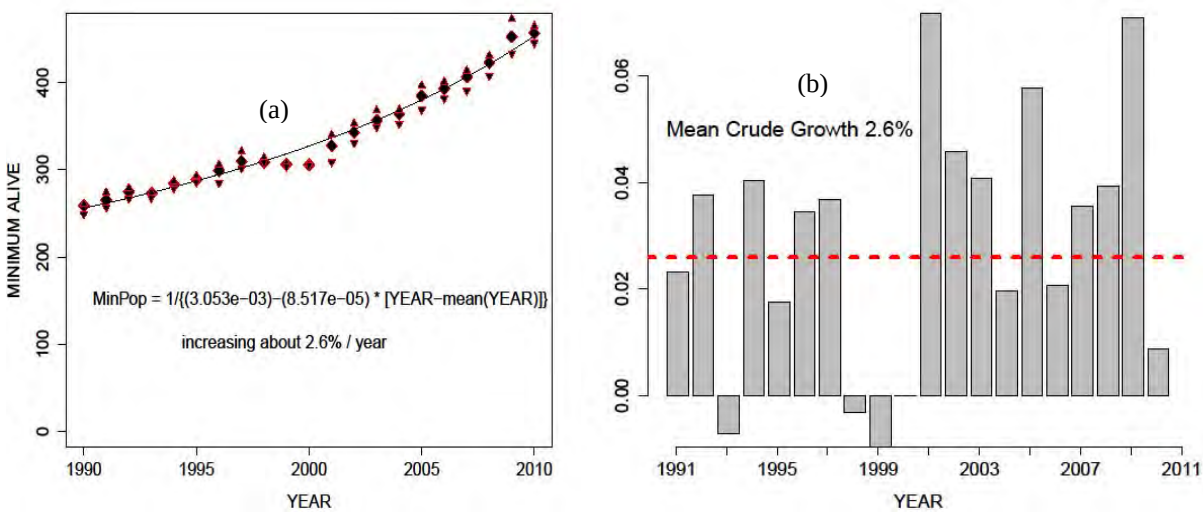

Figure 1. Minimum number alive (a) and crude annual growth rate (b) for cataloged North Atlantic right whales. Minimum number (N) of cataloged individuals known to be alive in any given year includes all whales known to be alive prior to that year and seen in that year or subsequently plus all whales newly cataloged that year. Cataloged whales may include some but not all calves produced each year. Bracketing the minimum number of cataloged whales is the number without calves (below) and that plus calves above, the latter which yields Nmin for purposes of stock assessment. Mean crude growth rate (dashed line) is the exponentiated mean of $\log_e [(N_{t+1}-N_t)/N_t]$ *for each year (t).*

The minimum number alive may increase slightly in later years as analysis of the backlog of unmatched but high-quality photographs proceeds. For example, the minimum number alive for 2002 was calculated to be 313 from a 15 June 2006 data set and revised to 325 using the 30 May 2007 data set.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

During 1980–1992, at least 145 calves were born to 65 identified females. The number of calves born annually ranged from 5 to 17, with a mean of 11.2 (SE=0.90). The reproductively active female pool was static at approximately 51 individuals during 1987–1992. Mean calving interval, based on 86 records, was 3.67 years. There was an indication that calving intervals may have been increasing over time, although the trend was not statistically significant (P=0.083) (Knowlton *et al.* 1994). Since 1993, calf production has been more variable than a simple stochastic model would predict (Table 1).

Total reported calf production and calf mortalities from 1993 to 2012 are shown below in Table 1. The mean calf production for this 20-year period was 17.25. During the 2004 and 2005 calving seasons three adult females were found dead with near-term fetuses.

An updated analysis of calving intervals through the 1997/1998 season suggested that the mean calving interval increased since 1992 from 3.67 years to more than 5 years, a significant trend (Kraus *et al.* 2001). This conclusion was supported by modeling work reviewed by the IWC workshop on status and trends in this population (Best *et al.* 2001); the workshop agreed that calving intervals had indeed increased and further that the reproductive rate was approximately half that reported from studied populations of southern right whales, *E. australis*. A workshop on

possible causes of reproductive failure was held in April 2000 (Reeves *et al.* 2001). Factors considered included contaminants, biotoxins, nutrition/food limitation, disease, and inbreeding problems. Analyses completed since that workshop found that in the early part of this century, calving intervals were closer to 3 years (Kraus *et al.* 2007).

North Atlantic right whales have thinner blubber than southern right whales off South Africa (Miller *et al.* 2011). Blubber thickness of male North Atlantic right whales (males were selected to avoid the effects of pregnancy and lactation) varied with *Calanus* abundance in the Gulf of Maine (Miller *et al.* 2011). Sightings of North Atlantic right whales correlated with satellite-derived sea-surface chlorophyll concentration (as a proxy for productivity), and calving rates correlated with chlorophyll concentration prior to gestation (Hlista *et al.* 2009). On a regional scale, observations of North Atlantic right whales correlate well with copepod concentrations (Pendleton *et al.* 2009). The available evidence suggests that at least some of the observed variability in the calving rates of North Atlantic right whales is related to variability in nutrition.

An analysis of the age structure of this population suggested that it contains a smaller proportion of juvenile whales than expected (Hamilton *et al.* 1998; Best *et al.* 2001), which may reflect lowered recruitment and/or high juvenile mortality. Calf and perinatal mortality was estimated by Browning *et al.* (2010) to be between 17 and 45 animals during the period 1989 and 2003. In addition, it is possible that the apparently low reproductive rate is due in part to an unstable age structure or to reproductive senescence in some females. However, few data are available on either factor and senescence has not been documented for any baleen whale.

The maximum net productivity rate is unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

Table 1. North Atlantic right whale calf production and mortality, 1993-2012.

Year[a]	Reported calf production	Reported calf mortalities
1993	8	2
1994	9	0
1995	7	0
1996	22	3
1997	20	1
1998	6	1
1999	4	0
2000	1	0
2001	31	4
2002	21	2
2003	19	0
2004	17	1
2005	28	0
2006	19	2
2007	23	2
2008	23	2
2009	39	1
2010	19	0
2011	22	0
2012	7	1

[a] includes December of the previous year

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal (PBR) is the product of minimum population size, one-half the maximum net productivity rate and a recovery factor for endangered, depleted, threatened stocks, or stocks of unknown status relative to OSP (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The recovery factor for right whales is 0.10 because this species is listed as endangered under the Endangered Species Act (ESA). The minimum population size is 465. The maximum productivity rate is 0.04, the default value for cetaceans. PBR for the Western Atlantic stock of the North Atlantic right whale is 0.9.

ANNUAL HUMAN-CAUSED SERIOUS INJURY AND MORTALITY

For the period 2008 through 2012, the minimum rate of annual human-caused mortality and serious injury to right whales averaged 4.55 per year. This is derived from two components: 1) incidental fishery entanglement records at 3.65 per year, and 2) ship strike records at 0.9 per year. Of the 12.75 reported fisheries entanglements first reported in U.S. waters during this 5-year time period that were classified as serious injury or mortality, 2 were reported before the Atlantic Large Whale Take Reduction Plan's sinking-groundline rule went into effect in April 2009, and 10.75 were reported after enactment of the rule. All 5 of the reported ship strike serious injury and mortalities from U.S. waters during this 5-year time period were after the speed limit rule which went into effect in December 2008, although all were found more than 45 nmi from regulated areas or involved vessels smaller than those subject to regulation. Some analyses of the effectiveness of the ship strike rule were reported by Silber and Bettridge (2012). Beginning with the 2001 Stock Assessment Report, Canadian records have been incorporated into the mortality and serious injury rates of this report to reflect the effective range of this stock. It is also important to stress that serious injury determinations are made based upon the best available information; these determinations may change with the availability of new information (Cole and Henry 2015.). For the purposes of this report, discussion is primarily limited to those records considered confirmed human-caused mortalities or serious injuries. Annual rates calculated from detected mortalities should not be considered an unbiased estimate of human-caused mortality, but they represent a definitive lower bound. Detections are haphazard, incomplete, and not the result of a designed sampling scheme. As such they represent a minimum estimate of human-caused mortality which is biased low.

Background

The details of a particular mortality or serious injury record often require a degree of interpretation. The assigned cause is based on the best judgment of the available data; additional information may result in revisions. When reviewing Table 2 below, several factors should be considered: 1) a ship strike or entanglement may occur at some distance from the location where the animal is detected/reported; 2) the mortality or injury may involve multiple factors; for example, whales that have been both ship struck and entangled are not uncommon; 3) the actual vessel or gear type/source is often uncertain; and 4) in entanglements, several types of gear may be involved.

The total minimum detected annual average human-induced mortality and serious injury incurred by this stock (including fishery and non-fishery related causes) for the period 2008-2012 was 4.55 right whales per year. As with entanglements, some injury or mortality due to ship strikes is almost certainly undetected, particularly in offshore waters. Decomposed and/or unexamined animals (e.g., carcasses reported but not retrieved or necropsied) represent lost data, some of which may relate to human impacts. For these reasons, the estimate of 4.55 right whales per year must be regarded as a minimum count.

Further, the small population size and low annual reproductive rate of right whales suggest that human sources of mortality may have a greater effect relative to population growth rates than for other whales. The principal factors believed to be retarding growth and recovery of the population are ship strikes and entanglement with fishing gear. Between 1970 and 1999, a total of 45 right whale mortalities was recorded (IWC 1999; Knowlton and Kraus 2001; Glass *et al.* 2009). Of these, 13 (28.9%) were neonates that were believed to have died from perinatal complications or other natural causes. Of the remainder, 16 (35.6%) resulted from ship strikes, 3 (6.7%) were related to entanglement in fishing gear (in two cases lobster gear, and one gillnet gear), and 13 (28.9%) were of unknown cause. At a minimum, therefore, 42.2% of the observed total for the period and 50% of the 32 non-calf deaths was attributable to human impacts (calves accounted for three deaths from ship strikes). Young animals, ages 0-4 years, are apparently the most impacted portion of the population (Kraus 1990).

Finally, entanglement or minor vessel collisions may not kill an animal directly, but may weaken or otherwise affect it so that it is more likely to become vulnerable to further injury. Such was apparently the case with the two-year-old right whale killed by a ship off Amelia Island, Florida in March 1991 after having carried gillnet gear wrapped around its tail region since the previous summer (Kenney and Kraus 1993). A similar fate befell right whale #2220, found dead on Cape Cod in 1996.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality.*" All injury determinations for this stock assessment were performed under the new guidelines. The new process involves proration of serious injury

determinations where there is uncertainty regarding the severity or cause.

Fishery-Related Serious Injury and Mortality

Reports of mortality and serious injury relative to PBR as well as total human impacts are contained in records maintained by the New England Aquarium and the NMFS Northeast and Southeast Regional Offices (Table 2). From 2008 through 2012, 19 records of mortality or serious injury (including records from both U.S. and Canadian waters, pro-rated to 18.25 using serious injury guidelines) involved entanglement or fishery interactions. For this time frame, the average reported mortality and serious injury to right whales due to fishery entanglement was 3.65 whales per year. Information from an entanglement event often does not include the detail necessary to assign the entanglements to a particular fishery or location.

Although disentanglement is often unsuccessful or not possible for many cases, there are several documented cases of entanglements for which the intervention of disentanglement teams averted a likely serious-injury determination. An adult female, #2029, first sighted entangled in the Great South Channel on 9 March 2007, may have avoided serious injury due to being partially disentangled on 18 September 2007 by researchers in the Bay of Fundy, Canada. On 8 December 2008, #3294 was successfully disentangled. Sometimes, even with disentanglement, an animal may die of injuries sustained from fishing gear. A female yearling right whale, #3107 was first sighted with gear wrapping its caudal peduncle on 6 July 2002 near Briar Island, Nova Scotia. Although the gear was removed on 1 September by the New England Aquarium disentanglement team, and the animal seen alive on an aerial survey on 1 October, its carcass washed ashore at Nantucket on 12 October 2002 with deep entanglement injuries on the caudal peduncle. Additionally, but infrequently, a whale listed as seriously injured becomes gear-free without a disentanglement effort and is seen later in reasonable health. Such was the case for whale #1980, listed as a serious injury in 2008 but seen gear-free and apparently healthy in 2011. Three whales freed from probably fatal entanglements are known to have birthed calves at least once after their disentanglement, including 2 disentangled during the period 2008–2012.

The only bycatch of a right whale observed by the Northeast Fisheries Observer Program was in the pelagic drift gillnet fishery in 1993. No mortalities or serious injuries have been documented in any of the other fisheries monitored by NMFS.

Whales often free themselves of gear following an entanglement event, and as such scarring may be a better indicator of fisheries interaction than entanglement records. A review of scars detected on identified individual right whales over a period of 30 years (1980–2009) documented 1032 definite, unique entanglement events on the 626 individual whales identified (Knowlton *et al*. 2012). Most individual whales (83%) were entangled at least once, and almost half of them (306 of 626) were definitely entangled more than once. About a quarter of the individuals identified in each year (26%) were entangled in that year. Juveniles and calves were entangled at higher rates than were adults. Scarring rates suggest that entanglements are occurring at about an order of magnitude greater than that detected from observations of whales with gear on them.

Knowlton *et al* (2012) concluded from their analysis of entanglement scar rates over time that efforts made since 1997 to reduce right whale entanglement have not worked. Working from a completely different data source (observed mortalities of eight large whale species, 1970-2009), van der Hoop *et al*. (2012) arrived at a similar conclusion. Vessel strike and entanglements were the two leading causes of death for known mortalities of right whales for which a cause of death could be determined. Across all 8 species of large whales, there was no detectable change in causes of anthropogenic mortality over time (van der Hoop *et al*. 2012).

Incidents of entanglements in groundfish gillnet gear, cod traps, and herring weirs in waters of Atlantic Canada and the U.S. east coast were summarized by Read (1994). In six records of right whales that were entangled in groundfish gillnet gear in the Bay of Fundy and Gulf of Maine between 1975 and 1990, the whales were either released or escaped on their own, although several whales were observed carrying net or line fragments. A right whale mother and calf were released alive from a herring weir in the Bay of Fundy in 1976.

For all areas, specific details of right whale entanglement in fishing gear are often lacking. When direct or indirect mortality occurs, some carcasses come ashore and are subsequently examined, or are reported as "floaters" at sea. The number of unreported and unexamined carcasses is unknown, but may be significant in the case of floaters. More information is needed about fisheries interactions and where they occur.

Other Mortality

Ship strikes are a major cause of mortality and injury to right whales (Kraus 1990; Knowlton and Kraus 2001, van der Hoop *et al* 2012). Records from 2008 through 2012 have been summarized in Table 2. For this time frame, the average reported mortality and serious injury to right whales due to ship strikes was 0.9 whales per year.

Table 2. Confirmed human-caused serious injury and mortality records of North Atlantic Right Whales (*Eubalaena glacialis*) where the cause was assigned as either an entanglement (EN) or a vessel strike (VS): 2008-2012 a

Date[b]	Injury Determination	ID	Location[b]	Assigned Cause	Value against PBR[c]	Country[d]	Gear Type[e]	Description
9/24/2008	Serious Injury	2110	Jeffreys Ledge, NH	EN	1	XU	NP	In poor health with heavy cyamid load, swath lesions and rake marks. Presented old prop scars and fresh entanglement scars (no gear present). SI due to entanglement with ship strike as secondary cause. Images received in 2011 clearly show scoliosis. Spinal damage to peduncle similar to entanglement injury of right whale case reported on 27-Jan-09 off Cape Lookout NC
1/14/2009	Serious Injury	3311	off Brunswick, GA	EN	1	XU	GU	Line deeply embedded in rostrum and lip. Sedated & wrap on head cut and some gear removed. SI due to health decline (heavy cyamids, skin discoloration). No resights.
7/18/2009	Prorated Injury	1019	off Nantucket, MA	EN	0.75	XU	NR	Entanglement configuration unknown.
8/9/2009	Serious Injury	3930	Bay of Fundy	EN	1	XC	NP	Deep lacerations at fluke insertion potentially affecting arteries. Health decline including fluke

								deformation, increased cyamids & rake marks.
6/27/2010	Mortality	1124	off Cape May, NJ	EN	1	XU	NR	Evidence of constricting rostrum,mouth & pectoral wraps w/associated hemorrhage & bonedamage
7/2/2010	Mortality		off Great Wass Island, ME	VS	1	XU	-	2 large lacerations from dorsal to ventral surface.
8/12/2010	Mortality	1113	Digby Neck, NS	EN	1	XC	NP	Evidence of entanglement w/associated hemorrhaging around right pectoral
9/10/2010	Serious Injury	1503	Jeffreys Ledge, NH	EN	1	XU	NR	Constricting wrap on rostrum. Poor health. No resights.
12/25/2010	Mortality	3911	off Jacksonville Beach, FL	EN	1	XU	GU	Embedded line on flipper & in mouth. Severe health decline. Partial disentanglement.
1/20/2011	Serious Injury	3853	off South Carolina	VS	1	US	-	Sixteen deep lacerations across back, potentially penetrating body cavity. No resights.
2/13/2011	Serious Injury	3993	off Tybee, GA	EN	1	XU	NR	Right pectoral compromised, likely necrotic. Emaciated and poor skin condition. No resights.
3/16/2011	Mortality		Cape Romain, SC	EN	1	XU	GU	Multiple wraps embedded inright pectoral bones; unknown rope
3/27/2011	Mortality	1308	Nags Head, NC	VS	1	US	-	Fractured right skull.

3/27/2011	Serious Injury	2011 Calf of 1308	Nags Head, NC	VS	1	US	-	Dependent calf of mom that was killed by ship strike.
4/22/2011	Serious Injury	3302	off Martha's Vineyard, MA	EN	1	XU	NR	Constricting wrap on head.
7/19/2011	Serious Injury	4160	off Provincetown, MA	EN	1	XU	NP	Calf of the year with fresh entanglement wounds but no gear present. Mom not present. Abandoned dependent calf of seriously injured mother (see 9/3/11 event).
9/3/2011	Serious Injury	2660	Gaspe Bay	EN	1	XC	NP	No gear present but evidence of extensive, constricting entanglement. Significant health decline--cyamids, sloughing skin. Right blow hole not functional. Dependent calf absent (see 7/19/11 event).
9/18/2011	Prorated Injury	4090	Jeffreys Ledge, NH	EN	0.75	XU	NR	Entanglement configuration unknown. Could not confirm if anchored.
9/27/2011	Prorated Injury	3111	off Grand Manan Island, New Brunswick	EN	0.75	XC	NR	Constricting wrap on left flipper. Partial disentanglement. Entanglement configuration unknown. Resight in 2012 did not confirm configuration or if still entangled, but health apparently improved.

2/15/2012	Serious Injury	3996	off Provincetown, MA	EN	1	XU	NR	Constricting gear across head and health decline.
7/19/2012	Mortality	-	Clam Bay, Nova Scotia	EN	1	XC	NR	Multiple constricting wraps on peduncle; COD - peracute underwater entrapment.
9/24/2012	Serious Injury	3610	Bay of Fundy	EN	1	XC	NP	New significant entanglement wounds on head, dorsal & ventral peduncle, and leading fluke edges Health decline - moderate cyamid load, thin
12/7/2012	Prorated Injury	-	off Wassaw Island, GA	VS	0.52	US	-	46' vessel, 12-13 kts struck whale. Animal not resighted butlarge expanding pool of blood at surface.
12/18/2012	Mortality	4193	off Palm Coast, FL	EN	1	US	PT	Constricting and embedded wraps with associated hemorrhaging at peduncle, mouthline, tongue, oral rete, rostrum and pectoral; malnourished.
Five-year averages		Shipstrike (US/CN/XU/XC)			0.90 (0.70/ 0.00/ 0.20/ 0.00)			
		Entanglement (US/CN/XU/XC)			3.65 (0.20/ 0.00/ 2.30/ 1.15)			
a. For more details on events please see Henry *et al.* 2014 and Cole and Henry 2015.								
b. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.								
c. Mortality events are counted as 1 against PBR. Serious injury events have been evaluated using NMFS guidelines (NOAA 2012)								
d. CN=Canada, US=United States, XC=Unassigned 1st sight in CN, XU=Unassigned 1st sight in US								

e. H=hook, GN=gillnet, GU=gear unidentifiable, MF=monofilament, NP=none present, NR=none recovered/received, PT=pot/trap, WE=weir	

STATUS OF STOCK

The size of this stock is considered to be extremely low relative to OSP in the U.S. Atlantic EEZ, and this species is listed as endangered under the ESA. The North Atlantic right whale is considered one of the most critically endangered populations of large whales in the world (Clapham *et al.* 1999). A Recovery Plan has been published for the North Atlantic right whale and is in effect (NMFS 2005). NMFS is presently engaged in evaluating the need for critical habitat designation for the North Atlantic right whale. Under a prior listing as northern right whale, three critical habitats, Cape Cod Bay/Massachusetts Bay, Great South Channel, and the Southeastern U.S., were designated by NMFS (59 FR 28793, June 3, 1994). Two additional critical habitat areas in Canadian waters, Grand Manan Basin and Roseway Basin, were identified in Canada's final recovery strategy for the North Atlantic right whale (Brown *et al.* 2009). Status review by the National Marine Fisheries Service affirms endangered status (NMFS Northeast Regional Office 2012). The total level of human-caused mortality and serious injury is unknown, but reported human-caused mortality and serious injury was a minimum of 4.75 right whales per year from 2008 through 2012. Given that PBR has been set to 0.9, any mortality or serious injury for this stock can be considered significant. This is a strategic stock because the average annual human-related mortality and serious injury exceeds PBR, and also because the North Atlantic right whale is an endangered species.

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HUMPBACK WHALE (*Megaptera novaeangliae*): Gulf of Maine Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the western North Atlantic, humpback whales feed during spring, summer and fall over a geographic range encompassing the eastern coast of the United States (including the Gulf of Maine), the Gulf of St. Lawrence, Newfoundland/Labrador, and western Greenland (Katona and Beard 1990). Other North Atlantic feeding grounds occur off Iceland and northern Norway, including off Bear Island, Jan Mayen, and Franz Josef Land (Christensen *et al.* 1992; Palsbøll *et al.* 1997; M. Moore, WHOI, pers. comm.). These six regions represent relatively discrete subpopulations, fidelity to which is determined matrilineally (Clapham and Mayo 1987), which is supported by studies of the mitochondrial genome (Palsbøll *et al.* 1995; Palsbøll *et al.* 2001) and individual animal movements (Stevick *et al*. 2006). In early stock assessment reports, the North Atlantic humpback whale population was treated as a single stock for management purposes (Waring *et al.* 1999). Subsequently, a decision was made to reclassify the Gulf of Maine as a separate feeding stock (Waring *et al.* 2000) based upon the strong fidelity by individual whales to this region, and the attendant assumption that, were this subpopulation wiped out, repopulation by immigration from adjacent areas would not occur on any reasonable management timescale. During the 2002 Comprehensive Assessment of North Atlantic humpback whales, the International Whaling Commission acknowledged the evidence for treating the Gulf of Maine as a separate management unit (IWC 2002).

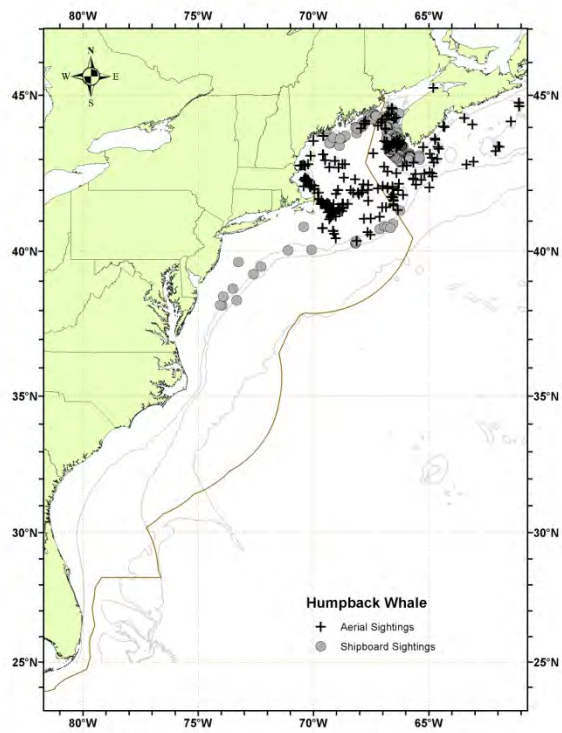

Figure 1. *Distribution of humpback whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008, 2010 and 2011. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

During the summers of 1998 and 1999, the Northeast Fisheries Science Center conducted surveys for humpback whales on the Scotian Shelf to establish the occurrence and population identity of the animals found in this region, which lies between the well-studied populations of the Gulf of Maine and Newfoundland. Photographs from both surveys were compared to both the overall North Atlantic Humpback Whale Catalogue and a large regional catalogue from the Gulf of Maine (maintained by the College of the Atlantic and the Provincetown Center for Coastal Studies, respectively); this work is summarized in Clapham *et al.* (2003). The match rate between the Scotian Shelf and the Gulf of Maine was 27% (14 of 52 Scotian Shelf individuals from both years). Comparable rates of exchange were obtained from the southern (28%, n=10 of 36 whales) and northern (27%, *n*=4 of 15 whales) ends of the Scotian Shelf, despite the additional distance of nearly 100 nautical miles (one whale was observed in both areas). In contrast, all of the 36 humpback whales identified by the same NMFS surveys elsewhere in the Gulf of Maine (including Georges Bank, southwestern Nova Scotia and the Bay of Fundy) had been previously observed in the Gulf of Maine region. The sighting histories of the 14 Scotian Shelf whales matched to the Gulf of Maine suggested that many of them were transient through the latter area. There were no matches between the Scotian Shelf and any other North Atlantic feeding ground, except the Gulf of Maine; however, instructive comparisons are compromised by the often low sampling effort in other regions in recent years. Overall, it appears that the northern range of many members of the Gulf of Maine stock does not extend onto the Scotian Shelf.

During winter, whales from most North Atlantic feeding areas (including the Gulf of Maine) mate and calve in

the West Indies, where spatial and genetic mixing among feeding groups occurs (Katona and Beard 1990; Clapham *et al.* 1993; Palsbøll *et al.* 1997; Stevick *et al.* 1998). A few whales likely using eastern North Atlantic feeding areas migrate to the Cape Verde Islands (Reiner *et al.* 1996; Wenzel *et al.* 2009). In the West Indies, the majority of whales are found in the waters of the Dominican Republic, notably on Silver Bank and Navidad Bank, and in Samana Bay (Balcomb and Nichols 1982; Whitehead and Moore 1982; Mattila *et al.* 1989; Mattila *et al.* 1994). Humpback whales are also found at much lower densities throughout the remainder of the Antillean arc, from Puerto Rico to the coast of Venezuela (Winn *et al.* 1975; Levenson and Leapley 1978; Price 1985; Mattila and Clapham 1989). Although recognition of 2 breeding areas for North Atlantic humpbacks is the prevailing model, several observations suggest that our knowledge of breeding season distribution is far from complete (see Smith and Pike 2009).

All whales from this stock may not migrate to the West Indies every winter, because significant numbers of animals may be found in mid- and high-latitude regions at this time (Clapham *et al.* 1993; Swingle *et al.* 1993) and some individuals have been resighted across a winter season (Clapham *et al.* 1993; Robbins 2007). Acoustic recordings made in Stellwagen Bank National Marine Sanctuary in 2006 and 2008 detected humpback song in almost all months, including throughout the winter (Vu *et al*. 2012). This confirms the presence of male humpback whales in the area (a mid-latitude feeding ground) through the winter in these years. In addition, photographic records from Newfoundland have shown a number of adult humpbacks remain there year-round, particularly on the island's north coast. In collaboration with colleagues in the French islands of St. Pierre and Miquelon, a new photographic catalogue and concurrent matching effort is being undertaken for this region (J. Lawson, DFO, pers. comm.).

An increased number of sightings of humpback whales in the vicinity of the Chesapeake and Delaware Bays occurred in 1992 (Swingle *et al.* 1993). Wiley *et al.* (1995) reported that 38 humpback whale strandings occurred during 1985–1992 in the U.S. mid-Atlantic and southeastern states. Humpback whale strandings increased, particularly along the Virginia and North Carolina coasts, and most stranded animals were sexually immature; in addition, the small size of many of these whales strongly suggested that they had only recently separated from their mothers. Wiley *et al.* (1995) concluded that these areas were becoming an increasingly important habitat for juvenile humpback whales and that anthropogenic factors may negatively impact whales in this area. There have also been a number of wintertime humpback sightings in coastal waters of the southeastern U.S. Whether the increased numbers of sightings represent a distributional change, or are simply due to an increase in sighting effort and/or whale abundance, is unknown.

A key question with regard to humpback whales off the southeastern and mid-Atlantic states is their population identity. This topic was investigated using fluke photographs of living and dead whales observed in the region (Barco *et al.* 2002). In this study, photographs of 40 whales (alive or dead) were of sufficient quality to be compared to catalogs from the Gulf of Maine (i.e., the closest feeding ground) and other areas in the North Atlantic. Of 21 live whales, 9 (43%) matched to the Gulf of Maine, 4 (19%) to Newfoundland, and 1 (4.8%) to the Gulf of St Lawrence. Of 19 dead humpbacks, 6 (31.6%) were known Gulf of Maine whales. Although the population composition of the mid-Atlantic is apparently dominated by Gulf of Maine whales, lack of photographic effort in Newfoundland makes it likely that the observed match rates under-represent the true presence of Canadian whales in the region. A new photographic catalog and concurrent matching effort is being undertaken for this region which may improve knowledge in this regard. Barco *et al.* (2002) suggested that the mid-Atlantic region primarily represents a supplemental winter feeding ground used by humpbacks.

In New England waters, feeding is the principal activity of humpback whales, and their distribution in this region has been largely correlated to abundance of prey species, although behavior and bathymetry are factors influencing foraging strategy (Payne *et al.* 1986, 1990). Humpback whales are frequently piscivorous when in New England waters, feeding on herring (*Clupea harengus*), sand lance (*Ammodytes* spp.), and other small fishes. In the northern Gulf of Maine, euphausiids are also frequently taken (Paquet *et al.* 1997). Commercial depletion of herring and mackerel led to an increase in sand lance in the southwestern Gulf of Maine in the mid-1970s, with a concurrent decrease in humpback whale abundance in the northern Gulf of Maine. Humpback whales were densest over the sandy shoals in the southwestern Gulf of Maine favored by the sand lance during much of the late 1970s and early 1980s, and humpback distribution appeared to have shifted to this area (Payne *et al.* 1986). An apparent reversal began in the mid-1980s, and herring and mackerel increased as sand lance again decreased (Fogarty *et al.* 1991). Humpback whale abundance in the northern Gulf of Maine increased markedly during 1992–1993, along with a major influx of herring (P. Stevick, pers. comm.). Humpback whales were few in nearshore Massachusetts waters in the 1992–1993 summer seasons. They were more abundant in the offshore waters of Cultivator Shoal and on the Northeast Peak on Georges Bank and on Jeffreys Ledge; these latter areas are traditional locations of herring occurrence. In 1996 and 1997, sand lance and therefore humpback whales were once again abundant in the

Stellwagen Bank area. However, unlike previous cycles, when an increase in sand lance corresponded to a decrease in herring, herring remained relatively abundant in the northern Gulf of Maine, and humpbacks correspondingly continued to occupy this portion of the habitat, where they also fed on euphausiids (Wienrich *et al.* 1997). Diel patterns in humpback foraging behavior have been shown to correlate with diel patterns in sand lance behavior (Friedlaender *et al.* 2009).

In early 1992, a major research program known as the Years of the North Atlantic Humpback (YONAH) (Smith *et al.* 1999) was initiated. This was a large-scale, intensive study of humpback whales throughout almost their entire North Atlantic range, from the West Indies to the Arctic. During two primary years of field work, photographs for individual identification and biopsy samples for genetic analysis were collected from summer feeding areas and from the breeding grounds in the West Indies. Additional samples were collected from certain areas in other years. Results pertaining to the estimation of abundance and to genetic population structure are summarized below.

POPULATION SIZE

North Atlantic Population

The overall North Atlantic population (including the Gulf of Maine), derived from genetic tagging data collected by the YONAH project on the breeding grounds, was estimated to be 4,894 males (95% CI=3,374-7,123) and 2,804 females (95% CI=1,776-4,463) (Palsbøll *et al.* 1997). Because the sex ratio in this population is known to be even (Palsbøll *et al.* 1997), the excess of males is presumed a result of sampling bias, lower rates of migration among females, or sex-specific habitat partitioning in the West Indies; whatever the reason, the combined total is an underestimate of overall population size. Photographic mark-recapture analyses from the YONAH project provided an ocean-basin-wide estimate of 11,570 animals during 1992/1993 (CV=0.068, Stevick *et al.* 2003), and an additional genotype-based analysis yielded a similar but less precise estimate of 10,400 whales (CV=0.138, 95% CI=8,000 to 13,600) (Smith *et al.* 1999).

Gulf of Maine stock - earlier estimates

Please see Appendix IV for earlier estimates. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable and should not be used for PBR determinations.

Gulf of Maine Stock - Recent surveys and abundance estimates

An abundance estimate of 847 animals (CV=0.55) was derived from a line-transect sighting survey conducted during August 2006, which covered 10,676 km of trackline from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the Gulf of St. Lawrence (Table 1; Palka pers. comm.). Photo-identification evidence indicates a 25% exchange rate between whales on the Scotian Shelf and the catalogued Gulf of Maine population (Clapham *et al.* 2003), which suggest that a 25% correction factor should be applied to the humpback population estimate from the Scotian Shelf stratum. Because the Scotian Shelf was surveyed during 2006, the 25% correction factor was applied to only the 2006 abundance estimate. In contrast to 2006, a line-transect based abundance estimate for humpbacks on the Scotian Shelf based on the 2007 Canadian component of the Trans-North Atlantic Sighting Survey (TNASS) survey was 2,612 (CV=0.26) whales (Lawson and Gosselin 2011).

An abundance of 335 (CV=0.42) humpback whales was estimated from a line-transect survey conducted during June-August 2011 by ship and plane (Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters north of New Jersey and shallower than the 100-m depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ. Both sighting platforms used a two-simultaneous-team data collection procedure, which allows estimation of abundance corrected for perception bias (Laake and Borchers, 2004). Estimation of abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). This estimate did not include the portion of the Scotian Shelf that is known to be part of the range used by Gulf of Maine humpback whales. These various line-transect surveys lack consistency in geographic coverage, and because of the mobility of humpback whales, pooling stratum estimates across years to produce a single estimate is not advisable. However, similar to an estimate that appeared in Clapham *et al.* (2003), J. Robbins (Provincetown Center for Coastal Studies, Pers comm.) used photo-id evidence of presence (see Robbins 2009, 2010, 2011 for data description) to calculate the minimum number alive of catalogued individuals seen during the 2008 feeding season within the Gulf of Maine, or seen both before and after 2008, plus whales seen for the first time

as non-calves in 2009. That procedure placed the minimum number alive in 2008 at 823 animals.

Minimum Population Estimate

For statistically-based estimates, the minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The most recent line-transect survey, which did not include the Scotian Shelf portion of the stock, produced an estimate of abundance for Gulf of Maine humpback whales of 331 animals (CV=0.48) with a resultant minimum population estimate for this stock of 228 animals. The line-transect based Nmin is unrealistic because at least 500 uniquely identifiable individual whales from the GOM stock were seen during the calendar year of that survey and the actual population would have been larger because re-sighting rates of GOM humpbacks have historically been <1 (Robbins 2007). Using the minimum count from at least 2 years prior to the year of a stock assessment report allows time to resight whales known to be alive prior to and after the focal year. Thus, the minimum population estimate is set to the 2008 mark-recapture based count of 823.

Table 1. Summary of abundance estimates for Gulf of Maine humpback whales with month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV). Note that the second row represents the results from an analysis of resights of individually identified animals.

Month/Year	Type	N_{best}	CV
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	847	0.55
Jun-Oct 2008	Gulf of Maine and Bay of Fundy	823	0
Jun-Aug 2011	Virginia to lower Bay of Fundy	335	0.42

Current Population Trend

As detailed below, the most recent available data suggest that the Gulf of Maine humpback whale stock is characterized by a positive trend in size. This is consistent with an estimated average trend of 3.1% (SE=0.005) in the North Atlantic population overall for the period 1979-1993 (Stevick *et al.* 2003), although there are no feeding-area-specific estimates.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Zerbini *et al.* (2010) reviewed various estimates of maximum productivity rates for humpback whale populations, and, based on simulation studies, they proposed that 11.8% be considered as the maximum rate at which the species could grow. Barlow and Clapham (1997), applying an interbirth interval model to photographic mark-recapture data, estimated the population growth rate of the Gulf of Maine humpback whale stock at 6.5% (CV=0.012). Maximum net productivity is unknown for this population, although a theoretical maximum for any humpback population can be calculated using known values for biological parameters (Brandão *et al.* 2000; Clapham *et al.* 2001). For the Gulf of Maine stock, data supplied by Barlow and Clapham (1997) and Clapham *et al.* (1995) give values of 0.96 for survival rate, 6 years as mean age at first parturition, 0.5 as the proportion of females, and 0.42 for annual pregnancy rate. From this, a maximum population growth rate of 0.072 is obtained according to the method described by Brandão *et al.* (2000). This suggests that the observed rate of 6.5% (Barlow and Clapham 1997) is close to the maximum for this stock.

Clapham *et al.* (2003) updated the Barlow and Clapham (1997) analysis using data from the period 1992 to 2000. The population growth estimate was either 0% (for a calf survival rate of 0.51) or 4.0% (for a calf survival rate of 0.875). Although confidence limits were not provided (because maturation parameters could not be estimated), both estimates of population growth rate are outside the 95% confidence intervals of the previous estimate of 6.5% for the period 1979 to 1991 (Barlow and Clapham 1997). More recent work by Robbins (2007) places apparent survival of calves at 0.664 (95% CI: 0.517-0.784), a value intermediate between those used by Barlow and Clapham (1997).

Despite the uncertainty accompanying the more recent estimates of observed population growth rate for the Gulf of Maine stock, the maximum net productivity rate was assumed to be 6.5% calculated by Barlow and

Clapham (1997) because it represents an observation greater than the default of 0.04 for cetaceans (Barlow *et al.* 1995) but is conservative in that it is well below the results of Zerbini *et al.* (2010).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for the Gulf of Maine stock is 823 whales. The maximum productivity rate is 0.065. The recovery factor, which accounts for endangered, depleted, or threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.10 because this stock is listed as an endangered species under the Endangered Species Act. PBR for the Gulf of Maine humpback whale stock is 2.7 whales.

ANNUAL HUMAN-CAUSED SERIOUS INJURY AND MORTALITY

For the period 2008 through 2012, the minimum annual rate of human-caused mortality and serious injury to the Gulf of Maine humpback whale stock averaged 10.3 animals per year. This value includes incidental fishery interaction records, 8.90; and records of vessel collisions, 1.4 (Table 2; Henry *et al.* 2014, Cole and Henry 2015).

In contrast to stock assessment reports before 2007, these averages include humpback mortalities and serious injuries that occurred in the southeastern and mid-Atlantic states that could not be confirmed as involving members of the Gulf of Maine stock. In past reports, only events involving whales confirmed to be members of the Gulf of Maine stock were counted against the PBR. Starting in the 2007 report, we assumed whales were from the Gulf of Maine unless they were identified as members of another stock. At the time of this writing, no whale was identified as a member of another stock. These determinations may change with the availability of new information. Canadian records from the southern side of Nova Scotia were incorporated into the mortality and serious injury rates, to reflect the effective range of this stock as described above. For the purposes of this report, discussion is primarily limited to those records considered to be confirmed human-caused mortalities or serious injuries.

To better assess human impacts (both vessel collision and gear entanglement) there needs to be greater emphasis on the timely recovery of carcasses and complete necropsies. The literature and review of records described here suggest that there are significant human impacts beyond those recorded in the data assessed for serious injury and mortality. For example, a study of entanglement-related scarring on the caudal peduncle of 134 individual humpback whales in the Gulf of Maine suggested that between 48% and 65% had experienced entanglements (Robbins and Mattila 2001). Decomposed and/or unexamined animals (e.g., carcasses reported but not retrieved or no necropsy performed) represent 'lost data', some of which may relate to human impacts.

Background

As with right whales, human impacts (vessel collisions and entanglements) may be slowing recovery of the humpback whale population. Van der Hoop *et al.* (2012) reviewed 1762 mortalities and serious injuries recorded for 8 species of large whales in the Northwest Atlantic for the 40 years 1970–2009. Of 473 records of humpback whales, cause of death could be attributed for 203. Of the 203, 116 (57%) mortalities were caused by entanglements in fishing gear, and 31 (15%) were attributable to vessel strikes.

Robbins and Mattila (2001) reported that males were more likely to be entangled than females. Annually updated inferences made from scar prevalence and multistate models of GOM humpback whales that (1) younger animals are more likely to become entangled than adults, (2) juvenile scarring rates may be trending up, (3) maybe less than 10% of humpback entanglements are ever reported, and (4) 3 % of the population maybe dying annually as the result of entanglements (Robbins 2009, 2010, 2011, 2012). Humpback whale entanglements also occur in relatively high numbers in Canadian waters. Reports of interactions with fixed fishing gear set for groundfish around Newfoundland averaged 365 annually from 1979 to 1987 (range 174-813). An average of 50 humpback whale entanglements (range 26-66) was reported annually between 1979 and 1988, and 12 of 66 humpback whales entangled in 1988 died (Lien *et al.* 1988). A total of 965 humpbacks was reported entangled in fishing gear in Newfoundland and Labrador from 1979 to 2008 (Benjamins *et al.* 2012). Volgenau *et al.* (1995) reported that in Newfoundland and Labrador, cod traps caused the most entanglements and entanglement mortalities (21%) of humpbacks between 1979 and 1992. They also reported that gillnets were the primary cause of entanglements and entanglement mortalities (20%) of humpbacks in the Gulf of Maine between 1975 and 1990. In more recent times, following the collapse of the cod fishery, groundfish gillnets for other fish species and crab pot lines have been the most common sources of humpback entanglement in Newfoundland. Since the crab pot fishery is primarily an offshore activity on the Grand Banks, these entanglements are hard to respond to and are likely underreported. One humpback whale was reported released alive (status unknown) from a herring weir off Grand Manan in 2009 (H. Koopman, UNC Wilmington, pers. comm.).

Wiley *et al.* (1995) reported that serious injuries attributable to ship strikes are more common and probably more serious than those from entanglements, but this claim is not supported by more recent analysis (van der Hoop *et al*. 2012). Furthermore, in the NMFS records for 2008 through 2012, there are 7 reports of serious injuries and mortalities as a result of collision with a vessel and 41 serious injuries and mortalities attributed to entanglement. Because it has never been shown that serious injuries and mortalities related to ships or to fisheries interactions are equally detectable, it is unclear as to which human source of mortality is more prevalent. A major aspect of vessel collision that will be cryptic as a serious injury is blunt trauma, where when lethal it is usually undetectable from an external exam (Moore *et al.* 2013). No whale involved in the recorded vessel collisions had been identified as a member of a stock other than the Gulf of Maine stock at the time of this writing (Cole and Henry 2015; Henry *et al.* 2014).

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*." All injury determinations for this stock assessment were performed under the new guidelines. The new process involves proration of serious injury determinations where there is uncertainty regarding the severity or cause.

Fishery-Related Serious Injuries and Mortalities

A description of fisheries is provided in Appendix III. Two mortalities were observed in the pelagic drift gillnet fishery, one in 1993 and the other in 1995. In winter 1993, a juvenile humpback was observed entangled and dead in a pelagic drift gillnet along the 200-m isobath northeast of Cape Hatteras. In early summer 1995, a humpback was entangled and found dead in a pelagic drift gillnet on southwestern Georges Bank. Additional reports of mortality and serious injury, as well as description of total human impacts, are contained in records maintained by NMFS. A number of these records (11 entanglements involving lobster pot/trap gear) from the 1990–1994 period were the basis used to reclassify the lobster fishery (62 FR 33, Jan. 2, 1997). Large whale entanglements are rarely observed during fisheries sampling operations. However, during 2008, 3 humpback whales were observed as incidental bycatch: 2 in gillnet gear (1 no serious injury; 1 undetermined) and 1 in a purse seine (released alive) , in 2011 a humpback was caught on an observed gillnet trip (disentangled and released free of gear; Cole and Henry 2015), and in 2012 there was an observed interaction with a humpback whale in mid-Atlantic gillnet gear (non-serious injury). A recent review (Cassoff *et al*. 2011) describes in detail the types of injuries that baleen whales, including humpbacks, suffer as a result of entanglement in fishing gear.

For this report, the records of dead, injured, and/or entangled humpbacks (found either stranded or at sea) for the period 2008 through 2012 were reviewed. With no evidence to the contrary, all events were assumed to involve members of the Gulf of Maine stock. While these records are not statistically quantifiable in the same way as observer fishery records, they provide some indication of the minimum frequency of entanglements. Specifically to this stock, if the calculations of Robbins (2011 and 2012) are reasonable then the 3% mortality due to entanglement that they calculate equates to a minimum average rate of 25, which is nearly 10 times PBR.

Table 2. Confirmed human-caused mortality and serious injury records of Humpback Whales (*Megaptera novaeangliae*) where the cause was assigned as either an entanglement (EN) or a vessel strike (VS): 2008–2012 [a]

Date[b]	Injury Determination	ID	Location[b]	Assigned Cause	Value against PBR[c]	Country[d]	Gear Type[e]	Description
1/6/2008	Serious Injury	-	off Cape Lookout, NC	EN	1	XU	NR	Line cutting into right pectoral flipper in several places. Moderate cyamid load and appears emaciated.
1/10/08	Prorated Injury	-	off Wilmington,	EN	0.75	US	H/MF	Entanglement configuration

			NC					unknown.
5/7/2008	Prorated Injury	Brillo	off Provincetown, MA	EN	0.75	XU	NR	Extent of entanglement unclear--previously embedded wrap on body appears to have shifted aft. Thin and has some cyamids, however moving around actively in a feeding group during last sighting.
5/30/2008	Mortality	-	Georges Bank	EN	1	XU	NR	Constricting body and head wrap. Open wound on right pectoral.
6/9/2008	Mortality	-	Georges Bank	EN	1	US	PT	Constricting body wrap.
7/8/2008	Serious Injury	Estuary	off Wellfleet, MA	EN	1	US	GU	Anchored. Cuts were made, but no gear was removed. Animal was emaciated and had moderate cyamid coverage. Deep wounds in fluke blades from gear. Hunched over position maintained after cuts were made to the gear.
7/2008	Prorated Injury	-	off Chatham, MA	EN	0.75	US	GN	Left pectoral pinned. Partial disentanglement. Remaining configuration unknown.
7/13/2008	Prorated Injury	-	off Monomoy Point, MA	EN	0.75	XU	NR	Entanglement configuration unknown.
8/13/2008	Serious Injury	-	off Montauk, NY	EN	1	XU	NR	Wraps around tail, polyball attached, but full entanglement configuration unknown. Partial disentanglement. Whale

								emaciated, lethargic and with heavy cyamid load.
8/21/2008	Serious Injury	-	off Chatham, MA	EN	1	XU	NR	No wraps or weighted gear. Sloughing skin & extensive scuffing indicate health decline. Therefore SI.
9/20/2008	Prorated Injury	Cranny	off Brier Island, Nova Scotia	EN	0.75	XC	NR	Full extent of entanglement unclear--at least 4 non-constricting body wraps around midsection and peduncle.
11/4/2008	Mortality	-	Assateague, MD	VS	1	US	-	Cranial fractures w/ associated hemorrhaging.
11/8/2008	Prorated Injury	-	Nova Scotia	EN	0.75	XC	NR	Disentangled by fishermen. No photos or description of entanglement. Unknown if all gear removed.
2/8/2009	Mortality	-	Cape Fear, NC	EN	1	XU	NP	Evidence of entanglement at mouthline, peduncle, & pectoral w/ associated hemorrhaging. Emaciated.
2/16/2009	Mortality	-	Nags Head, NC	EN	1	XU	NP	Evidence of entanglement involving anchoring or heavily weighted gear w/ associated hemorrhaging.
2/25/2009	Serious Injury	-	off Sandy Hook, NJ	EN	1	US	NR	Anchored. Disentangled but SI due to deformed body position that did not substantially improve after disentanglement.
4/9/2009	Prorated	-	off	EN	0.75	XU	NR	Full

	Injury		Provincetown, MA					configuration unknown.
4/11/2009	Prorated Injury	-	off Gloucester, MA	EN	0.75	XU	NR	Configuration unclear--unknown if body wrap is loose or constricting. No photos.
5/23/2009	Prorated Injury	-	off Provincetown, MA	EN	0.75	XU	NR	Entanglement configuration unknown.
6/9/2009	Serious Injury	Inukshuk	off Provincetown, MA	EN	1	US	NR	Constricting body wrap.
9/12/2009	Prorated Injury	2008 Calf of Touchdown	off White Island, Nova Scotia	EN	0.75	CN	WE	Swam out of entrapment in weir, but carrying some gear in an unknown configuration.
9/16/2009	Prorated Injury	-	off Halifax, Nova Scotia	EN	0.75	XC	NR	Entanglement configuration unknown.
10/20/2009	Serious Injury	-	off Halifax, Nova Scotia	EN	1	CN	GN	Disentangled, but in poor condition: emaciated, heavy cyamid load, lethargic.
11/20/2009	Prorated Injury	-	off Goat Island, NC	EN	0.75	XU	NR	Entanglement configuration unknown.
3/7/2010	Serious Injury	-	off Ponte Vedra Beach, FL	EN	1	XU	NR	Constricting body & flipper wraps. May have shed some or all of gear, but severe health decline--emaciated, heavy cyamid load.
3/13/2010	Mortality	-	Ocean City Inlet, MD	VS	1	US	-	Skull fractures w/ associated hemorrhaging
5/5/2010	Serious Injury	-	off Northampton, VA	EN	1	XU	NR	Wrap around fluke blades near insertion and trailing gear. Young/small whale and gear likely to become constricting.

5/8/2010	Mortality	-	off Point Judith, RI	EN	1	US	GN	Evidence of constricting gear w/ associated hemorrhaging. Fluid filled lungs.
5/15/2010	Mortality	-	Hatteras Inlet, NC	EN	1	XU	NP	Live stranding - euthanized. Necrotic infected wounds at base of flukes and chronic abrasions on head.
5/28/2010	Mortality	-	off Martha's Vineyard, MA	EN	1	XU	GU	Evidence of entanglement w/ associated bruising & edema.
6/10/2010	Mortality	-	Jones Beach State Park, NY	VS	1	US	-	Extensive hemorrhage & edema on right dorsal lateral surface.
7/4/2010	Mortality	-	off Ocean City Inlet, MD	VS	1	US	-	Extensive hemorrhage & edema to left lateral area.
7/26/2010	Prorated Injury	-	off Chatham, MA	EN	0.75	XU	NR	Configuration and extent of entanglement unknown.
8/13/2010	Serious Injury	-	off Orleans, MA	EN	1	US	PT	Partial disentanglement, but remaining head wrap likely to become constricting.
8/20/2010	Serious Injury	Chili	off Provincetown, MA	EN	1	XU	NR	Embedded wraps, skinny, moderate cyamids indicating health decline.
9/10/2010	Prorated Injury	-	off White Head Island, Nova Scotia	EN	0.75	XC	NR	Configuration of entanglement unknown.
10/2/2010	Prorated Injury	-	off Provincetown, MA	EN	0.75	XU	NR	Entanglement configuration unknown. Unable to confirm if a resight of 8/20/10 event.
11/27/2010	Mortality	-	off Grand	EN	1	XC	NR	Evidence of

			Manan Island, New Brunswick					constricting wraps on fluke, peduncle, & pectoral
12/23/2010	Serious Injury	-	off Port Everglades Inlet, FL	EN	1	XU	NP	Evidence of recent constricting entanglement and severe health decline.
1/7/2011	Serious Injury	-	off Oregon Inlet, NC	EN	1	US	NR	Extensive entanglement with netting covering majority of body including head and blowholes. Anchored.
2/1/2011	Serious Injury	EKG	off Bar Harbor, ME	EN	1	US	NR	Anchored. Cuts were made to gear but whale still anchored.
3/7/2011	Mortality	-	Thorofare Bay, NC	VS	1	US	-	Live stranded with 8 deep lacerations across back. Euthanized.
4/11/2011	Prorated Injury	-	off Rockport, MA	EN	0.75	XU	NR	Entanglement configuration unknown.
5/5/2011	Mortality	-	Little Compton, RI	VS	1	US	-	Hemorrhaging at left jaw associated w/ blunt trauma.
5/27/2011	Mortality	-	Island Beach State Park, NJ	VS	1	US	-	5 broken vertebral processes along left side w/ associated hemorrhaging.
5/30/2011	Prorated Injury	-	off Orleans, MA	EN	0.75	XU	NR	Entanglement configuration unknown.
7/2/2011	Serious Injury	-	off Provincetown, MA	EN	1	XU	NP	Young whale. Missing flukes attributed to chronic entanglement. Laceration due to VS appears minor. Significant health decline, emaciated.

7/9/2011	Prorated Injury	-	off Monomoy Island, MA	EN	0.75	XU	NR	Entanglement configuration unknown.
7/10/2011	Prorated Injury	-	off Monomoy Island, MA	EN	0.75	XU	NR	Report was of two entangled whales but could not confirm that both were entangled. Configuration of entanglement unknown.
7/21/2011	Prorated Injury	-	off Oregon Inlet, NC	EN	0.75	XU	NR	Entanglement configuration unknown.
10/10/2011	Serious Injury	Clutter	off Grand Manan Island, New Brunswick	EN	1	XC	NR	Constricting wraps embedded at fluke insertion.
4/29/2012	Serious Injury	-	off Chatham, MA	EN	1	US	NR	SI based on description of body position which indicates constriction
5/27/2012	Prorated Injury	-	off Louisberg, Nova Scotia	EN	0.75	CN	PT	Partial disentanglement. Original and final configurations unclear, likely not life-threatening, but description is insufficient
7/29/2012	Serious Injury	-	off Gloucester, MA	EN	1	XU	NR	Calf with line cutting into peduncle
8/4/2012	Serious Injury	Aphid	off Provincetown, MA	EN	1	XU	NR	Line exiting both sides of mouth, under flippers, twisting together aft of the dorsal fin and trailing 75 ft past flukes; no wraps. Health decline – thin with graying skin.
8/21/12	Prorated Injury	2011 Calf of Wizard	off Provincetown, MA	EN	0.75	XU	NR	Calf with monofilament trailing over left fluke. Point of attachment unknown. No

								resights.
8/24/2012	Serious Injury	Forceps	off Provincetown, MA	EN	1	US	NR	Closed, possibly weighted, bridle w/ large tangle of line just above left eye. SI due to odd behavior and apparent difficulty staying at the surface.
Five-year averages		Shipstrike (US/CN/XU/XC)			1.40 (1.40/ 0.00/ 0.00/ 0.00)			
		Entanglement (US/CN/XU/XC)			8.90 (2.3/ 0.50/5.1/ 1.00)			
a. For more details on events please see Cole and Henry 2015 and Henry *et al.* 2014.								
b. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.								
c. Mortality events are counted as 1 against PBR. Serious injury events have been evaluated using NMFS guidelines (NOAA 2012)								
d. CN=Canada, US=United States, XC=Unassigned 1st sight in CN, XU=Unassigned 1st sight in US								
e. H=hook, GN=gillnet, GU=gear unidentifiable, MF=monofilament, NP=none present, NR=none recovered/received, PT=pot/trap, WE=weir								

Other Mortality

Between November 1987 and January 1988, at least 14 humpback whales died after consuming Atlantic mackerel containing a dinoflagellate saxitoxin (Geraci *et al.* 1989). The whales subsequently stranded or were recovered in the vicinity of Cape Cod Bay and Nantucket Sound, and it is highly likely that other unrecorded mortalities occurred during this event. During the first six months of 1990, seven dead juvenile (7.6 to 9.1 m long) humpback whales stranded between North Carolina and New Jersey. The significance of these strandings is unknown.

Between July and September 2003, an Unusual Mortality Event (UME) that included 16 humpback whales was invoked in offshore waters of coastal New England and the Gulf of Maine . Biotoxin analyses of samples taken from some of these whales found saxitoxin at very low/questionable levels and domoic acid at low levels, but neither were adequately documented and therefore no definitive conclusions could be drawn. Seven humpback whales were considered part of a large whale UME in New England in 2005. Twenty-one dead humpback whales found between 10 July and 31 December 2006 triggered a humpback whale UME declaration. Causes of these UME events have not been determined.

STATUS OF STOCK

NMFS has concluded a global humpback whale status review, the report of which is being finalized. NMFS will include the relevant results of this review in the SARs when they are available. The status of the North Atlantic humpback whale population was the topic of an International Whaling Commission Comprehensive Assessment in June 2001, and again in May 2002. These meetings conducted a detailed review of all aspects of the population and made recommendations for further research (IWC 2002). Although recent estimates of abundance indicate a stable or growing humpback whale population, the stock may be below OSP in the U.S. Atlantic EEZ. A Recovery Plan was published and is in effect (NMFS 1991). There are insufficient data to reliably determine current population trends for humpback whales in the North Atlantic overall. The average annual rate of population increase for this stock was estimated at 3.1% (SE=0.005, Stevick *et al.* 2003). An analysis of demographic parameters for the Gulf of Maine (Clapham *et al.* 2003) suggested a lower rate of increase than the 6.5% reported by Barlow and Clapham (1997), but results may have been confounded by distribution shifts. The total level of U.S. fishery-caused mortality and serious injury is unknown, but reported levels are more than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant or approaching a zero mortality and serious injury rate. This is a strategic stock because the average annual human-related mortality and serious injury exceeds PBR, and because the North Atlantic

humpback whale is an endangered species.

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FIN WHALE (*Balaenoptera physalus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The Scientific Committee of the International Whaling Commission (IWC) has proposed stock boundaries for North Atlantic fin whales. Fin whales off the eastern United States, Nova Scotia and the southeastern coast of Newfoundland are believed to constitute a single stock under the present IWC scheme (Donovan 1991). Although the stock identity of North Atlantic fin whales has received much recent attention from the IWC, the current stock boundaries remain uncertain. The existence of a subpopulation structure was suggested by local depletions that resulted from commercial overharvesting (Mizroch *et al.* 1984).

A genetic study conducted by Bérubé *et al.* (1998) using both mitochondrial and nuclear DNA provided strong support for an earlier population model proposed by Kellogg (1929) and others. This postulates the existence of several subpopulations of fin whales in the North Atlantic and Mediterranean with limited gene flow among them. Bérubé *et al.* (1998) also proposed that the North Atlantic population showed recent divergence due to climatic changes (i.e., postglacial expansion), as well as substructuring over even relatively short distances. The genetic data are consistent with the idea that different subpopulations use the same feeding ground, a hypothesis that was also originally proposed by Kellogg (1929). More recent genetic studies have called into question conclusions drawn from early allozyme work (Olsen *et al.* 2014) and North Atlantic fin whales show a very low rate of genetic diversity throughout their range excluding the Mediteranean (Pampoulie *et al*. 2008).

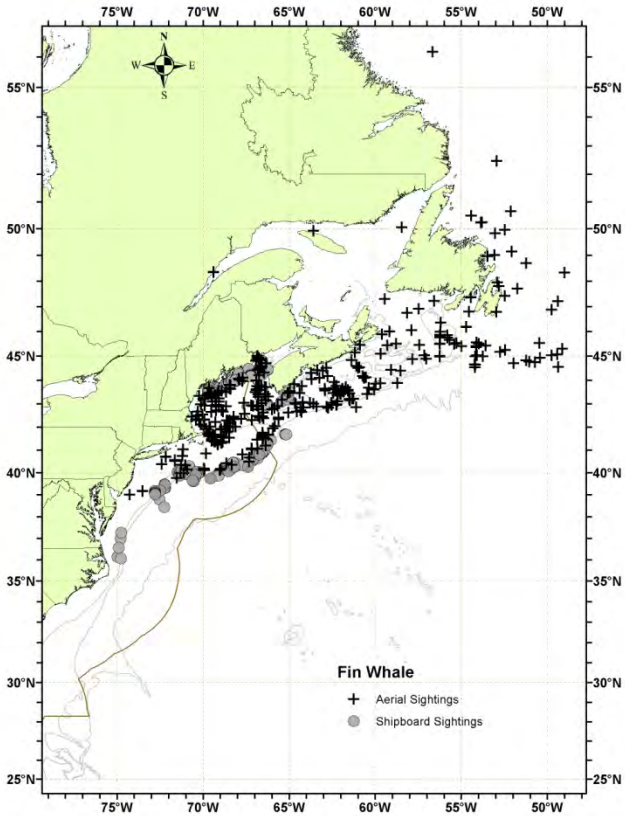

Figure 1. *Distribution of fin whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008, 2010 and 2011 and DFO's 2007 TNASS survey. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

Fin whales are common in waters of the U. S. Atlantic Exclusive Economic Zone (EEZ), principally from Cape Hatteras northward (Figure 1). Fin whales accounted for 46% of the large whales and 24% of all cetaceans sighted over the continental shelf during aerial surveys (CETAP 1982) between Cape Hatteras and Nova Scotia during 1978–82. While much remains unknown, the magnitude of the ecological role of the fin whale is impressive. In this region fin whales are the dominant large cetacean species during all seasons, having the largest standing stock, the largest food requirements, and therefore the largest influence on ecosystem processes of any cetacean species (Hain *et al.* 1992; Kenney *et al.* 1997).

New England waters represent a major feeding ground for fin whales. There is evidence of site fidelity by females, and perhaps some segregation by sexual, maturational or reproductive class in the feeding area (Agler *et al.* 1993). Seipt *et al.* (1990) reported that 49% of fin whales sighted on the Massachusetts Bay area feeding grounds were resighted within the same year, and 45% were resighted in multiple years. The authors suggested that fin whales on these grounds exhibited patterns of seasonal occurrence and annual return that in some respects were similar to those shown for humpback whales. This was reinforced by Clapham and Seipt (1991), who showed maternally-directed site fidelity for fin whales in the Gulf of Maine.

Hain *et al.* (1992), based on an analysis of neonate stranding data, suggested that calving takes place during October to January in latitudes of the U.S. mid-Atlantic region; however, it is unknown where calving, mating and wintering occurs for most of the population. Results from the Navy's SOSUS program (Clark 1995) indicate a substantial deep-ocean distribution of fin whales. It is likely that fin whales occurring in the U.S. Atlantic EEZ undergo migrations into Canadian waters, open-ocean areas, and perhaps even subtropical or tropical regions. However, the popular notion that entire fin whale populations make distinct annual migrations like some other mysticetes has questionable support in the data; in the North Pacific, year-round monitoring of fin whale calls found no evidence for large-scale migratory movements (Watkins *et al.* 2000).

POPULATION SIZE

The best abundance estimate available for the western North Atlantic fin whale stock is 1,618 (CV=0.33). This is the estimate derived from the 2011 NOAA shipboard surveys and is considered best because it represents the most current data in spite of the survey not including all of the stock's range.

Earlier abundance estimates

Please see Appendix IV for earlier abundance estimates. As recommended in the GAMMS II Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable and should not be used for PBR determinations.

Recent surveys and abundance estimates

An abundance of 2,269 (CV=0.37) fin whales was estimated from an aerial survey conducted in August 2006, which covered 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; D. Palka, NEFSC, Woods Hole, MA, pers. comm.). The value of *g(0)* used for this estimation was derived from the pooled 2002, 2004 and 2006 aerial survey data.

An abundance estimate of 3,522 (CV=0.27; J. Lawson, DFO, pers. comm.) fin whales was generated from the TNASS in July–August 2007. This aerial survey covered the area from northern Labrador to the Scotian Shelf, providing full coverage of the Atlantic Canadian coast (Lawson and Gosselin 2009). The abundance estimates from this survey have been corrected for perception and availability bias, when possible. In general this involved correcting for perception bias using mark-recapture distance sampling, and correcting for availability bias using dive/surface times, as reported in the literature, and the Laake (1997) analysis method (Lawson and Gosselin 2011).

An abundance estimate of 1,595 (CV=0.33) fin whales was generated from a shipboard and aerial survey conducted during June–August 2011 (Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters north of New Jersey from the coastline to the 100-m depth contour, through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in waters offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the multiple covariate distance sampling (MCDS) option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). The abundance estimates of fin whales include a percentage of the estimate of animals identified as fin/sei whales (the two species being sometimes hard to distinguish). The percentage used is the ratio of positively identified fin whales to the total number of positively identified fin whales and positively identified sei whales; the CV of the abundance estimate includes the variance of the estimated fraction.

An abundance estimate of 23 (CV=0.87) fin whales was generated from a shipboard survey conducted concurrently (June–August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25× bigeye binoculars. A total of 4,445 km of tracklines was surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Table 1. Summary of recent abundance estimates for western North Atlantic fin whales with month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	2,269	0.37
July-Aug 2007	N. Labrador to Scotian Shelf	3,522	0.27
Jun-Aug 2011	Central Virginia to lower Bay of Fundy	1,595	0.33
Jun-Aug 2011	Central Florida to Central Virginia	23	0.76
Jun-Aug 2011	Central Florida to lower Bay of Fundy (COMBINED)	1,618	0.33

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for fin whales is 1,618 (CV=0.33). The minimum population estimate for the western North Atlantic fin whale is 1,234.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. Based on photographically identified fin whales, Agler *et al.* (1993) estimated that the gross annual reproduction rate was 8%, with a mean calving interval of 2.7 years.

For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 1,234. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, or threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.10 because the fin whale is listed as endangered under the Endangered Species Act (ESA). PBR for the western North Atlantic fin whale is 2.5.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

For the period 2008 through 2012, the minimum annual rate of human-caused mortality and serious injury to fin whales was 3.35 per year. This value includes incidental fishery interaction records, 1.55; and records of vessel collisions, 1.8 (Table 2; Cole and Henry 2015). Annual rates calculated from detected mortalities should not be considered an unbiased representation of human-caused mortality, but they represent a lower bound. Detections are haphazard and not the result of a designed sampling scheme. As such they represent a minimum estimate of human-caused mortality which is almost certainly biased low.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious

injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*." All injury determinations for this stock assessment were performed under the new guidelines. The new process involves proration of serious injury determinations where there is uncertainty regarding the severity or cause.

Fishery-Related Serious Injury and Mortality

No confirmed fishery-related mortalities or serious injuries of fin whales have been reported in the NMFS Sea Sampling bycatch database. A review of the records of stranded, floating or injured fin whales for the period 2008 through 2012 on file at NMFS found 3 records with substantial evidence of fishery interactions causing mortality (Henry *et al*. 2014). Serious injury determination of non-fatal fishery interaction records yielded a value of 4.75 (Cole and Henry 2015). The resultant estimated minimum annual rate of serious injury and mortality from fishery interactions for this fin whale stock is 1.55. These records are not statistically quantifiable in the same way as the observer fishery records, and they almost surely undercount entanglements for the stock.

Table 2. Confirmed human-caused serious injury and mortality records of Fin Whales (*Balaenoptera physalus*) where the cause was assigned as either an entanglement (EN) or a vessel strike (VS): 2008-2012[a]

Date[b]	Injury Determination	ID	Location[b]	Assigned Cause	Value against PBR[c]	Country[d]	Gear Type[e]	Description
7/2/2008	Mortality	-	off Barnegat Inlet, NJ	VS	1	US	-	Vertebral fractures w/ associated hemorrhaging. Hemorrhaging around ball joint of right pectoral
4/27/2009	Prorated Injury	-	off Portsmouth, NH	EN	0.75	XU	NR	Entanglement configuration unknown.
9/9/2009	Prorated Injury	-	off Campobello Island, New Brunswick	EN	0.75	XC	NR	Partial disentanglement, but final entanglement configuration unknown.
10/1/2009	Mortality	-	off Jersey City, NJ	VS	1	US	-	Fresh carcass w/ broken pectoral, hematomas, & abrasions.
10/9/2009	Prorated Injury	-	off Long Island, Nova Scotia	EN	0.75	XC	GU	Configuration unknown. Cannot confirm gear free. Indication of poor health, but incomplete description and no photos.
3/18/2010	Mortality	-	South Delaware Bay Beach, DE	VS	1	US	-	Fractured skull w/ associated hemorrhaging. Abrasion mid-dorsal consistent

								w/ being folded over the bow of a ship.
9/3/2010	Mortality	-	Cape Henlopen State Park, DE	VS	1	US	-	Large laceration & vertebral fractures w/ associated hemorrhaging.
1/1/2011	Mortality	-	off Portland, ME	EN	1	XU	NP	Fresh carcass w/ evidence of constricting gear.
6/5/2011	Mortality	-	off Long Branch, NJ	VS	1	US	-	Extensive hemorrhage & soft tissue damage to the dorsal & right lateral thoracic region.
7/2/2011	Serious Injury	F100	Gulf of St. Lawrence	EN	1	CN	PT	Deep lacerations at peduncle. Unconfirmed if gear free.
7/24/2011	Mortality	-	Cheticamp, Nova Scotia	EN	1	CN	NP	Fresh carcass w/ evidence of extensive entanglement.
9/21/2011	Mortality	-	off Atlantic City, NJ	EN	1	US	NP	Fresh carcass w/ evidence of extensive entanglement.
1/23/2012	Mortality	-	Ocean City, NJ	VS	1	US	-	Hemorrhaging along right, midlateral surface.
2/19/2012	Mortality	-	Norfolk, VA	VS	1	US	-	Deep laceration on head. Skeletal fractures of rostrum and vertebrae. Extensive hemorrhaging.
7/16/2012	Prorated Injury	-	off Portland, ME	EN	0.75	XU	NR	Full configuration unknown.
7/30/2012	Prorated Injury	0631	off Portsmouth, NH	EN	0.75	XU	NR	Full configuration unknown.
8/10/2012	Mortality	-	Hampton Bays, NY	VS	1	US	-	Extensive bruising along right lateral and ventral aspects.
10/7/2012	Mortality	-	Boston Harbor, MA	VS	1	US	-	Deep mid-line impression with associated hemorrhaging consistent with being folded

								across bow of ship.
Five-year averages		Shipstrike (US/CN/XU/XC)			1.80 (1.80/ 0.00/ 0.00/ 0.00)			
		Entanglement (US/CN/XU/XC)			1.55 (0.20/ 0.40/ 0.65/ 0.30)			
a. For more details on events please see Cole and Henry 2015 and Henry *et al.* 2014.								
b. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.								
c. Mortality events are counted as 1 against PBR. Serious injury events have been evaluated using NMFS guidelines (NOAA 2012)								
d. CN=Canada, US=United States, XC=Unassigned 1st sight in CN, XU=Unassigned 1st sight in US								
e. H=hook, GN=gillnet, GU=gear unidentifiable, MF=monofilament, NP=none present, NR=none recovered/received, PT=pot/trap, WE=weir								

Other Mortality

After reviewing NMFS records for 2008 through 2012, nine were found that had sufficient information to confirm the cause of death as collisions with vessels (Table 2; Henry *et al.* 2014.). These records constitute an annual rate of serious injury or mortality of 1.8 fin whales from vessel collisions

STATUS OF STOCK

This is a strategic stock because the fin whale is listed as an endangered species under the ESA. The total level of human-caused mortality and serious injury is unknown. NMFS records represent coverage of only a portion of the area surveyed for the population estimate for the stock. The total U.S. fishery-related mortality and serious injury for this stock derived from the available records is likely biased low and is still not less than 10% of the calculated PBR. Therefore entanglement rates cannot be considered insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP in the U.S. Atlantic EEZ is unknown, but the species is listed as endangered under the ESA. There are insufficient data to determine the population trend for fin whales. A final recovery plan for the fin whale was published in 2010 (NMFS 2010).

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SEI WHALE (*Balaenoptera borealis borealis*): Nova Scotia Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Mitchell and Chapman (1977) reviewed the sparse evidence on stock identity of northwest Atlantic sei whales, and suggested two stocks—a Nova Scotia stock and a Labrador Sea stock. The range of the Nova Scotia stock includes the continental shelf waters of the northeastern U.S., and extends northeastward to south of Newfoundland. The Scientific Committee of the International Whaling Commission (IWC), while adopting these general boundaries, noted that the stock identity of sei whales (and indeed all North Atlantic whales) was a major research problem (Donovan 1991). In the absence of evidence to the contrary, the proposed IWC stock definition is provisionally adopted, and the "Nova Scotia stock" is used here as the management unit for this stock assessment. The IWC boundaries for this stock are from the U.S. east coast to Cape Breton, Nova Scotia, thence east to longitude 42° W.

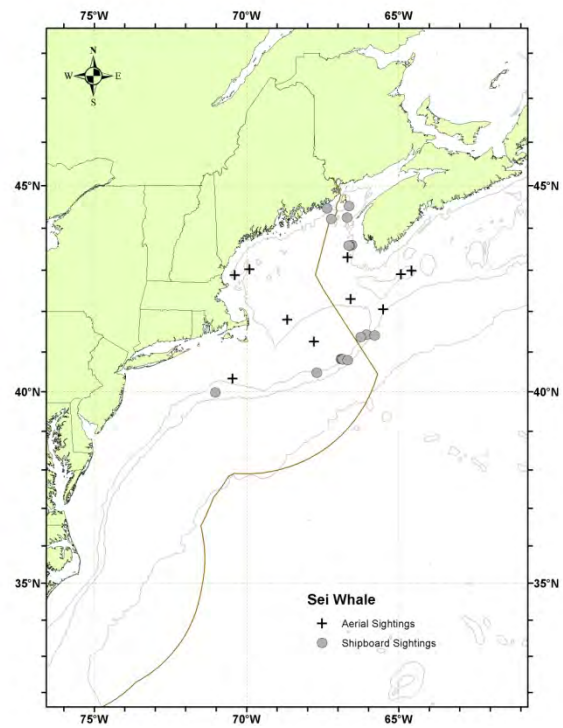

Figure 1. *Distribution of sei whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008, 2010 and 2011. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

Indications are that, at least during the feeding season, a major portion of the Nova Scotia sei whale stock is centered in northerly waters, perhaps on the Scotian Shelf (Mitchell and Chapman 1977). The southern portion of the species' range during spring and summer includes the northern portions of the U.S. Atlantic Exclusive Economic Zone (EEZ)—the Gulf of Maine and Georges Bank. Spring is the period of greatest abundance in U.S. waters, with sightings concentrated along the eastern margin of Georges Bank and into the Northeast Channel area, and along the southwestern edge of Georges Bank in the area of Hydrographer Canyon (CETAP 1982). NMFS aerial surveys from 1999 on have found concentrations of sei and right whales along the northern edge of Georges Bank in the spring. The sei whale is often found in the deeper waters characteristic of the continental shelf edge region (Hain *et al.* 1985), and NMFS aerial surveys found substantial numbers of sei whales in this region, in particular south of Nantucket, in the spring of 2001. Similarly, Mitchell (1975) reported that sei whales off Nova Scotia were often distributed closer to the 2,000-m depth contour than were fin whales.

This general offshore pattern of sei whale distribution is disrupted during episodic incursions into shallower, more inshore waters. Although known to eat fish, sei whales (like right whales) are largely planktivorous, feeding primarily on euphausiids and copepods (Flinn *et al.* 2002). A review by prey preferences by Horwood (1987) showed that in the North Atlantic sei whales seem to prefer copepods over all other prey species. In Nova Scotia sampled stomachs from captured sei whales showed a clear preference for copepods between June and October, and euphausiids were taken only in May and November (Mitchell 1975). Sei whales are reported in some years in more inshore locations, such as the Great South Channel (in 1987 and 1989) and Stellwagen Bank (in 1986) areas (R.D. Kenney, pers. comm.; Payne *et al.* 1990). An influx of sei whales into the southern Gulf of Maine occurred in the summer of 1986 (Schilling *et al.* 1993). Such episodes, often punctuated by years or even decades of absence from an area, have been reported for sei whales from various places worldwide (Jonsgård and Darling 1977).

Based on analysis of records from the Blandford, Nova Scotia, whaling station, where 825 sei whales were taken between 1965 and 1972, Mitchell (1975) described two "runs" of sei whales, in June-July and in September-October. He speculated that the sei whale population migrates from south of Cape Cod and along the coast of eastern Canada in June and July, and returns on a southward migration again in September and October; however,

such a migration remains unverified.

POPULATION SIZE

The summer 2011 abundance estimate of 357 (CV=0.52) is considered the best available for the Nova Scotia stock of sei whales. However, this estimate must be considered conservative because all of the known range of this stock was not surveyed, and because of uncertainties regarding population structure and whale movements between surveyed and unsurveyed areas.

Earlier abundance estimates

Please see appendix IV for earlier abundance estimates. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable and should not be used for PBR determinations.

Recent surveys and abundance estimates

An abundance estimate of 207 (CV=0.62) sei whales was obtained from an aerial survey conducted in August 2006, which covered 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; Palka pers. comm.). The value of *g(0)* used for this estimation was derived from the pooled 2002, 2004 and 2006 aerial survey data.

An abundance estimate of 357 (CV=0.52) sei whales was generated from a shipboard and aerial survey conducted during June–August 2011 (Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters from north of New Jersey from the coastline to the 100-m depth contour, through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in waters offshore of Virginia to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the multiple covariate distance sampling (MCDS) option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). The abundance estimates of sei whales include a percentage of the estimate of animals identified as fin/sei whales (the two species being sometimes hard to distinguish). The percentage used is the ratio of positively identified sei whales to the total of positively identified fin whales and positively identified sei whales; the CV of the abundance estimate includes the variance of the estimated fraction.

Table 1. Summary of recent abundance estimates for Nova Scotia sei whales with month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	207	0.62
Jun-Aug 2011	Central Virginia to lower Bay of Fundy	357	0.52

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by (Wade and Angliss 1997). The best estimate of abundance for the Nova Scotia stock sei whales is 357 (CV=0.52). The minimum population estimate is 236.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.*

2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 236. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.10 because the sei whale is listed as endangered under the Endangered Species Act (ESA). PBR for the Nova Scotia stock of the sei whale is 0.5.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

For the period 2008 through 2012, the minimum annual rate of human-caused mortality and serious injury to sei whales was 0.8. This value includes incidental fishery interaction records, 0.4, and records of vessel collisions, 0.4 (Table 2; Henry *et al.* 2014; Cole and Henry 2015). Annual rates calculated from detected mortalities should not be considered an unbiased estimate of human-caused mortality, but they represent a definitive lower bound. Detections are haphazard, incomplete and not the result of a designed sampling scheme. As such they represent a minimum estimate of human-caused mortality which is almost certainly biased low.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". All injury determinations for this stock assessment were performed under the new guidelines. The new process involves proration of serious injury determinations where there is uncertainty regarding the severity or cause.

Fishery-Related Serious Injury and Mortality

No confirmed fishery-related mortalities or serious injuries of sei whales have been reported in the NMFS Sea Sampling bycatch database. A review of the records of stranded, floating or injured sei whales for the period 2008 through 2012 on file at NMFS found 2 records with substantial evidence of fishery interactions causing serious injury or mortality (Table 2), which results in an annual serious injury and mortality rate of 0.4 sei whales from fishery interactions.

Table 2. Confirmed human-caused mortality records of Sei Whales (*Balaenoptera borealis*) where the cause was assigned as either an entanglement (EN) or a vessel strike (VS): 2008-2012 [a]

Date[b]	Injury Determination	ID	Location[b]	Assigned Cause	Value against PBR[c]	Country[d]	Gear Type[e]	Description
4/9/2008	Serious Injury		51 nm E of Chatham, MA	EN	1	XU	NR	Constricting gear and health decline (sloughing skin).
6/29/2008	Mortality		Slack's Cove, NB	EN	1	CN	NP	Extensive entanglement evident.

5/19/2009	Mortality		off Rehobeth Beach, DE	VS	1	US	-	Posterior portion of skull & right mandible fractured. Hemorrhaging dorsal to left Pectoral.
3/26/2011	Mortality		Virginia Beach, VA	VS	1	US	-	Jaw, scapula, rib & vertebral fractures along right side w/ associated hemorrhaging.
Five-year averages		Shipstrike (US/CN/XU/XC)			0.40 (0.40/ 0.00/ 0.00/ 0.00)			
		Entanglement (US/CN/XU/XC)			0.40 (0.00/ 0.20/ 0.20/ 0.00)			
a. For more details on events please see Henry *et al*. 2014 and Cole and Henry 2015.								
b. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.								
c. Mortality events are counted as 1 against PBR. Serious injury events have been evaluated using NMFS guidelines (NOAA 2012)								
d. CN=Canada, US=United States, XC=Unassigned 1st sight in CN, XU=Unassigned 1st sight in US								
e. H=hook, GN=gillnet, GU=gear unidentifiable, MF=monofilament, NP=none present, NR=none recovered/received, PT=pot/trap, WE=weir								

Other Mortality

For the period 2008 through 2012 files at NMFS included two records with substantial evidence of vessel collisions causing serious injury or mortality (Table 2), which results in an annual rate of serious injury and mortality of 0.4 sei whales from vessel collisions.

STATUS OF STOCK

This is a strategic stock because the average annual human-related mortality and serious injury exceeds PBR, and because the sei whale is listed as an endangered species under the ESA. A final recovery plan for the sei whale was published in 2011 (NMFS 2011). The total U.S. fishery-related mortality and serious injury for this stock derived from the available records is not less than 10% of the calculated PBR, and therefore cannot be considered insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP in the U.S. Atlantic EEZ is unknown. There are insufficient data to determine population trends for sei whales.

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MINKE WHALE (*Balaenoptera acutorostrata acutorostrata*): Canadian East Coast Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Minke whales have a cosmopolitan distribution in temperate, tropical and high-latitude waters. In the North Atlantic, there are four recognized populations—Canadian East Coast, west Greenland, central North Atlantic, and northeastern North Atlantic (Donovan 1991). These divisions were defined by examining segregation by sex and length, catch distributions, sightings, marking data and pre-existing ICES boundaries. However, there were very few data from the Canadian East Coast population. Anderwald *et al.* (2011) found no evidence for geographic structure comparing these putative populations but did, using individual genotypes and likelihood assignment methods, identify two cryptic stocks distributed across the North Atlantic. Until better information is available, minke whales off the eastern coast of the United States are considered to be part of the Canadian East Coast stock, which inhabits the area from the western half of the Davis Strait (45ºW) to the Gulf of Mexico. It is also uncertain if there are separate sub-stocks within the Canadian East Coast stock.

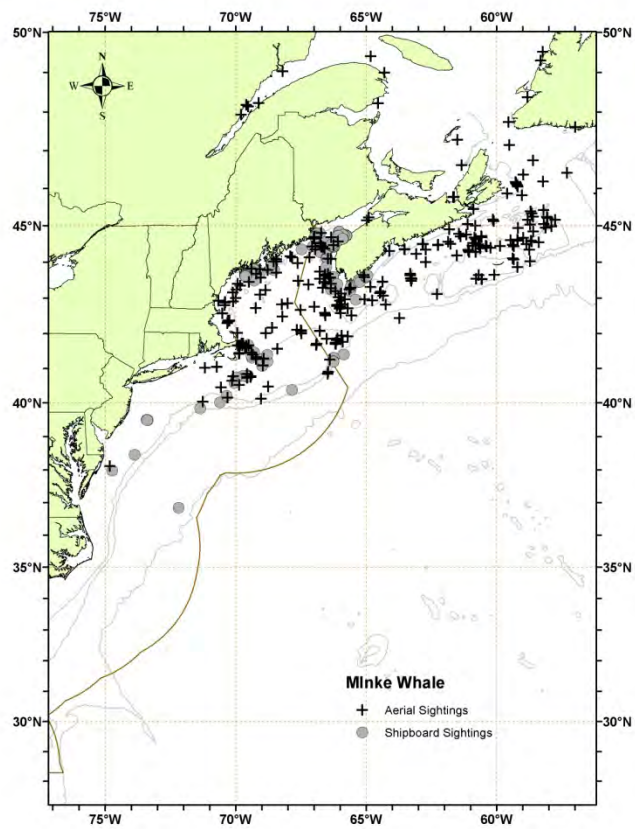

Figure 1. *Distribution of minke whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008, 2010, and 2011and DFO's 2007 TNASS survey. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

The minke whale is common and widely distributed within the U.S. Atlantic Exclusive Economic Zone (EEZ) (CETAP 1982). There appears to be a strong seasonal component to minke whale distribution. Spring to fall are times of relatively widespread and common occurrence, and when the whales are most abundant in New England waters, while during winter the species appears to be largely absent (e.g., Risch *et al.* 2013). Like most other baleen whales, minke whales generally occupy the continental shelf proper (< 100 m deep), rather than the continental shelf-edge region. Records summarized by Mitchell (1991) hint at a possible winter distribution in the West Indies, and in the mid-ocean south and east of Bermuda. As with several other cetacean species, the possibility of a deep-ocean component to the distribution of minke whales exists but remains unconfirmed.

POPULATION SIZE

Multiple estimates are available for portions of minke whale habitat (see Appendix IV for details on these surveys and estimates). The best recent abundance estimate for this stock is 20,741 (CV=0.30) minke whales. This is the estimate derived from the Canadian Trans-North Atlantic Sighting Survey (TNASS) in July-August 2007 and is considered best because, while it did not cover any U.S. waters, the survey covered more of the minke whale range than the other surveys reported here.

Earlier estimates

For earlier abundance estimates please see Appendix IV.

Recent surveys and abundance estimates

An abundance estimate of 3,312 (CV=0.74) minke whales was generated from an aerial survey conducted in August 2006, which surveyed 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; Palka pers. comm.). The value of *g(0)* used for this estimation was derived from the pooled 2002, 2004 and 2006 aerial survey data.

An abundance estimate of 20,741 (CV=0.30) minke whales was generated from the TNASS in July-August 2007. This survey covered from northern Labrador to the Scotian Shelf, providing full coverage of the Atlantic Canadian coast (Lawson and Gosselin 2009). The abundance estimates from this survey have been corrected for perception and availability bias, when possible. In general this involved correcting for perception bias using mark-recapture distance sampling, and correcting for availability bias using dive/surface times, as reported in the literature, and the Laake *et al.* (1997) analysis method (Lawson and Gosselin 2011).

An abundance estimate of 2,591 (CV=0.81) minke whales was generated from a shipboard and aerial survey conducted during June-August 2011 (Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters north of New Jersey from the coastline to the 100-m depth contour through the U.S. and Canadian Gulf of Maine, and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in waters offshore of central Virginia to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the multiple covariate distance sampling (MCDS) option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Table 1. Summary of abundance estimates for the Canadian east coast stock of minke whales (*Balaenoptera acutorostrata acutorostrata*) with month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation. (CV).

Month/Year	Area	N_{best}	CV
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	3,312	0.74
Jul-Aug 2007	N. Labrador to Scotian Shelf	20,741	0.30
Jul-Aug 2011	Central Virginia to lower Bay of Fundy	2,591	0.81

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for the Canadian east coast stock of minke whales is 20,741animals (CV=0.30). The minimum population estimate is 16,199 animals.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. Life history parameters that could be used to estimate net productivity are that females mature between 6 and 8 years of age, and pregnancy rates are approximately 0.86 to 0.93. Based on these parameters, the calving interval is between 1 and 2 years. Calves are

probably born during October to March after 10 to 11 months gestation and nursing lasts for less than 6 months. Maximum ages are not known, but for Southern Hemisphere minke whales maximum age appears to be about 50 years (IWC 1991; Katona *et al.* 1993).

For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 16,199. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, or threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because this stock is of unknown status. PBR for the Canadian east coast minke whale is 162.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

During 2008 to 2012, the average annual minimum detected human-caused mortality and serious injury was 9.9 minke whales per year (1.6 (CV=0.69) minke whales per year from observed U.S. fisheries, 7.1 minke whales per year (unknown CV) from U.S. and Canadian fisheries using strandings and entanglement data, and 1.2 per year from ship strikes.

Data to estimate the mortality and serious injury of minke whales come from the Northeast Fisheries Science Center Observer Program, the At-Sea Monitor Program, and from records of strandings and entanglements in U.S. and Canadian waters. For the purposes of this report, mortalities and serious injuries recorded by the Observer or At-Sea Monitor Programs are recorded in Table 3, while all other reports of strandings and entanglements considered confirmed human-caused mortalities or serious injuries are shown in Table 2.

Detected interactions in the strandings and entanglement data should not be considered an unbiased representation of human-caused mortality. Detections are haphazard and not the result of a designed sampling scheme. As such they represent a minimum estimate which is almost certainly biased low.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*." All injury determinations for this stock assessment were performed under the new guidelines. The new process involves proration of serious injury determinations where there is uncertainty regarding the severity or cause.

Fishery Information

Detailed fishery information is reported in Appendix III.

Earlier Interactions

For more details on the historical fishery interactions prior to 1999, see Waring *et al.* (2007).

In 2002, one minke whale mortality and one live release were attributed to the lobster trap fishery. A June 2003 mortality, while wrapped in lobster gear, cannot be confirmed to have become entangled in the area, and so is not attributed to the fishery. Annual mortalities due to the Northeast/mid-Atlantic Lobster Trap/Pot fishery, as determined from strandings and entanglement records that have been audited, were 1 in 1991, 2 in 1992, 1 in 1994, 1 in 1995, 0 in 1996, 1 in 1997, 0 in 1998 to 2001, 1 in 2002, and 0 in 2003 through 2011.

U.S.

Northeast Bottom Trawl

The fishery is active in New England waters in all seasons (Appendix III). One freshly dead minke whale was caught in 2004 on the northeastern tip of Georges Bank in U.S. waters. Two dead minkes were reported by observers in 2008. Fishery related bycatch rates for years 2008-2012 were estimated using an annual stratified ratio-estimator. These estimates replace the 2008-2010 annual estimates reported in the 2013 stock assessment report that were generated using a different method. No serious injuries were observed. The estimated annual mortality (CV in parentheses) attributed to this fishery was 7.8 (0.69) for 2008, and 0 for 2009–2012. Annual average estimated

minke whale mortality and serious injury from the Northeast bottom trawl fishery during 2008 to 2012 was 1.6 (CV=0.69;Table 3).

Pelagic Longline

In 2010, a minke whale was caught but released alive (no serious injury) in the pelagic longline fishery, South Atlantic Bight fishing area (Garrison and Stokes 2012).

Other Fisheries

The audited NE Regional Office/NMFS entanglement/stranding database contains records of minke whales, of which the confirmed mortalities and serious injuries from the last five years are reported in Table 2. During 2008 to 2012, as determined from stranding and entanglement records confirmed to be of U.S. origin or first sighted in U.S. waters, the minimum detected average annual mortality and serious injury was 3.9 minke whales per year in U.S. fisheries (Table 2). Most cases where gear was recovered and identified involved gillnet or pot/trap gear.

CANADA

Read (1994) reported interactions between minke whales and gillnets in Newfoundland and Labrador, in cod traps in Newfoundland, and in herring weirs in the Bay of Fundy. Hooker *et al.* (1997) summarized bycatch data from a Canadian fisheries observer program that placed observers on all foreign fishing vessels operating in Canadian waters, on between 25% and 40% of large Canadian fishing vessels (greater than 100 feet long), and on approximately 5% of smaller Canadian fishing vessels. During 1991 through 1996, no minke whales were observed taken.

Herring Weirs

During 1980 to 1990, 15 of 17 minke whales were released alive from herring weirs in the Bay of Fundy. During January 1991 to September 2002, 26 minke whales were trapped in herring weirs in the Bay of Fundy. Of these 26, 1 died (H. Koopman, pers. comm.) and several (number unknown) were released alive and unharmed (A. Westgate, pers. comm.). Four minke whales were reported released alive from Grand Manan herring weirs in 2009 (H. Koopman pers. comm.).

Other Fisheries

Mortalities and serious injuries that were likely a result of an interaction with an unknown Canadian fishery are detailed in Table 2. During 2008 to 2012, as determined from stranding and entanglement records confirmed to be of Canadian origin or first sighted in Canadian waters, the minimum detected average annual mortality and serious injury was 3.2 minke whales per year in Canadian fisheries (Table 2; prorated value).

Table 2. Confirmed human-caused mortality and serious injury records of minke whales (*Balaenoptera acutorostrata*): where the cause was assigned as either an entanglement (EN), entrapment (ET) or a vessel strike (VS): 2008-2012[a]

Date[b]	Injury Determination	ID	Location[b]	Assigned Cause[f]	Value against PBR[c]	Country[d]	Gear Type[e]	Description
3/11/2008	Prorated Injury	-	off Yarmouth, NS	EN	0.75	XC	NR	Entanglement configuration unknown.
6/14/2008	Mortality	-	off Orleans, MA	EN	1	US	NP	Braided line impressions wrapped body in 3 places & left a deep, hemorrhaged laceration across the rostrum & blowholes.

								Hemorrhaged abrasions present on roof of mouth.Wet, bloodfilled lungs indicate drowning
6/19/2008	Prorated Injury	-	Grand Manan Island, New Brunswick	EN	0.75	XC	NR	Entanglement configuration unknown.
7/23/2008	Mortality	-	Kelligrews, Newfoundland	EN	1	CN	GU	Constricting wraps of gear on caudal peduncle
7/26/2008	Mortality	-	Conception Harbour, Newfoundland	EN	1	CN	GN	Constricting wraps of gear through mouth & around tail
7/28/2008	Prorated Injury	-	Trinity Bay, Newfoundland	EN	0.75	CN	GN	Gear removed from whale, but unclear if some gear remains..
8/20/2008	Prorated Injury	-	off Outer Heron Island, ME	EN	0.75	XU	NR	Entanglement configuration unknown.
8/21/2008	Mortality	-	Richibucto Cape, New Brunswick	EN	1	CN	NR	Evidence of constricting body wraps
9/21/2008	Prorated Injury	-	off Monhegan Island, ME	EN	0.75	XU	NR	Configuration of entanglement unclear.
10/9/2008	Prorated Injury	-	off Appledore Island, ME	EN	0.75	XU	NR	Entanglement configuration unknown.
4/19/2009	Prorated Injury	-	Grand Le Pierre, Labrador	EN	0.75	CN	PT	Entanglement configuration unknown.
5/20/2009	Mortality	-	off Point Pleasant, NJ	VS	1	US	-	Large hemorrhage at right pectoral
6/3/2009	Serious Injury	-	Tadoussac, Quebec	EN	1	CN	NR	Tight wrap on rostrum.
7/16/2009	Prorated Injury	-	Grand Manan Island, New Brunswick	ET	0.75	CN	WE	Live in weir. Not present the next day. Unclear if whale swam out or drowned.
8/11/2009	Serious Injury	-	off Plymouth, MA	EN	1	XU	NR	Constricting wrap & poor skin condition indicating health decline.

9/2/2009	Prorated Injury	-	off Pumpkin Island, ME	EN	0.75	XU	NR	Entanglement configuration unknown.
10/11/2009	Serious Injury	-	off Truro, MA	EN	1	US	MT	In net and on deck for short period. Released & swam off.
7/9/2010	Mortality	-	Fire Island Inlet, NY	VS	1	US	-	3-4 large dorsal lacerations associated w/ fractured ribs
7/27/2010	Prorated Injury	-	off Bliss Island, New Brunswick	ET	0.75	CN	WE	Live in weir. Not present next day. Unclear if whale swam out or drowned.
8/21/2010	Serious Injury	-	off Plymouth Harbor, MA	EN	1	XU	NR	Constricting wrap embedded in rostrum.
5/6/2011	Mortality	-	off Martha's Vineyard, MA	EN	1	US	PT	Anchored in gear. Embedded line at fluke. Evidence of entanglement w/ associated hemorrhaging at mouth corners & insertion of pectorals
6/3/2011	Serious Injury	-	Tadoussac, Quebec	EN	1	CN	NR	Tight rostrum wrap.
7/17/2011	Prorated Injury	-	off Nahant, MA	EN	0.75	XU	NR	Entanglement configuration unknown. No resights.
7/24/2011	Prorated Injury	-	off North Truro, MA	EN	0.75	XU	NR	Entanglement configuration unknown. No resights.
8/4/2011	Mortality	-	Sandy Hook Bay, NJ	VS	1	US	-	4 propellar lacerations across dorsal surface. Fractured ribs w/associated hemorrhaging
8/26/2011	Mortality	-	Horseshoe Cove, NJ	EN	1	US	NP	Fresh carcass w/ evidence of extensive entanglement
8/29/2011	Mortality	-	Moriches Bay, NY	VS	1	US	-	Extensive hemorrhage & edema along dorsal & both lateral surfaces

9/7/2011	Prorated Injury	-	Greenspond, Newfoundland	EN	0.75	CN	GN	Partially disentangled from anchoring gear. Final configuration unknown.
9/19/2011	Prorated Injury	-	Northumberland Strait, Prince Edward Island	EN	0.75	CN	NR	Partially disentangled from anchoring gear. Final configuration unknown.
10/6/2011	Mortality	-	off Matinicus Island, ME	EN	1	US	PT	Fresh carcass anchored in gear
12/7/2011	Mortality	-	Carolina Beach, NC	VS	1	US	-	Healed deep & superficial propellar lacerations; internal lesions associated w/ deep lacerations indicative of peritonitis & infection
12/19/2011	Mortality	-	off Grand Manan Island, New Brunswick	EN	1	CN	PT	Live entanglement; recovered dead in gear the following day. Constricting peduncle wraps
2/4/2012	Prorated Injury	-	off Virginia Beach, VA	EN	0.75	XU	CE	Reported with hook/monofilament gear. Attachment point unknown.
3/16/2012	Mortality	-	Ipswich, MA	EN	1	US	NP	Evidence of extensive, constricting gear with associated hemorrhaging
5/15/2012	Serious Injury	-	Sable Island Bank, Canada	EN	1	CN	PT	Carcass with gear embedded down to bone of peduncle.
6/21/2012	Serious Injury	-	off Frenchboro, ME	EN	1	XU	NR	Constricting body wrap, flipper pinned, embedded in mouthline, emaciated
6/23/2012	Mortality	-	Newark, NJ	VS	1	US	-	Fresh carcass on bow of ship. Deep laceration across ventral surface; COD - disembowlment and hypovolemic shock

6/26/2012	Mortality	-	Renews Rock, Newfoundland	EN	1	CN	PT	Fresh carcass with constricting gear around peduncle
6/30/2012	Mortality	-	off Naufrage, Prince Edward Island	EN	1	CN	PT	Fresh carcass anchored in gear
7/1/2012	Prorated Injury	-	off Portsmouth, NH	EN	0.75	XU	NR	Entanglement configuration unknown
7/1/2012	Mortality	-	Northern Lake Harbor, Prince Edward Island	EN	1	CN	PT	Constricting gear with associated hemorrhaging; COD - drowning
7/13/2012	Prorated Injury	-	off Jonesport, ME	EN	0.75	US	NR	released from anchoring gear w/ final configuration unknown; would've been SI w/out intervention
7/17/2012	Serious Injury	-	off Chatham, MA	EN	1	XU	NR	full configuration unknown, but tight wrap across back and health decline - emaciated
8/2/2012	Prorated Injury	-	off Provincetown, MA	EN	0.75	XU	NR	full configuration unknown
8/5/2012	Mortality	-	Chatham, MA	EN	1	US	NR	Multiple constricting wraps through and around mouth and on fluke blades; COD - acute underwater entrapment
10/4/2012	Mortality	-	Cliff Island, ME	EN	1	US	NR	Evidence of constricting gear at mouthline, across ventral pleats, and at peduncle
Five-year averages		Shipstrike (US/CN/XU/XC)		1.20 (1.20/ 0.00/ 0.00/ 0.00)				
		Entanglement/Entrapment (US/CN/XU/XC)		7.1 (1.75/ 2.90/ 2.15/ 0.30)				

a. For more details on events please see Cole and Henry 2015 and Henry *et al.* 2014.

b. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.

c. Mortality events are counted as 1 against PBR. Serious injury events have been evaluated using NMFS guidelines (NOAA 2012)

d. CN=Canada, US=United States, XC=Unassigned 1st sight in CN, XU=Unassigned 1st sight in US

e. H=hook, GN=gillnet, GU=gear unidentifiable, MF=monofilament, MT=midwater trawl, NP=none present, NR=none recovered/received, PT=pot/trap, WE=weir
f. Assigned cause: EN=entanglement, VS=vessel strike.

Table 3. Summary of the incidental mortality of Canadian East Coast stock of minke whales (*Balaenoptera acutorostrata acutorostrata*) by commercial fishery including the years sampled, the type of data used, the annual observer coverage, the serious injuries and mortalities recorded by on-board observers , the estimated annual serious injury and mortality, the estimated CV of the combined annual mortality and the mean annual mortality (CV in parentheses).

Fishery	Years	Data Type[b]	Observer Coverage[c]	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Combined Annual Mortality
Northeast Bottom Trawl[a]	08-12	Obs. Data, Trip Logbook	.08, .09, .16, .26, .17	0, 0, 0, 0, 0	2, 0, 0, 0	0, 0, 0, 0, 0	7.8, 0, 0, 0, 0	7.8, 0, 0, 0, 0	.69, 0, 0, 0, 0	1.6 (.69)
TOTAL										1.6 (.69)

[a] Fishery related bycatch rates for years 2008-2012 were estimated using an annual stratified ratio-estimator. These estimates replace the 2008-2010 annual estimates reported in the 2013 stock assessment report that were generated using a different method.

[b] Observer data (Obs. Data), used to measure bycatch rates, are collected within the Northeast Fisheries Observer Program and mandatory Vessel Trip Reports (VTR) (Trip Logbook) are used to determine the spatial distribution of landings and fishing effort.

[c] Northeast bottom trawl fishery coverage is ratios based on trips. Total observer coverage reported for bottom trawl gear in the years starting in 2010 includes samples collected from traditional fisheries observers, in addition to at-sea fishery monitors (both programs currently run through the Northeast Fisheries Observer Program (NEFOP).

Other Mortality

North Atlantic minke whales have been and continue to be hunted. From the Canadian East Coast population, documented whaling occurred from 1948 to 1972 with a total kill of 1,103 animals (IWC 1992). Animals from other North Atlantic minke populations are presently being harvested.

U.S.

Minke whales inhabit coastal waters during much of the year and are thus susceptible to collision with vessels. According to the NMFS/NER marine mammal entanglement and stranding database, on 7 July 1974, a necropsy of a minke whale suggested a vessel collision; on 15 March 1992, a juvenile female minke whale with propeller scars was found floating east of the St. Johns Channel entrance (R. Bonde, USFWS, Gainesville, FL, pers. comm.); and on 15 July 1996 the captain of a vessel reported hitting a minke whale offshore of Massachusetts. After reviewing this record, it was concluded the animal struck was not a serious injury or mortality. On 12 December 1998, a minke whale was struck and presumed killed by a whale-watching vessel in Cape Cod Bay off Massachusetts.

During 1999 to 2003, no minke whale was confirmed struck by a ship. During 2004 and 2005, one minke whale mortality was attributed to ship strike in each year. During 2006 to 2008, no minke whale was confirmed struck by a ship. During 2009, one minke whale was confirmed dead due to a ship strike off New Jersey. In 2010 a juvenile male minke was discovered killed by ship strike off Fire Island, New York. In 2011, three juvenile minkes were confirmed dead due to ship strikes: a female off Sandy Hook, New Jersey, female off Moriches, New York, and a male off Carolina Beach, North Carolina. In 2012, a confirmed vessel strike resulted in a mortality off Newark, New

Jersey. Thus, during 2008–2012, as determined from stranding and entanglement records, the minimum detected annual average was 1.2 minke whales per year struck by ships in U.S. waters or first seen in U.S. waters (Table 2; Cole and Henry 2015; Henry *et al.* 2014).

In October 2003, an Unusual Mortality Event was declared involving minke whales and harbor seals along the coast of Maine; since then, the number of minke whale stranding reports has returned to normal.

On 11 October 2009, the NOAA research vessel FSV Delaware II captured a minke whale during mid-water trawling operations associated with the 2009 Atlantic Herring Acoustics survey. Although brought on deck, the animal was released alive and appeared to exhibit healthy behavior upon release. This record was evaluated under the serious injury determination guidelines (NOAA 2012) and included in Table 2 as a serious injury.

CANADA

The Nova Scotia Stranding Network documented whales and dolphins stranded on the coast of Nova Scotia between 1991 and 1996 (Hooker *et al.* 1997). Researchers with the Department of Fisheries and Oceans, Canada documented strandings on the beaches of Sable Island (Lucas and Hooker 2000). Sable Island is approximately 170 km southeast of mainland Nova Scotia. Lucas and Hooker (2000) reported 4 minke whales stranded on Sable Island between 1970 and 1998, 1 in spring 1982, 1 in January 1992, and a mother/calf in December 1998. On the mainland of Nova Scotia, a total of 7 minke whales stranded during 1991 to 1996. The 1996 stranded minke whale was released alive off Cape Breton on the Atlantic Ocean side, the rest were found dead. All the minke whales stranded between July and October. One was from the Atlantic Ocean side of Cape Breton, 1 from Minas Basin, 1 was at an unknown location, and the rest stranded in the vicinity of Halifax, Nova Scotia. It is unknown how many of the strandings resulted from fishery interactions.

Starting in 1997, minke whales stranded on the coast of Nova Scotia as recorded by the Marine Animal Response Society (MARS) and the Nova Scotia Stranding Network are as follows: 4 minke whales stranded in 1997, 0 documented strandings in 1998 to 2000, 1 in September 2001, 4 in 2002, 2 in 2003, 0 in 2004, 3 in 2005, 8 in 2006, 1 in 2007, 4 in 2008, 5 in 2009 (including one minke released alive from a weir), 0 in 2010, 4 in 2011 (including 2 animals released or relocated) and 12 in 2012 (including one minke released alive from a weir). The events that are determined to be human-caused serious injury or mortality are included in Table 2.

Starting in 2008, the Whale Release and Strandings program has reported the following minke whale stranding mortalities in Newfoundland and Labrador: 3 in 2008, 1 in 2009, 1 in 2010, 0 in 2011 and 3 in 2012. Four of these records are included in Table 2 (Ledwell and Huntington 2004; 2006; 2007; 2008; 2009; 2010, 2011, 2012, 2012b). The 2011 Bay of Fundy minke whale entanglement mortality reported in Table 2 was reported by the Nova Scotia Marine Animal Response Society (T. Wimmer, pers. comm.).

During 2008–2012, as determined from stranding and entanglement records, the minimum detected annual average was 0 minke whales per year struck by ships in Canadian waters or first seen in Canadian waters (Table 2; Cole and Henry 2015; Henry *et al.* 2014).

STATUS OF STOCK

Minke whales are not listed as threatened or endangered under the Endangered Species Act, and the Canadian east coast stock is not considered strategic under the Marine Mammal Protection Act. The total U.S. fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. The status of minke whales, relative to OSP, in the U.S. Atlantic EEZ is unknown.

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SPERM WHALE (*Physeter macrocephalus*): North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The distribution of the sperm whale in the U.S. Exclusive Economic Zone (EEZ) occurs on the continental shelf edge, over the continental slope, and into mid-ocean regions (Figure 1). Waring *et al.* (1993, 2001) suggested that this offshore distribution is more commonly associated with the Gulf Stream edge and other features. However, the sperm whales that occur in the eastern U.S. Atlantic EEZ likely represent only a fraction of the total stock. The nature of linkages of the U.S. habitat with those to the south, north, and offshore is unknown. Historical whaling records compiled by Schmidly (1981) suggested an offshore distribution off the southeast U.S., over the Blake Plateau, and into deep ocean waters. In the southeast Caribbean, both large and small adults, as well as calves and juveniles of different sizes are reported (Watkins *et al.* 1985). Whether the northwestern Atlantic population is discrete from northeastern Atlantic is currently unresolved. The International Whaling Commission recognizes one stock for the North Atlantic. Based on reviews of many types of stock studies, (i.e., tagging, genetics, catch data, mark-recapture, biochemical markers, etc.) Reeves and Whitehead (1997) and Dufault *et al.* (1999) suggested that sperm whale populations have no clear geographic structure. Ocean-wide genetic studies (Lyrholm and Gyllensten 1998; Lyrholm *et al.* 1999) indicated low genetic diversity, but strong differentiation between potential social (matrilineally related) groups. Further, Englehaupt *et al.* (2009) found no differentiation for mtDNA between samples from the western North Atlantic and from the North Sea, but significant differentiation between samples from the Gulf of Mexico and from the Atlantic Ocean just outside the Gulf of Mexico. These ocean-wide findings, combined with observations from other studies, indicate stable social groups, site fidelity, and latitudinal range limitations in groups of females and juveniles (Whitehead 2002). In contrast, males migrate to polar regions to feed and move among populations to breed (Whitehead 2002, Englehaupt 2009). There exists one tag return of a male tagged off Browns Bank (Nova Scotia) in 1966 and returned from Spain in 1973 (Mitchell 1975). Another male taken off northern Denmark in August 1981 had been wounded the previous summer by whalers off the Azores (Reeves and Whitehead 1997). Steiner *et al.* (2012) reported on the resightings of photographed individual male sperm whales between the Azores and Norway. In the U.S. Atlantic EEZ waters, there appears to be a distinct seasonal cycle (CETAP 1982; Scott and Sadove 1997). In winter, sperm whales are concentrated east and northeast of Cape Hatteras. In spring, the center of distribution shifts northward to east of Delaware and Virginia, and is widespread throughout the central portion of the mid-Atlantic bight and the southern portion of Georges Bank. In summer, the distribution is similar but now also includes the area east and north of Georges Bank and into the Northeast Channel region, as well as the continental shelf (inshore of the 100-m isobath) south of New England. In the fall, sperm whale occurrence south of New England on the continental shelf is at its highest level, and there remains a continental shelf edge occurrence in the mid-Atlantic bight. Similar inshore (<200 m) observations have been made on the southwestern (Kenney, pers. comm) and eastern Scotian Shelf, particularly in the region of "the Gully" (Whitehead *et al.* 1991).

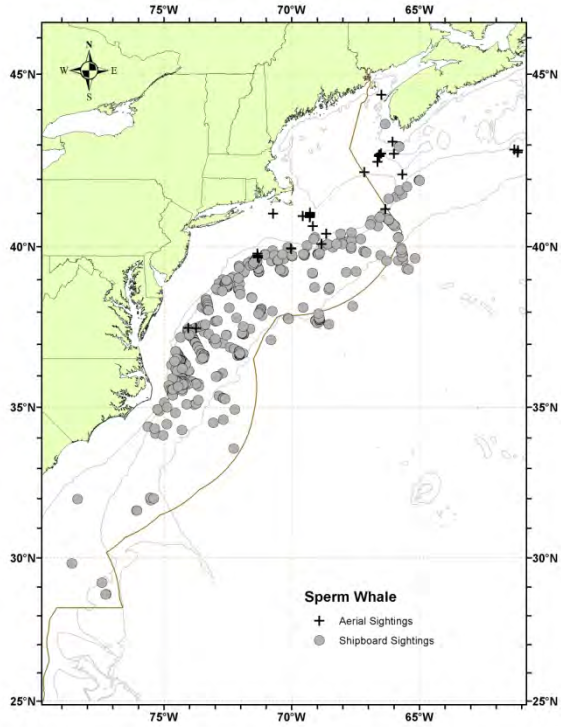

Figure 1. *Distribution of sperm whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1998, 1999, 2002, 2004, 2006 and 2011. Isobaths are the 100m, 1,000m, and 4,000m depth contours.*

Geographic distribution of sperm whales may be linked to their social structure and their low reproductive rate and both of these factors have management implications. Several basic groupings or social units are generally recognized—nursery schools, harem or mixed schools, juvenile or immature schools, bachelor schools, bull schools or pairs, and solitary bulls (Best 1979; Whitehead *et al.* 1991; Christal *et al.* 1998). These groupings have a distinct geographical distribution, with females and juveniles generally based in tropical and subtropical waters, and males more wide-ranging and occurring in higher latitudes. Male sperm whales are present off and sometimes on the continental shelf along the entire east coast of Canada south of Hudson Strait, whereas, females rarely migrate north of the southern limit of the Canadian EEZ (Reeves and Whitehead 1997; Whitehead 2002). Off the northeast U.S., Cetacean and Turtle Assessment Program (CETAP) and NEFSC sightings in shelf-edge and off-shelf waters included many social groups with calves/juveniles (CETAP 1982; Waring *et al.* 1992, 1993). The basic social unit of the sperm whale appears to be the mixed school of adult females plus their calves and some juveniles of both sexes, normally numbering 20-40 animals in all. There is evidence that some social bonds persist for many years (Christal *et al.* 1998).

POPULATION SIZE

Several estimates from selected regions of sperm whale habitat exist for select time periods, however, at present there is no reliable estimate of total sperm whale abundance in the entire western North Atlantic. Sightings have been almost exclusively in the continental shelf edge and continental slope areas (Figure 1). The best recent abundance estimate for sperm whales is the sum of the 2011 surveys—2,288 (CV=0.28). Because all the sperm whale estimates presented here were not corrected for dive-time, they are likely downwardly biased and an underestimate of actual abundance. The average dive-time of sperm whales is approximately 30-60 min (Whitehead *et al.* 1991; Watkins *et al.* 1993; Amano and Yoshioka 2003; Watwood *et al.* 2006), therefore, the proportion of time that they are at the surface and available to visual observers is assumed to be low.

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions. Due to changes in survey methodology these historical data should not be used to make comparisons to more current estimates.

Recent surveys and abundance estimates

An abundance estimate of 1,593 (CV=0.36) sperm whales was generated from a shipboard and aerial survey conducted during Jun–Aug 2011 (Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters north of New Jersey from the coastline to the 100-m depth contour, through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portioned covered 3,107 km of tracklines that were in waters offshore of Virginia to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Shipboard data were inspected to determine if there was significant responsive movement to the ship (Palka and Hammond 2001). Because there was an insignificant amount of responsive movement for this species, the estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

An abundance estimate of 695 (CV=0.39) sperm whales was generated from a shipboard survey conducted concurrently (June-August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed the double-platform methodology searching with 25x bigeye binoculars. A total of 4,445 km of tracklines was surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Table 1. Summary of abundance estimates for the western North Atlantic sperm whale (*Physeter macrocephalus*). Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Jun–Aug 2011	Central Virginia to lower Bay of Fundy	1,593	0.36
Jun-Aug 2011	Central Florida to Central Virginia	695	0.39
Jun-Aug 2011	Central Florida to lower Bay of Fundy (COMBINED)	2,288	0.28

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for sperm whales is 2,288 (CV=0.28). The minimum population estimate for the western North Atlantic sperm whale is 1,815.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. While more is probably known about sperm whale life history in other regions, some life history and vital rates information is available for the northwest Atlantic. These include: calving interval is 4-6 years; lactation period is 24 months; gestation period is 14.5-16.5 months; births occur mainly in July to November; length at birth is 4.0 m; length at sexual maturity 11.0-12.5 m for males and 8.3-9.2 m for females; mean age at sexual maturity is 19 years for males and 9 years for females; and mean age at physical maturity is 45 years for males and 30 years for females (Best 1974; Best *et al.* 1984; Lockyer 1981; Rice 1989).

For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 1,815. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.10 because the sperm whale is listed as endangered under the Endangered Species Act (ESA). PBR for the western North Atlantic sperm whale is 3.6.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

During 2008–2012, annual average human caused mortality was 0.8 due to reports of one sperm whale mortality in 2009 and one in 2010 in the Canadian Labrador halibut longline fishery (J. Lawson, DFO, pers. comm.), one entanglement mortality in Canadian pot/trap gear, and one vessel strike mortality (Table 2; NMFS unpublished data). A sperm whale was reported entangled in monkfish net on the Canadian Grand Banks in 2011, but was released alive and gear free (Ledwell and Huntington, 2012). Sperm whales have not been documented as bycatch in the observed U.S. Atlantic commercial fisheries.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al.* 2008; NOAA 2012). NMFS defines

serious injury as an "*injury that is more likely than not to result in mortality*". All injury determinations for this stock assessment were performed under the new guidelines. The new process involves proration of serious injury determinations where there is uncertainty regarding the severity or cause.

Fishery Information

Detailed fishery information is reported in Appendix III.

Table 2. Confirmed human-caused mortality records of North Atlantic stock of Sperm Whales where the cause was assigned as either an entanglement (EN) or a ship strike (SS): 2008-2012 [a]

Date[a]	Injury Determination	ID	Location[a]	Assigned Cause	Value against PBR[b]	Country[c]	Gear Type[d]
2009	Mortality			EN	1	CN	PL
2010	Mortality			EN	1	CN	PL
6/9/2009	Mortality	Tryphon	Sept-Iles, Quebec	EN	1	CN	PT
12/16/2012	Mortality	-	Deerfield Beach, FL	VS	1	XU	
Five-year totals		Shipstrike (US/CN/XU/XC)			0.20 (0.00/ 0.00/ 0.20/ 0.00)		
		Entanglement (US/CN/XU/XC)			0.60 (0.00/ 0.60/ 0.00/ 0.00)		

a. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.

b. Mortality events are counted as 1 against PBR. Serious injury events have been evaluated using NMFS guidelines (NOAA 2012)

c. CN=Canada, US=United States, XC=Unassigned 1st sight in CN, XU=Unassigned 1st sight in US

d. H=hook, GN=gillnet, GU=gear unidentifiable, MF=monofilament, NP=none present, NR=none recovered/received, PL=pelagic longline, PT=pot/trap, WE=weir

Other Mortality

Four hundred twenty-four sperm whales were harvested in the Newfoundland-Labrador area between 1904 and 1972 and 109 male and no female sperm whales were taken near Nova Scotia in 1964-1972 (Mitchell and Kozicki 1984) in a Canadian whaling fishery. There was also a well-documented sperm whale fishery based on the west coast of Iceland. Other sperm whale catches occurred near West Greenland, the Azores, Madeira, Spain, Spanish Morocco, Norway (coastal and pelagic), the Faroes, and Britain. At present, because of their general offshore distribution, sperm whales are less likely to be impacted by humans and those impacts that do occur are less likely to be recorded. There has been no complete analysis and reporting of existing data on this topic for the western North Atlantic.

During 1994–2006, 37 sperm whale strandings have been documented along the U.S. Atlantic coast including Puerto Rico and the EEZ (NMFS unpublished data). One 1998 and one 2000 stranding off Florida showed signs of human interactions. The 1998 animal's head was severed, but it is unknown if it occurred pre- or post-mortem. The 2000 animal had fishing gear in the blowhole. In October 1999, a live sperm whale calf stranded on eastern Long Island, and was subsequently euthanized. Also, a dead calf was found in the surf off Florida in 2000.

During 2008–2014, 14 sperm whale strandings were documented along the U.S. Atlantic coast within the EEZ according to the NER and SER strandings databases (Table 3). The 2012 Maine stranding mortality was classified as a human (fishery) interaction, though was not included in Table 3 because entanglement injuries were old and

healed and cause of death was not determined.

Table 3. Sperm whale (*Physeter macrocephalus*) reported strandings along the U.S. and Canada Atlantic coast 2008–2012.

Stranding State	2008	2009	2010	2011	2012	**Total**
Newfoundland/Labrador[a]	1	1	0	2	2	**6**
Maine	0	0	0	0	1	**1**
Massachusetts	0	0	0	2	1	**3**
New York	0	1	0	1	0	**2**
Virginia	0	0	0	0	1	**1**
North Carolina	1	0	1	1	0	**3**
South Carolina	0	0	0	1	0	**1**
Florida	1	0	1[b]	0	1	**3**
TOTAL U.S.	**2**	**1**	**2**	**5**	**4**	**14**

a. Data provided by Whale Release and Strandings, Tangly Whales Inc. Newfoundland, Canada

b. Young sperm whale swimming in the Miami Beach Marina eluded euthanasia attempts.

In eastern Canada, 6 dead strandings were reported in Newfoundland/Labrador in 1987-2005; 20 dead strandings along Nova Scotia in 1988-2005; 9 dead strandings on Prince Edward Island in 1988-2005; 2 dead strandings in Quebec in 1992; 5 dead strandings in New Brunswick in 2005; and 13 animals in 8 stranding events on Sable Island, Nova Scotia in 1970-1998 (Reeves and Whitehead 1997; Hooker *et al.* 1997; Lucas and Hooker 2000). Sex was recorded for 11 of the 13 Sable island animals, and all were male, which is consistent with sperm whale distribution patterns (Lucas and Hooker 2000).

Mass strandings have been reported in many oceanic regions (Rice *et al*. 1986; Kompanje and Reumer 1995; Evans *et al*. 2002; Fujiwara *et al*. 2007; Pierce *et al*. 2007; Mazzariol *et al*. 2011). Reasons for the strandings are unknown, although multiple causes (e.g., topography, changes in geomagnetic field, solar cycles, ship strikes, global changes in water temperature and prey distribution, and pollution) have been suggested (Kirschvink *et al*. 1986; Brabyn and Frew 1994; Holsbeek *et al.* 1999; Mazzariol *et al*. 2011).

Ship strikes are another source of human-caused mortality (McGillivary *et al*. 2009; Carrillo and Ritter 2010). In May 1994 a ship-struck sperm whale was observed south of Nova Scotia (Reeves and Whitehead 1997), in May 2000 a merchant ship reported a strike in Block Canyon, and in 2001 the U.S. Navy reported a ship strike within the EEZ (NMFS, unpublished data). In 2006, a sperm whale was found dead from ship strike wounds off Portland, Maine. In spring, the Block Canyon region is part of a major pathway for sperm whales entering southern New England continental shelf waters in pursuit of migrating squid (CETAP 1982; Scott and Sadove 1997). A 2012 Florida stranding mortality was classified as a vessel strike mortality (Table 3;).

STATUS OF STOCK

This is a strategic stock because the species is listed as endangered under the ESA. Total U.S. fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR, and therefore can be considered to be insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP in U.S. Atlantic EEZ is unknown. There are insufficient data to determine population trends. The current stock abundance estimate was based upon a small portion of the known stock range. A Recovery Plan for sperm whales was finalized in 2010 (NMFS 2010).

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KILLER WHALE (*Orcinus orca*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Killer whales are characterized as uncommon or rare in waters of the U.S. Atlantic Exclusive Economic Zone (EEZ) (Katona et al. 1988). The 12 killer whale sightings constituted 0.1% of the 11,156 cetacean sightings in the 1978-81 CETAP surveys (CETAP 1982). The same may be true for eastern Canadian waters, where the species has been described as relatively uncommon and numerically few (Mitchell and Reeves 1988). Lawson and Stevens (2013) reported on eastern Canada killer whale sighting events from 1758 to 2012, and found that sightings were most common from June to September and especially more frequent over the last ten years. This is possibly due to increased public awareness of this species, and more boats, people and cameras on the water during those months. In eastern Canada 17.4% and in the U.S. Gulf of Maine 9.3% of humpbacks had scars on their flukes caused by non-fatal predatory interactions with killer whales. This may be due to migration patterns or may reflect dietary differences and relative distributions of different ecotypes of killer whales (McCordic *et al.* 2013). Killer whale distribution extends from the Arctic ice edge to the West Indies. They are normally found in small groups, although 40 animals were reported from the southern Gulf of Maine in September 1979, and 29 animals in Massachusetts Bay in August 1986 (Katona et al. 1988). In the U.S. Atlantic EEZ, while their occurrence is unpredictable, they do occur in fishing areas, perhaps coincident with tuna, in warm seasons (Katona et al. 1988; NMFS unpublished data). In an extensive analysis of historical whaling records, Reeves and Mitchell (1988) plotted the distribution of killer whales in offshore and mid-ocean areas. Their results suggest that the offshore areas need to be considered in present-day distribution, movements, and stock relationships.

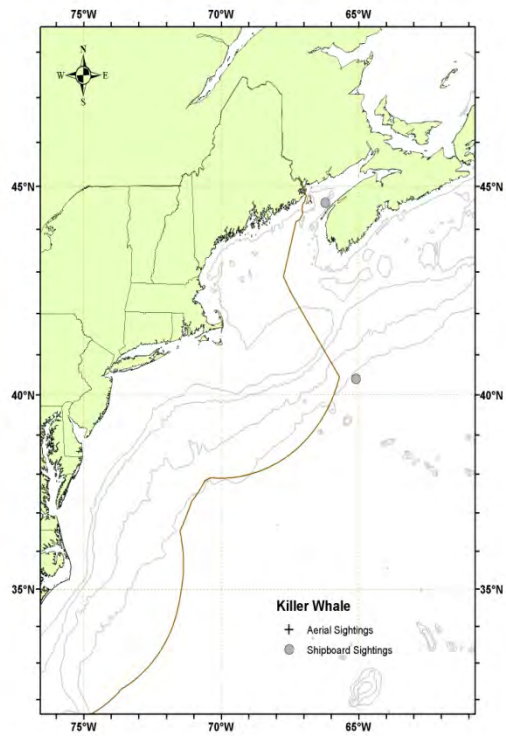

Figure 1. *Distribution of killer whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1998, 1999, 2002, 2004, 2006 and 2011. Isobaths are the 100m, 1,000m, and 4,000m depth contours.*

Stock and ecotype definitions are largely unknown. Results from other areas (e.g., the Pacific Northwest and Norway) suggest that social structure and territoriality may be important.

POPULATION SIZE

The total number of killer whales off the eastern U.S. coast is unknown.

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate.

Current Population Trend

There are insufficient data to determine the population trends for this species.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for this stock. The maximum net productivity rate was assumed to be 0.04 for purposes of this assessment. This value is based on theoretical calculations showing that cetacean populations may not generally grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow et al. 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (Wade and Angliss 1997). The minimum population size is unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because this stock is of unknown. PBR for the western North Atlantic killer whale is unknown because the minimum population size cannot be determined.

ANNUAL HUMAN-CAUSED MORTALITY

In 1994, one killer whale was caught in the New England multispecies sink gillnet fishery but released alive. Known mortality events in eastern Canada (DFO, unpublished data; Lawson and Stevens 2013), for the last 40 years equate to at least one killer whale death every 2 years.

Fishery Information

Data on current incidental takes in U.S. fisheries are available from several sources. In 1986, NMFS established a mandatory self-reported fishery information system for large pelagic fisheries. Data files are maintained at the Southeast Fisheries Science Center (SEFSC). The Northeast Fisheries Science Center (NEFSC) Sea Sampling Observer Program was initiated in 1989, and since that year several fisheries have been covered by the program. In late 1992 and in 1993, the SEFSC provided observer coverage of pelagic longline vessels fishing off the Grand Banks (Tail of the Banks) and provides observer coverage of vessels fishing south of Cape Hatteras.

There have been no observed mortalities or serious injuries by NMFS Sea Samplers in the pelagic drift gillnet, pelagic longline, pelagic pair trawl, New England multispecies sink gillnet, mid-Atlantic coastal sink gillnet, and North Atlantic bottom trawl fisheries.

STATUS OF STOCK

The status of killer whales relative to OSP in U.S. Atlantic EEZ is unknown. Because there are no observed mortalities or serious injury between 2008 and 2012, the total U.S. fishery-related mortality and serious injury for this stock is considered insignificant and approaching zero mortality and serious injury rate. The species is not listed as threatened or endangered under the Endangered Species Act. In Canada, the Cetacean Protection Regulations of 1982, promulgated under the standing Fisheries Act, prohibit the catching or harassment of all cetacean species. There are insufficient data to determine the population trends for this species. This is not a strategic stock because, although PBR could not be calculated, there is no evidence of human-induced mortality.

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May 2015

FALSE KILLER WHALE (*Pseudorca crassidens*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The false killer whale is distributed worldwide throughout warm temperate and tropical oceans (Jefferson *et al.* 2008). This species is usually sighted in offshore waters but in some cases inhabits waters closer shore (e.g., Hawaii, Baird *et al.* 2013). Sightings of this species in the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) occur in oceanic waters, primarily in the eastern Gulf (Mullin and Fulling 2004; Maze-Foley and Mullin 2006). While records from the U.S. western North Atlantic have been uncommon, the combination of sighting, stranding and bycatch records indicates that this species routinely occurs in the western North Atlantic. False killer whales have been sighted in U.S. Atlantic waters from southern Florida to Maine (Schmidly 1981). There are periodic records (primarily stranding) from southern Florida to Cape Hatteras dating back to 1920 (Schmidly 1981). Most of the records are from the southern half of Florida and include a mass stranding in 1970 that may have numbered as many as 175 individuals (Caldwell *et al*. 1970; Schmidly 1981).

The western North Atlantic population is being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the northern Gulf of Mexico stock(s). While it may be a unique situation, false killer whales that inhabit U.S. waters around the Hawaiian Islands are made up of two genetically identifiable populations (i.e., near-shore island and pelagic; Chivers *et al.* 2007) and the near-shore population is a distinct population segment (Oleson *et al.* 2010). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation in the western North Atlantic.

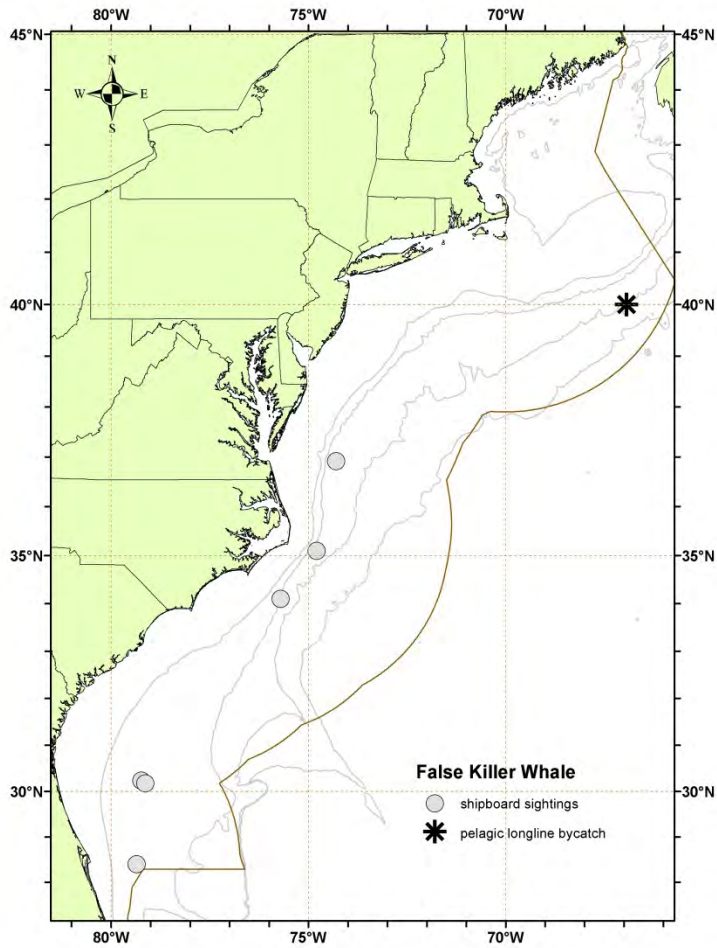

Figure 1. *Distribution of false killer whale sightings from NEFSC and SEFSC vessel surveys during 1992, 1995, 2006 and 2011. Also shown is the location of a 2011 interaction with the pelagic longline fishery. Isobaths are the 100-m, 1,000-m and 4,000- m depth contours, and the dark line is U.S. EEZ.*

POPULATION SIZE

The best available abundance estimate for western North Atlantic false killer whales is 442 (CV=1.06; Table 1). This estimate is from summer 2011 surveys covering waters from central Florida to the lower Bay of Fundy. Sightings of this species have not occurred or have been rare during any given survey, and hence this is the first abundance estimate ever made for U.S. Atlantic waters.

Recent surveys and abundance estimates

There were no sightings of false killer whales during aerial and shipboard surveys conducted during June-August 2011 from central Virginia to the lower Bay of Fundy. The aerial portion covered 6,850 km of tracklines over waters north of New Jersey between the coastline and the 100-m depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,811 km of tracklines between central Virginia and Massachusetts in waters deeper than

the 100-m depth contour out to beyond the U.S. EEZ. Both sighting platforms used a double-platform data collection procedure.

An abundance estimate of 442 (CV=1.06; Table 1) false killer whales based on one sighting of approximately 11 animals was generated from a shipboard survey conducted concurrently (June-August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25x bigeye binoculars. A total of 4,445 km of tracklines was surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Table 1. Summary of abundance estimates for the western North Atlantic false killer whale *(Pseudorca crassidens)* by month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Jun-Aug 2011	central Virginia to lower Bay of Fundy	0	0
Jun-Aug 2011	central Florida to central Virginia	442	1.06
Jun-Aug 2011	central Florida to lower Bay of Fundy (COMBINED)	442	1.06

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for false killer whales is 442 (CV=1.06). The minimum population estimate for false killer whales is 212.

Current Population Trend

There are insufficient data to determine population trends for this stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one half the maximum net productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 212. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because this stock is of unknown status. PBR for the western North Atlantic false killer whale stock is 2.1.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual estimated fishery-related mortality and serious injury to this stock during 2008-2012 is unknown.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998, Andersen *et al*. 2008, NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

The commercial fishery that could potentially interact with this stock in the Atlantic Ocean is the Category I Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). Pelagic swordfish, tunas and billfish are the targets of the longline fishery. During 2008-2012, 1 interaction with this fishery was observed during quarter 3 of 2011, and involved a false killer whale entangled and released alive, presumed not to be seriously injured (Garrison *et al.* 2009; Garrison and Stokes 2010; Garrison and Stokes 2012a,b; Garrison and Stokes 2013).

Other Mortality

There was 1 reported stranding of a false killer whale in the U.S. Atlantic Ocean during 2008-2012 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 30 September 2013 (SER) and 11 November 2013 (NER)). This stranding occurred off North Carolina during 2009 and was classified as a fishery interaction due to longline markings. Historically, there have been intermittent false killer whale strandings. From 1990 through 2007, the following false killer whale strandings occurred: 1 animal in 2002 in North Carolina; 2 in Florida in 1997; 1 in Massachusetts in 1997; 1 in Georgia in 1996; and 1 in Florida in 1995. Stranding data probably underestimate the extent of human-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other human interactions. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interactions.

STATUS OF STOCK

Western North Atlantic false killer whales are not listed as threatened or endangered under the Endangered Species Act. However, because the abundance of the Western North Atlantic stock is small and relatively few mortalities and serious injuries would exceed PBR, the NMFS considers this to be a strategic stock. Insufficient information is available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching a zero mortality and serious injury rate. The status of false killer whales in the U.S. EEZ relative to OSP is unknown. There are insufficient data to determine population trends for this stock.

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NORTHERN BOTTLENOSE WHALE (*Hyperoodon ampullatus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Northern bottlenose whales are characterized as extremely uncommon or rare in waters of the U.S. Atlantic Exclusive Economic Zone (EEZ). The two sightings of three individuals constituted less than 0.1% of the 11,156 cetacean sightings in the 1978-82 CETAP surveys. Both sightings were in the spring, along the 2,000-m isobath (CETAP 1982). In 1993 and 1996, two sightings of single animals, and in 1996, a single sighting of six animals (one juvenile), were made during summer shipboard surveys conducted along the southern edge of Georges Bank (NMFS 1993; 1996). More recent sightings of northern bottlenose whales are shown in Figure 1.

Northern bottlenose whales are distributed in the North Atlantic from Nova Scotia to about 70ºN in the Davis Strait, along the east coast of Greenland to 77ºN and from England, Norway, Iceland and the Faroe Islands to the south coast of Svalbard. It is largely a deep-water species and is very seldom found in waters less than 2,000 m deep (Mead 1989; Whitehead and Hooker 2012).

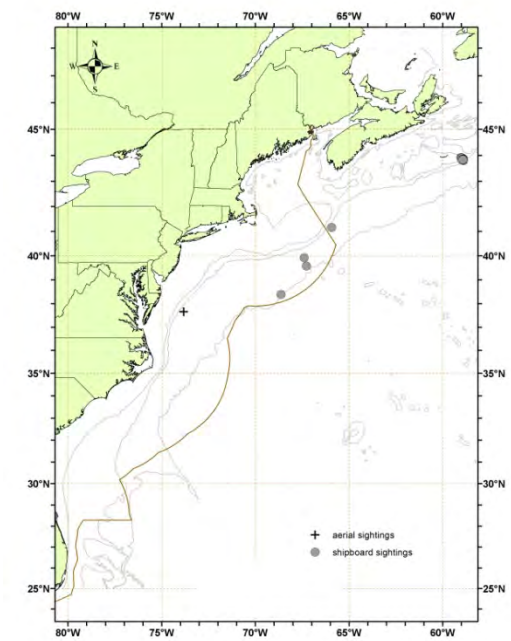

Figure 1: *NEFSC and SEFSC shipboard and aerial surveys during the summers of 1998, 1999, 2002, 2004, 2006 and 2007. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

There are two main centers of bottlenose whale distribution in the western North Atlantic, one in the area called "The Gully" just north of Sable Island, Nova Scotia, and the other in Davis Strait off northern Labrador (Reeves *et al.* 1993). Studies at the entrance to the Gully from 1988 to 1995 identified 237 individuals and estimated the local population size at about 230 animals (95% C.I. 160-360) (Whitehead *et al.* 1997). Wimmer and Whitehead (2004) identified individuals moving between several Scotian Shelf canyons more than 100 km from the Gully. Whitehead and Wimmer (2005) estimated a population of 163 animals (95% confidence interval 119-214), with no statistically significant population trend. O'Brian and Whitehead (2013) applied mark-recapture techniques to estimate the current population size of northern bottlenose whales on the Scotian Shelf as 143 animals (95% CI: 95 to 156 animals). These individuals are believed to be year-round residents and all age and sex classes are present (Gowans *et al.* 2000; Hooker *et al.* 2002). Mitchell and Kozicki (1975) reported stranding records in the Bay of Fundy and as far south as Rhode Island. Lucas and Hooker (2000) documented three stranded individuals on Sable Island, Nova Scotia, Canada.

Several genetic studies have been undertaken in the waters off Nova Scotia (Dalebout *et al.* 2001; Hooker *et al.* 2001a; Hooker *et al.* 2001b; Hooker *et al.* 2002; Dalebout *et al.* 2006). Dalebout *et al.* (2006) found distinct differences in the nuclear and mitochondrial markers for the small populations of bottlenose whales of the Gully, Labrador and Iceland. Stock identity is currently unknown for those individuals inhabiting/visiting U.S. waters.

POPULATION SIZE

The total number of northern bottlenose whales off the eastern U.S. coast is unknown.

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate.

Current Population Trend

There are insufficient data to determine the population trends for this species.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened stock, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because this stock is of unknown status. PBR for the western North Atlantic northern bottlenose whale is unknown because the minimum population size cannot be determined.

ANNUAL HUMAN-CAUSED MORTALITY

No mortalities have been reported in U.S. waters. A fishery for northern bottlenose whales existed in Canadian waters during both the 1800s and 1900s. Its development was due to the discovery that bottlenose whales contained spermaceti. A Norwegian fishery expanded from east to west (Labrador and Newfoundland) in several episodes. The fishery peaked in 1965. Decreasing catches led to the cessation of the fishery in the 1970s, and provided evidence that the population was depleted. A small fishery operated by Canadian whalers from Nova Scotia operated in the Gully, and took 87 animals from 1962 to 1967 (Mitchell 1977; Mead 1989). Canadian Department of Fisheries and Oceans (2009) had 8 At-Sea Observer program reports of entanglements of northern bottlenose whales in Atlantic Canada and one entanglement in the Gully observed by Dalhousie University since the early 1980s. These entanglements were in fisheries using benthic and pelagic long-lines and otter-trawls. (DFO 2009).

Fishery Information

The only documented U.S. fishery interaction with northern bottlenose whales occurred in 2001 in the U.S. Northeast Distant Water experimental pelagic longline fishery in Canadian waters. The animal was released alive, but considered a serious injury (Garrison 2003).

Other Mortality

In 2006, two northern bottlenose whales stranded alive in Delaware Bay. This mother-calf pair was first reported stranded in New Jersey, where volunteers pushed them off the beach. The two animals restranded in Delaware, where the calf was encouraged back into the water and was last seen swimming, but the mother stranded dead. This is believed to be the southernmost U.S. stranding record for this species.

STATUS OF STOCK

The status of northern bottlenose whales relative to OSP in U.S. Atlantic EEZ is unknown; however, the depletion in Canadian waters in the 1970s may have impacted U.S. distribution and may be relevant to current status in U.S. waters. The Canadian Scotian Shelf population was designated by Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as of Special Concern. Its status was uplisted to Endangered in November 2002, based on its small population and the potential threat posed by oil and gas development in and around the population's prime habitat (COSEWIC 2002). This population was listed under the Canadian Species at Risk Act in 2006 (DFO 2007). This species is not listed as threatened or endangered under the U.S. Endangered Species Act. There are insufficient data to determine population trends for this species. The total level of U.S. fishery-caused mortality and serious injury is unknown. Because this stock has a marginal occurrence in U.S. waters and there are no documented takes in U.S. waters, this stock has been designated as not strategic.

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SOWERBY'S BEAKED WHALE (*Mesoplodon bidens*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Within the genus *Mesoplodon*, there are four species of beaked whales that reside in the northwest Atlantic. These include True's beaked whale, *M. mirus*; Gervais' beaked whale, *M. europaeus*; Blainville's beaked whale, *M. densirostris*; and Sowerby's beaked whale, *M. bidens* (Mead 1989). These species are difficult to identify to the species level at sea; therefore, much of the available characterization for beaked whales is to genus level only. Stock structure for each species is unknown. Thus, it is plausible the stock could actually contain multiple demographically independent populations that should themselves be stocks, because the current stock spans multiple eco-regions (Longhurst 1998; Spalding *et al*. 2007).

The distributions of *Mesoplodon* spp. in the northwest Atlantic are known principally from stranding records (Mead 1989; Nawojchik 1994; Mignucci-Giannoni *et al.* 1999; MacLeod *et al.* 2006). Off the U.S. Atlantic coast, beaked whale (*Mesoplodon* spp.) sightings have occurred principally along the shelf-edge and deeper oceanic waters (Figure 1; CETAP 1982; Waring *et al.* 1992; Tove 1995; Waring *et al.* 2001; Hamazaki 2002; Palka 2006). Most sightings were in late spring and summer, which corresponds to survey effort. The distributions of Sowerby's beaked whales are also known from acoustical surveys (Cholewiak et al. 2013) and bycatch confirmed genetically to be *M. bidens* (Wenzel et al. 2013).

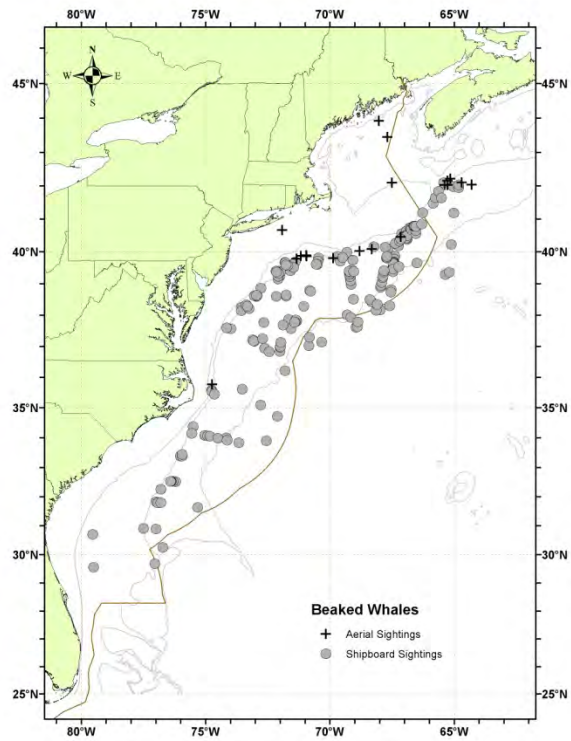

Figure 1: *Distribution of beaked whale (includes Ziphius and Mesoplodon spp.) sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008 2010 and 2011. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

Sowerby's beaked whales have been reported from New England waters north to the ice pack (e.g., Davis Strait), and individuals are seen along the Newfoundland coast in summer (Leatherwood *et al.* 1976; Mead 1989; MacLeod *et al.* 2006; Jefferson *et al*. 2008). Furthermore, a single stranding occurred off the Florida west coast (Mead 1989). This species is considered rare in Canadian waters (Lien *et al.* 1990) and has been designated as "Special Concern" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Whitehead (2013) reports that in the 23 years of cetacean observations in the Gully Marine Protected Area, on the edge of the Scotian Shelf, Nova Scotia, Canada, they have observed a significant increase in sightings of Sowerby's.

POPULATION SIZE

Several estimates of the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) from selected regions are available for select time periods (Barlow *et al.* 2006), as well as two estimates of *Mesoplodon* spp. beaked whales alone. Survey platform type influences observer ability to identify species, with differentiation most difficult from aircraft. Sightings are almost exclusively in the continental shelf edge and continental slope areas (Figure 1). The best abundance estimate for *Mesoplodon* spp. beaked whales is the sum of the 2011 survey estimates–7,092 (CV=0.54).

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions. Due to changes in survey methodology these historical data should not be used to make comparisons to

more current estimates.

Recent surveys and abundance estimates

An abundance estimate of 922 (CV=1.47) undifferentiated beaked whales (*Ziphius* and *Mesoplodon* spp.) was obtained from an aerial survey conducted in August 2006, which covered 10,676 km of trackline in the region from the 2000 m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence. (Table 1; Palka pers. comm.)

An abundance estimate of 5,500 (CV=0.67) *Mesoplodon* spp. beaked whales (not including *Ziphius*) was generated from a shipboard and aerial survey conducted during June–August 2011 (Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters north of New Jersey and shallower than the 100-m depth contour, through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in waters offshore of Virginia to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a two-simultaneous team data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Shipboard data were inspected to determine if there was significant responsive movement to the ship (Palka and Hammond 2001). Because there was an insignificant amount of responsive movement for this species, the estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

An abundance estimate of 1,570 (CV=0.65) *Mesoplodon* spp. beaked whales (not including *Ziphius*) was also generated from a shipboard survey conducted during June–August 2011 between central Florida and Virginia. The survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25x bigeye binoculars. A total of 4,445 km of survey effort were accomplished with 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Although the 1990–2011 surveys did not sample exactly the same areas or encompass the entire beaked whale habitat, they did focus on segments of known or suspected high-use habitats off the northeastern U.S. coast. The collective 1990–2011 data suggest that, seasonally, at least several thousand beaked whales are occupying these waters, with highest levels of abundance in the Georges Bank region. NMFS surveys suggest that beaked whale abundance may be highest in association with Gulf Stream and warm-core ring features (Waring *et al.* 2001; Hamazaki 2002).

Because the estimates presented here were not dive-time corrected, they are likely negatively biased and probably underestimate actual abundance. Given that *Mesoplodon* spp. prefer deep-water habitats (Mead 1989) the bias may be substantial.

Table 1. Summary of abundance estimates for *Mesoplodon* spp.[a] or the undifferentiated complex[b] of beaked whales which include *Ziphius* and *Mesoplodon* spp.[a] Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Aug 2006[b]	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	922	1.47
Jun-Aug 2011[a]	Central Virginia to lower Bay of Fundy	5,500	0.67
Jun-Aug 2011 [a]	Central Florida to Central Virginia	1,592	0.67
Jun-Aug 2011 [a]	Central Florida to lower Bay of Fundy (COMBINED)	7,092	0.54

[a] 2011estimates are for *Mesoplodon* spp. beaked whales alone, not the undifferentiated complex
[b]2006 estimate includes *Mesoplodon* and *Ziphius.*

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for *Mesoplodon* spp. beaked whales (not including *Ziphius*) is 7,092 (CV=0.54). The minimum population estimate for *Mesoplodon* spp beaked whales is

4,632.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. *Mesoplodon* spp. life history parameters that could be used to estimate net productivity include: length at birth is 2 to 3 m, length at sexual maturity 6.1 m for females, and 5.5 m for males, maximum age for females were 30 growth layer groups (GLG's) and for males was 36 GLG's, which may be annual layers (Mead 1984).

For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for the *Mesoplodon* spp. beaked whales is 4,632. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5. PBR for *Mesoplodon* spp. beaked whales (not including *Ziphius*) is 46.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The 2008–2012 total average estimated annual mortality of Sowerby's beaked whales in observed fisheries in the U.S. Atlantic EEZ is zero.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Total fishery-related mortality and serious injury cannot be estimated separately for each beaked whale species because of the uncertainty in species identification by fishery observers. The Atlantic Scientific Review Group advised adopting the risk-averse strategy of assuming that any beaked whale stock which occurred in the U.S. Atlantic EEZ might have been subject to the observed fishery-related mortality and serious injury.

Estimated annual average fishery-related mortality or serious injury of this stock in 2007–2011 in U.S. fisheries was zero. Detailed fishery information is reported in Appendix III.

Earlier Interactions

There is no historical information available that documents incidental mortality in either U.S. or Canadian Atlantic coast fisheries (Read 1994). The only documented bycatch prior to 2003 of beaked whales is in the pelagic drift gillnet fishery (now prohibited). The bycatch only occurred from Georges Canyon to Hydrographer Canyon along the continental shelf break and continental slope during July to October (Northridge 1996). Forty-six fishery-related beaked whale mortalities were observed between 1989 and 1998. These included: 24 Sowerby's; 4 True's; 1 Cuvier's; and 17 undifferentiated beaked whales. Recent analysis of biological samples (genetics and morphological analysis) has been used to determine species identifications for some of the bycaught animals. Estimates from the 1989 to 1993 period are for undifferentiated beaked whales. The estimated annual fishery-related mortality (CV in parentheses) was 60 in 1989 (0.21), 76 in 1990 (0.26), 13 in 1991 (0.21), 9.7 in 1992 (0.24) and 12 in 1993 (0.16).

Estimates of bycatch mortality by species are available for the 1994-1998 period. For animals identified as Sowerby's beaked whales, bycatch estimates were 3 (0.09) in 1994, 6 (0) in 1995, 9 (0.12) in 1996 and 2 (0) in 1998. Estimated annual fishery-related mortality for unidentified *Mesoplodon* beaked whales during this period was 0 in 1994, 3 (0) in 1995, 2 (0.25) in 1996, and 7 (0) in 1998. There was no fishery during 1997. During July 1996, one beaked whale was entangled and released alive with "gear in/around a single body part".

One unidentified beaked whale was seriously injured in the U.S. Atlantic pelagic longline fishery in 2003. This interaction occurred in the Sargasso Sea fishing area. The estimated fishery-related combined mortality in 2003 was 5.3 beaked whales (CV=1.0). No serious injury or mortality interactions have been reported since 2003.

Other Mortality

During 2008–2012 two Sowerby's beaked whales stranded along the U.S. Atlantic coast (Table 3). None of these animals showed evidence of a human interaction.

Several unusual mass strandings of beaked whales throughout their worldwide range have been associated with naval activities (D'Amico *et al.* 2009; Filadelfo *et al.* 2009). During the mid- to late 1980s multiple mass strandings of Cuvier's beaked whales (4 to about 20 per event) and small numbers of Gervais' beaked whale and Blainville's beaked whale occurred in the Canary Islands (Simmonds and Lopez-Jurado 1991). Twelve Cuvier's beaked whales that live stranded and subsequently died in the Mediterranean Sea on 12-13 May 1996 were associated with low frequency acoustic sonar tests conducted by the North Atlantic Treaty Organization (Frantzis 1998; D'Amico *et al.* 2009; Filadelfo *et al.* 2009). In March 2000, 14 beaked whales live stranded in the Bahamas; 6 beaked whales (5 Cuvier's and 1 Blainville's) died (Balcomb and Claridge 2001; NMFS 2001; Cox *et al.* 2006). Four Cuvier's, 2 Blainville's, and 2 unidentified beaked whales were returned to sea. The fate of the animals returned to sea is unknown, since none of the whales have been resighted. Necropsy of 6 dead beaked whales revealed evidence of tissue trauma associated with an acoustic or impulse injury that caused the animals to strand. Subsequently, the animals died due to extreme physiologic stress associated with the physical stranding (i.e., hyperthermia, high endogenous catecholamine release) (Cox *et al.* 2006).. Fourteen beaked whales (mostly Cuvier's beaked whales but also including Gervais' and Blainville's beaked whales) stranded in the Canary Islands in 2002 (Cox *et al.* 2006, Fernandez *et al.* 2005; Martin *et al.* 2004). Gas bubble-associated lesions and fat embolism were found in necropsied animals from this event, leading researchers to link nitrogen supersaturation with sonar exposure (Fernandez *et al.* 2005).

Table 3. Sowerby's beaked whale (*Mesoplodon bidens*) strandings along the U.S. Atlantic coast.

State	2008	2009	2010	2011	2012	Total
Virginia	0	2	0	0	0	**2**
Total	0	2	0	0	0	**2**

STATUS OF STOCK

While Sowerby's beaked whales are not listed as threatened or endangered under the Endangered Species Act they have been listed as a species of Special Concern by both COSEWIC and SARA (the Species at Risk Act) in Canada (COSEWIC 2006). The western North Atlantic stock of Sowerby's beaked whale is not considered strategic under the Marine Mammal Protection Act. No habitat issues are known to be of concern for this species, but questions have been raised regarding potential effects of human-made sounds on deep-diving cetacean species such as Sowerby's beaked whales (Richardson et al. 1995), There are insufficient data to determine the population size or trends, and, while a PBR value has been calculated for the *Mesoplodon* genus, PBR cannot be calculated for this species independently. The permanent closure of the pelagic drift gillnet fishery has eliminated the principal known source of incidental fishery mortality, and no fishery-related mortality and serious injury has been observed during the recent 5-year (2008–2012) period. Therefore, the total U.S. fishery mortality and serious injury rate can be considered to be insignificant and approaching zero. The status of Sowerby's beaked whales relative to OSP in U.S. Atlantic EEZ is unknown.

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RISSO'S DOLPHIN (*Grampus griseus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Risso's dolphins are distributed worldwide in tropical and temperate seas (Jefferson *et al*. 2008), and in the Northwest Atlantic occur from Florida to eastern Newfoundland (Leatherwood *et al*. 1976; Baird and Stacey 1991). Off the northeast U.S. coast, Risso's dolphins are distributed along the continental shelf edge from Cape Hatteras northward to Georges Bank during spring, summer, and autumn (CETAP 1982; Payne *et al*. 1984). In winter, the range is in the mid-Atlantic Bight and extends outward into oceanic waters (Payne *et al*. 1984). In general, the population occupies the mid-Atlantic continental shelf edge year round, and is rarely seen in the Gulf of Maine (Payne *et al*. 1984). During 1990, 1991 and 1993, spring/summer surveys conducted along the continental shelf edge and in deeper oceanic waters sighted Risso's dolphins associated with strong bathymetric features, Gulf Stream warm-core rings, and the Gulf Stream north wall (Waring *et al*. 1992, 1993; Hamazaki 2002). There is no information on stock structure of Risso's dolphin in the western North Atlantic, or to determine if separate stocks exist in the Gulf of Mexico and Atlantic. Thus, it is plausible the stock could actually contain multiple demographically independent populations that should themselves be stocks, because the current stock spans multiple eco-regions (Longhurst 1998; Spalding *et al*. 2007). In 2006, a rehabilitated adult male Risso's dolphin stranded and released in the Gulf of Mexico off Florida was tracked via satellite-linked tag to waters off Delaware (Wells *et al*. 2009). The Gulf of Mexico and Atlantic stocks are currently being treated as two separate stocks.

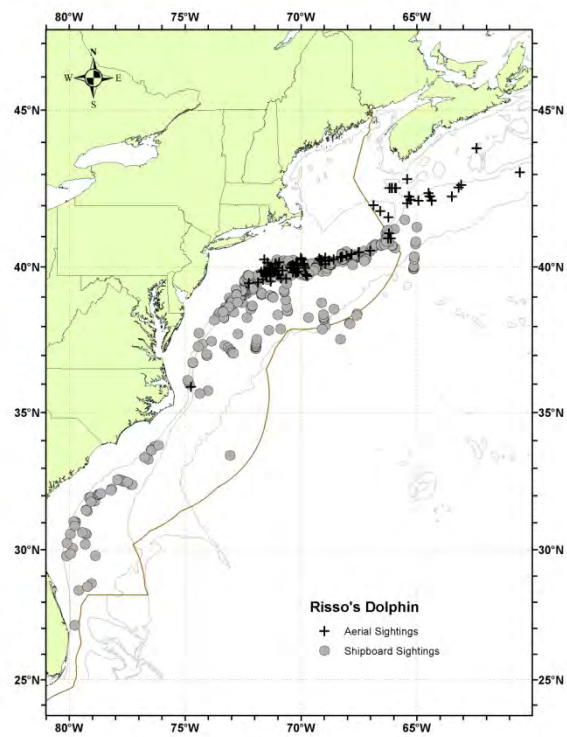

Figure 1. *Distribution of Risso's dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008 2010 and 2011. Isobaths are the 100-m, 1,000-m, and 4,000-m depth contours.*

POPULATION SIZE

Several abundance estimates are available for Risso's dolphins from selected regions for select time periods. Sightings were almost exclusively in continental shelf edge and continental slope areas (Figure 1). The best abundance estimate for Risso's dolphins is the sum of the 2011 surveys - 18,250 (CV = 0.46).

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions.

Recent surveys and abundance estimates

An abundance estimate of 14,408 (CV = 0.38) Risso's dolphins was obtained from an aerial survey conducted in August 2006, which covered 10,676 km of trackline in the region from the 2,000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; Palka, pers. comm.). The value of g(0) used for this estimation was derived from the pooled 2002, 2004 and 2006 aerial survey data.

An abundance estimate of 15,197 (CV = 0.55) Risso's dolphins was generated from a shipboard and aerial survey conducted during June–August 2011 (Palka 2012). The aerial portion that contributed to the abundance

estimate covered 5,313 km of tracklines that were over waters north of New Jersey from the coastline to the 100-m depth contour, through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in waters offshore of central Virginia to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Shipboard data were inspected to determine if there was significant responsive movement to the ship (Palka and Hammond 2001). Because there was evidence of responsive (evasive) movement of this species to the ship, estimation of the abundance was based on Palka and Hammond (2001) and the independent observer approach assuming full independence (Laake and Borchers 2004), and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

An abundance estimate of 3,053 (CV = 0.44) Risso's dolphins was generated from a shipboard survey conducted concurrently (June–August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed the double-platform methodology searching with 25× bigeye binoculars. A total of 4,445 km of tracklines was surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Table 1. Summary of abundance estimates for the western North Atlantic Risso's dolphin (*Grampus griseus*). Month, year, and area covered during each abundance survey, resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	14,408	0.38
Jun-Aug 2011	Central Virginia to lower Bay of Fundy	15,197	0.55
Jun-Aug 2011	Central Florida to Central Virginia	3,053	0.44
Jun-Aug 2011	Central Florida to lower Bay of Fundy (COMBINED)	18,250	0.46

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for Risso's dolphins is 18,250 (CV = 0.46), obtained from the 2011 surveys. The minimum population estimate for the western North Atlantic Risso's dolphin is 12,619.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al*. 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 12,619. The maximum productivity rate is 0.04, the default value for cetaceans (Barlow *et al.* 1995). The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because the CV of the average mortality estimate is less than 0.3 (Wade and Angliss 1997). PBR for the western North Atlantic stock of Risso's dolphin is 126.

ANNUAL HUMAN-CAUSED MORTALITY

Total annual estimated average fishery-related mortality or serious injury to this stock during 2008-2012 was 51 Risso's dolphins (CV = 0.27; Table 2).

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Detailed fishery information is reported in Appendix III.

Earlier Interactions

Prior to 1977, there was no documentation of marine mammal bycatch in distant-water fleet activities off the northeast coast of the U.S. With implementation of the Fisheries Conservation and Management Act in that year, an observer program was established which recorded fishery data and information on incidental bycatch of marine mammals. NMFS foreign-fishery observers reported four deaths of Risso's dolphins incidental to squid and mackerel trawling activities in the continental shelf and continental slope waters between March 1977 and December 1991 (Waring *et al.* 1990; NMFS unpublished data).

In the pelagic drift gillnet fishery 51 Risso's dolphin mortalities were observed between 1989 and 1998. One animal was entangled and released alive. Bycatch occurred during July, September and October along continental shelf edge canyons off the southern New England coast. Estimated annual mortality and serious injury (CV in parentheses) attributable to the drift gillnet fishery was 87 in 1989 (0.52), 144 in 1990 (0.46), 21 in 1991 (0.55), 31 in 1992 (0.27), 14 in 1993 (0.42), 1.5 in 1994 (0.16), 6 in 1995 (0), 0 in 1996, no fishery in 1997, and 9 in 1998 (0). This fishery was closed effective in 1999.

In the pelagic pair trawl fishery, one Risso's dolphin mortality was observed in 1992. Estimated annual fishery-related mortality (CV in parentheses) attributable to the pelagic pair trawl fishery was 0.6 dolphins in 1991 (1.0), 4.3 in 1992 (0.76), 3.2 in 1993 (1.0), 0 in 1994 and 3.7 in 1995 (0.45). This fishery ended as of 1996.

One Risso's dolphin mortality was observed in the mid-Atlantic gillnet fishery in 2007. The resulting estimated serious injury and mortality for 2007 was 34 (CV = 0.73).

Pelagic Longline

Pelagic longline bycatch estimates of Risso's dolphins for 2008—2011 were obtained from Garrison *et al.* (2009), Garrison and Stokes (2010), and Garrison and Stokes (2012a, 2012b). Most of the estimated marine mammal bycatch was from U.S. Atlantic EEZ waters between South Carolina and Cape Cod. Estimated annual fishery-related mortality (CV in parentheses) was 17 (0.73) in 2008, 11 (0.71) in 2009, 0 in 2010, 12 (0.63) in 2011, and 15 (1.0) in 2012. There is a high likelihood that dolphins released alive with ingested gear or gear wrapped around appendages will not survive (Wells *et al.* 2008). The annual average combined mortality and serious injury for 2008-2012 was 11 Risso's dolphins (0.41; Table 2).

Northeast Bottom Trawl

One Risso's dolphin was observed taken in northeast bottom trawl fisheries in 2010 (Table 2). This is the first time this species was observed taken in this fishery. New serious injury criteria were applied to all observed interactions retroactive back to 2007 (Waring *et al*. 2014). Estimated fishery-related serious injury and mortality values (CV in parentheses) were 2 (0.56) in 2008, 3 (0.53) in 2009, 2 (0.55) in 2010, 3 (0.55) in 2011, and 0 in 2012.

The 2008-2012 average annual serious injury and mortality attributed to the northeast bottom trawl was 2.0 animals (CV = 0.30; Table 2).

Mid-Atlantic Bottom Trawl

One Risso's dolphin was observed taken in mid-Atlantic bottom trawl fisheries in 2008, 15 in 2010, 2 in 2011, and 1 in 2012 (Table 2). New serious injury criteria were applied to all observed interactions retroactive back to 2007 (Waring *et al*. 2014). No seriously injured Risso's dolphins have been observed in this fishery. It was discovered in 2010 that a small segment of the mid-Atlantic bottom trawl feel was equipping fishing nets with acoustic deterrent devices (i.e., pingers). To the extent possible, the use of pingers on bottom trawl gear has been taken into account when estimating bycatch mortality of Risso's dolphins. The estimated annual fishery-related mortality and serious injury values attributable to the mid-Atlantic bottom trawl fishery (CV in parentheses) were 39 (0.69) in 2008, 23 (0.50) in 2009, 54 (0.74) in 2010, 62 (0.56) in 2011, and 7 (1.0) in 2012. The 2008-2012 average annual serious injury and mortality attributed to the mid-Atlantic bottom trawl was 37 animals (0.36; Table 2).

Northeast Sink Gillnet

In the northeast sink gillnet fishery, Risso's dolphin interactions were observed in 2000, 2005, 2006 and 2012. Estimated annual mortalities (CV in parentheses) from this fishery are: 0 in 1999, 15 (1.06) in 2000, 0 in 2001–2004, 15 in 2005 (0.93), 0 in 2006 through 2011 and 6 (0.87) in 2012 (Hatch and Orphanides 2014).

Mid-Atlantic Midwater Trawl

A Risso's dolphin mortality was observed in this fishery for the first time in 2008, and not again since. No bycatch estimate has been generated. Until this bycatch estimate can be developed, the 2008-2012 average annual serious injury and mortality attributed to the mid-Atlantic midwater trawl is calculated as 0.2 animals (1 animal/5 years).

Table 2. Summary of the incidental mortality of Risso's dolphin (*Grampus griseus*) by commercial fishery including the years sampled, the type of data used, the annual observer coverage, the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury, the estimated CV of the combined estimates and the mean of the combined estimates (CV in parentheses).

Fishery	Years	Data Type [a]	Observer Coverage [b]	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Combined Annual Mortality
Pelagic Longline [c]	08-12	Obs. Data Logbook	.07, .14, .08, .09, .07	2, 2, 0, 2, 1	0, 0, 0, 0, 0	17, 11, 0, 12, 15	0, 0, 0, 0. 0	17, 11, 0, 12, 15	.73, .71, 0, .63, 1.0	11 (0.41)
Northeast Sink Gillnet	08-12	Obs. Data, Trip Logbook, Allocated Dealer Data	.05, .04, .17, .19, .15	0, 0, 0, 0, 0	0, 0, 0, 0, 1	0, 0, 0, 0, 0	0, 0, 0, 0, 6	0, 0, 0, 0, 6	0, 0, 0, 0, .87	1.2 (0.87)
Northeast Bottom Trawl	08-12	Obs. Data Dealer Data VTR Data	.08, .09, .16, .26, .17	0, 0, 0, 0, 0	0, 0, 1, 0, 0	0, 0, 0, 0, 0	2, 3, 2, 3, 0	2, 3, 2, 3, 0	.56, .53, .55, .55, 0	2.0 (0.30)
Mid-Atlantic Bottom Trawl [d]	08-12	Obs. Data Dealer Data	.03. .05, .06, .08, .05	0, 0, 0, 0 , 0	1, 0, 15, 2, 1	0, 0, 0, 0 , 0	39, 23, 54, 62, 7	39, 23, 54, 62, 7	.69, .50, .74, .56, 1.0	37 (.36)
Mid-Atlantic Midwater Trawl - Including Pair Trawl [e]	08-12	Obs. Data Trip Logbook	.133, .132, .25, .41, .21	0,0,0,0,0	1,0, 0, 0, 0	na	na	na	na	0.2 (na)
TOTAL										51 (0.27)

[a] Observer data (Obs. Data) are used to measure bycatch rates and the data are collected within the Northeast Fisheries Observer Program. NEFSC collects landings data (unallocated Dealer Data and Allocated Dealer Data) which are used as a measure of total landings and mandatory Vessel Trip Reports (VTR) (Trip Logbook) are used to determine the spatial distribution of landings and fishing effort. Total landings are used as a measure of total effort for the coastal gillnet fishery.

[b] The observer coverages for the Northeast and mid-Atlantic sink gillnet fishery are ratios based on tons of fish landed. Northeast bottom trawl, mid-Atlantic bottom trawl, Northeast mid-water and mid-Atlantic mid-water trawl fishery coverages are ratios based on trips. Total observer coverage reported for gillnet and bottom trawl gear in the year 2010 includes samples collected from traditional fisheries observers in addition to fishery at-sea monitors through the Northeast Fisheries Observer Program (NEFOP). For 2010 only the NEFOP observed data were reported in this table, since the at-sea monitoring program just started in May 2010. Both at-sea monitor and traditional fisheries observer data were used for 2011 and 2012.

[c] Estimates can include data pooled across years, so years without observed SI or Mortality may still have an estimated value.

[d] Fishery related bycatch rates for 2012 were estimated using an annual stratified ratio-estimator using only data from 2012. The 2007-2011 estimates reported in the 2013 stock assessment report were generated using a different method, pooling observer data over the five year time period (2007-2011). Pooled stratified bycatch rates were applied to annual fishing effort data resulting in annual mortality estimates across the 2007-2011 time period.

[e] Estimates have not been generated for midwater trawl. Unexpanded values are provisionally provided.

Other mortality

From 2008 to 2012, 39 Risso's dolphin strandings were recorded along the U.S. Atlantic coast (NMFS unpublished data). Seven animals had indications of human interaction, four of which were fishery interactions. Indications of human interaction are not necessarily the cause of death (Table 3).

In eastern Canada, one Risso's dolphin stranding (unmarked by net entanglement or propeller scarring) was reported on Sable Island, Nova Scotia from 1970 to1998 (Lucas and Hooker 2000).

A Virginia Coastal Small Cetacean Unusual Mortality Event (UME) occurred along the coast of Virginia from 1 May to 31 July 2004, when 66 small cetaceans, including one Risso's dolphin, stranded mostly along the outer (eastern) coast of Virginia's barrier islands.

A Mid-Atlantic Offshore Small Cetacean UME was declared when 33 small cetaceans stranded from Maryland to Georgia between July and September 2004. The species involved are generally found offshore and are not expected to strand along the coast. Three Risso's dolphins were involved in this UME.

Table 3. Risso's dolphin (*Grampus griseus*) reported strandings along the U.S. Atlantic coast and Puerto Rico, 2008-2012.

STATE	2008	2009	2010	2011	2012	TOTALS
Maine	1	0	0	0	0	1
Massachusetts[a,d]	8	4	0	0	0	12
New York	0	0	0	1	0	1
New Jersey	0	1	0	0	0	1
Maryland	1	0	1	0	0	2
Virginia[b]	0	2	4	1	0	7
North Carolina[c]	1	3	2	1	2	9
Georgia	0	1	0	0	0	1
Florida	0	0	0	2	2	4
Puerto Rico	0	0	0	1	0	1
TOTAL	**11**	**11**	**7**	**6**	**4**	**39**

a. One of the 2009 animals had propeller wounds.

b. One of the 2009 animals showed signs of human interaction.

c. Two animals in 2009 showed signs of fishery interaction. One animal in 2010 was classified as human interaction. Two animals in 2012 showed signs of fishery interaction.

d. 2008 includes 4 animals mass stranded in Massachusetts, 3 of which were released alive.

Stranding data probably underestimate the extent of fishery-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore

necessarily show signs of entanglement or other fishery-interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interaction.

STATUS OF STOCK

Risso's dolphins are not listed as threatened or endangered under the Endangered Species Act and the Western North Atlantic stock is not considered strategic under the Marine Mammal Protection Act. The 2008-2012 average annual human-related mortality does not exceed PBR. The total U.S. fishery mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching a zero mortality and serious injury rate. The status of Risso's dolphins relative to OSP in the U.S. Atlantic EEZ is unknown. Population trends for this species have not been investigated.

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LONG-FINNED PILOT WHALE (*Globicephala melas melas*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

There are two species of pilot whales in the western Atlantic—the long-finned pilot whale, *Globicephala melas melas*, and the short-finned pilot whale, *G. macrorhynchus*. These species are difficult to differentiate at sea and cannot be reliably visually identified during either abundance surveys or observations of fishery mortality; therefore, the ability to separately assess the two species in U.S. Atlantic waters is complex and requires additional information on seasonal spatial distribution. The long-finned pilot whale is distributed from North Carolina to North Africa (and the Mediterranean) and north to Iceland, Greenland and the Barents Sea (Sergeant 1962; Leatherwood *et al.* 1976; Abend 1993; Bloch *et al.* 1993; Abend and Smith 1999). The stock structure of the North Atlantic population is uncertain (ICES 1993; Fullard *et al.* 2000). Morphometric (Bloch and Lastein 1993) and genetic (Siemann 1994; Fullard *et al.* 2000) studies have provided little support for stock separation across the Atlantic (Fullard *et al.* 2000). However, Fullard *et al.* (2000) have proposed a stock structure that is related to sea-surface temperature: 1) a cold-water population west of the Labrador/North Atlantic current, and 2) a warm-water population that extends across the Atlantic in the Gulf Stream.

In U.S. Atlantic waters, pilot whales (*Globicephala* sp.) are distributed principally along the continental shelf edge off the northeastern U.S. coast in winter and early spring (CETAP 1982; Payne and Heinemann 1993; Abend and Smith 1999; Hamazaki 2002). In late spring, pilot whales move onto Georges Bank and into the Gulf of Maine and more northern waters, and remain in these areas through late autumn (CETAP 1982; Payne and Heinemann 1993). Pilot whales tend to occupy areas of high relief or submerged banks. They are also associated with the Gulf Stream wall and thermal fronts along the continental shelf edge (Waring *et al.* 1992; NMFS unpublished data). Long-finned and short-finned pilot whales overlap spatially along the mid-Atlantic shelf break between New Jersey and the southern flank of Georges Bank (Payne and Heinemann 1993; NMFS unpublished data). Long-finned pilot whales have occasionally been observed stranded as far south as South Carolina, and short-finned pilot whales have occasionally been observed stranded as far north as Massachusetts. The latitudinal ranges of the two species therefore remain uncertain, although south of Cape Hatteras, most pilot whale sightings are expected to be short-finned pilot whales, while north of ~42°N most pilot whale sightings are expected to be long-finned pilot whales (Figure 1).

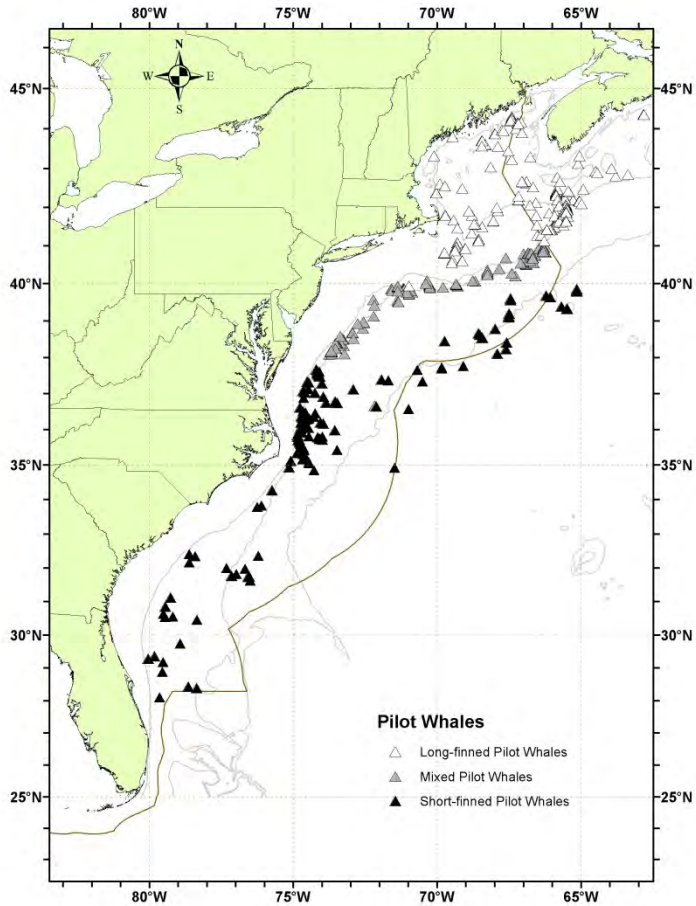

Figure 1. *Distribution of long-finned (open symbols), short-finned (black symbols), and possible mixed (gray symbols; could be either species) pilot whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1998, 1999, 2002, 2004, 2006, 2007 and 2011. The inferred distribution of the two species is preliminary and is valid for June-August only. Isobaths are the 100-m, 1,000-m, and 4,000-m depth contours.*

POPULATION SIZE

The best available estimate for long-finned pilot whales in the western North Atlantic is 26,535 (CV = 0.35; Table 1). This estimate is from summer 2006 aerial surveys covering waters from the southern Gulf of Maine to the upper Bay of Fundy and the Scotian Shelf (Palka 2006). The total number of long-finned pilot whales off the eastern U.S. and Canadian Atlantic coast is unknown, and this estimate does not include Canadian waters north of the Scotian Shelf or waters along the shelf break south of Georges Bank. Therefore, the current estimate is most likely an underestimate of the stock abundance. Because long-finned and short-finned pilot whales are difficult to distinguish at sea, sighting data are reported as *Globicephala* sp. Sightings from vessel and aerial surveys were strongly concentrated along the continental shelf break south of Georges Bank; however, pilot whales were also observed over the continental slope in waters associated with the Gulf Stream (Figure 1).

Earlier estimates

Please see appendix IV for a summary of abundance estimates including earlier estimates and survey descriptions. Due to changes in survey methodology, these historical data should not be used to make comparisons with more current estimates.

Recent surveys and abundance estimates for *Globicephala* sp.

An abundance estimate of 26,535 (CV = 0.35) *Globicephala* sp. was obtained from an aerial survey conducted in August 2006, which covered 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; NMFS 2006; NMFS unpublished data). This survey covered habitats that are expected to exclusively contain long-finned pilot whales.

An imprecise abundance estimate of 16,058 (CV = 0.79) pilot whales was generated from the Canadian Trans-North Atlantic Sighting Survey (TNASS) in July-August 2007 (Lawson and Gosselin 2011). This aerial survey covered the area from northern Labrador to the Scotian Shelf, providing full coverage of the Atlantic Canadian coast. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). Estimates from this survey were corrected using the g(0) values obtained from the integration of perception and availability biases (Tables 1 and 2 in Lawson and Gosselin 2011), or using g(0) values from Palka (unpubl. data) (Lawson and Gosselin 2011). This survey covered habitats expected to contain long-finned pilot whales exclusively.

An abundance estimate of 11,865 (CV = 0.57) *Globicephala sp.* was generated from aerial and shipboard surveys conducted during June-August 2011 between central Virginia and the lower Bay of Fundy. The aerial portion covered 6,850 km of tracklines over waters north of New Jersey between the coastline and the 100-m depth contour through the U.S. and Canadian Gulf of Maine, and up to and including the lower Bay of Fundy. Pilot whales were not observed during the aerial portion of the survey. The shipboard portion covered 3,811 km of tracklines between central Virginia and Massachusetts in waters deeper than the 100-m depth contour out to beyond the U.S. EEZ. Both sighting platforms used a double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). The vessel portion of this survey included habitats where both short-finned and long-finned pilot whales occur. The estimated abundance of long-finned pilot whales from this survey was 5,636 (CV=0.63).

An abundance estimate of 16,946 (CV = 0.43) *Globicephala* sp. was generated from a shipboard survey conducted concurrently (June-August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25× bigeye binoculars. A total of 4,445 km of tracklines was surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break north of Cape Hatteras, North Carolina, with a lower number of sightings over the continental slope in the southern portion of the survey. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). This survey included habitats where only short-finned pilot whales are expected to occur.

Spatial Distribution and Abundance Estimates for *Globicephala melas*

Biopsy samples from pilot whales were collected during summer months (June-August) from South Carolina to the southern flank of Georges Bank between 1998 and 2007. These samples were identified to species using genetic analysis of mitochondrial DNA sequences. A portion of the mtDNA genome was sequenced from each biopsy sample collected in the field, and genetic species identification was performed through phylogenetic reconstruction of the haplotypes. Stranded specimens that were morphologically identified to species were used to assign clades in the phylogeny to species and thereby identify all samples. The probability of a sample being from a long-finned (or short-finned) pilot whale was evaluated as a function of sea-surface temperature and water depth using logistic regression. This analysis indicated that the probability of a sample coming from a long-finned pilot whale was near 1 at water temperatures <22°C, and near 0 at temperatures >25°C. The probability of a long-finned pilot whale also decreased with increasing water depth. Spatially, during summer months, this regression model predicts that all pilot whales observed in offshore waters near the Gulf Stream are most likely short-finned pilot whales. The area of overlap between the 2 species occurs primarily along the shelf break off the coast of New Jersey between 38°N and 40°N latitude. This habitat model was used to partition the abundance estimates from surveys conducted during the summer of 2011. The sightings from the southeast shipboard survey covering waters from Florida to central Virginia were predicted to consist entirely of short-finned pilot whales. The aerial portion of the northeast surveys covered the Gulf of Maine and the Bay of Fundy and surveys where the model predicted that only long-finned pilot whales would occur, but no pilot whales were observed. The vessel portion of the northeast survey recorded a mix of both species along the shelf break, and the sightings in offshore waters near the Gulf Stream were predicted to consist predominantly of short-finned pilot whales. The abundance estimate for long-finned pilot whales from the northeast summer 2011 vessel survey was 5,636 (CV = 0.63; NMFS unpublished data). The summer 2011 aerial survey of the Gulf of Maine to the Bay of Fundy did not include areas of the Scotian Shelf where the highest densities of pilot whales were observed in the summer of 2006, therefore the 2011 summer surveys are a poor representation of the overall abundance of this stock. The abundance estimate from the summer 2006 survey is the best available estimate and is expected to exclusively represent long-finned pilot whales based on the results of the logistic regression model. While this estimate represents animals primarily in Canadian waters during the summer months, it reflects the abundance of the stock which moves into U.S. waters of the Gulf of Maine during other times of the year and thus interacts with U.S. fisheries. The best available estimate for the stock is therefore 26,535 (CV = 0.35). This is an underestimate of the total abundance of long-finned pilot whales in U.S. waters as it does not include estimates from the shelf break south of Georges Bank or waters north of the Scotian Shelf.

Table 1. Summary of abundance estimates for the western North Atlantic long-finned pilot whale by month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	26,535	0.35
July-Aug 2007	N. Labrador to Scotian Shelf	16,058	0.79
Jun-Aug 2011	central Virginia to Lower Bay of Fundy	5,636	0.63

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for western North Atlantic long-finned pilot whales is 26,535 animals (CV = 0.35). This reflects the abundance of the stock in Canadian waters during summer months; however, the stock moves into U.S. waters during other times of year when it interacts with U.S. fisheries. The minimum population estimate for long-finned pilot whales is 19,930.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha=0.30) unless surveys are conducted on an annual basis (Taylor *et al.*

2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for long-finned pilot whales is 19,930. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because the CV of the average mortality estimate is less than 0.3 (Wade and Angliss 1997). PBR for the western North Atlantic long-finned pilot whale is 199.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual observed average fishery-related mortality or serious injury during 2008-2012 was 35 long-finned pilot whales (CV=0.15; Table 2). The highest bycatch rates of undifferentiated pilot whales in the pelagic longline fishery were observed during September-October along the mid-Atlantic coast (Garrison 2007). Biopsy samples and photo-identification data collected during October-November 2011 in this region indicated that all of the animals observed within the region of pelagic longline bycatch during these months were short-finned pilot whales (NMFS unpublished data). During the remainder of the year, pilot whale bycatch in the pelagic longline fishery was likewise restricted to waters where short-finned pilot whales are expected to occur almost exclusively. Therefore, it is likely that the bycatch of pilot whales in the pelagic longline fishery is restricted to short-finned pilot whales. In bottom trawls and mid-water trawls and in the gillnet fisheries, mortalities are more generally observed north of 40°N latitude and in areas expected to have a higher proportion of long-finned pilot whales. Takes in these fisheries were examined individually using model-based predictions, and in all cases these animals were assigned as long-finned pilot whales.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Detailed fishery information is reported in Appendix III. Total fishery-related mortality and serious injury cannot be estimated separately for the two species of pilot whales in the U.S. Atlantic EEZ because of the uncertainty in species identification by fishery observers. The Atlantic Scientific Review Group advised adopting the risk-averse strategy of assuming that either species might have been subject to the observed fishery-related mortality and serious injury.

Earlier Interactions

Prior to 1977, there was no documentation of marine mammal bycatch in distant-water fleet (DWF) activities off the northeastern coast of the U.S. A fishery observer program, which has collected fishery data and information on incidental bycatch of marine mammals, was established in 1977 with the implementation of the Fisheries Conservation and Management Act (FCMA).

During 1977-1991, observers in this program recorded 436 pilot whale mortalities in foreign-fishing activities (Waring *et al.* 1990; Waring 1995). A total of 391 pilot whales (90%) was taken in the mackerel fishery, and 41 (9%) occurred during *Loligo* and *Illex* squid-fishing operations. This total includes 48 documented takes by U.S. vessels involved in joint-venture fishing operations. Two animals were also caught in both the hake and tuna longline fisheries (Waring *et al.* 1990).

Between 1989 and 1998, 87 mortalities were observed in the large pelagic drift gillnet fishery. The annual fishery-related mortality (CV in parentheses) was 77 in 1989 (0.24), 132 in 1990 (0.24), 30 in 1991 (0.26), 33 in 1992 (0.16), 31 in 1993 (0.19), 20 in 1994 (0.06), 9.1 in 1995 (0), 11 in 1996 (0.17), no fishery in 1997 and 12 in 1998 (0). This fishery was permanently closed in 1999.

Five pilot whale (*Globicephala* sp.) mortalities were reported in the self-reported fisheries information for the Atlantic tuna pair trawl in 1993. In 1994 and 1995 observers reported 1 and 12 mortalities, respectively. The estimated fishery-related mortality to pilot whales in the U.S. Atlantic attributable to this fishery in 1994 was 2.0 (CV=0.49) and 22 (CV=0.33) in 1995.

Two interactions with pilot whales in the Atlantic tuna purse seine fishery were observed in 1996. In 1 interaction, the net was pursed around 1 pilot whale, the rings were released and the animal escaped alive, condition unknown. This set occurred east of the Great South Channel and just north of the Cultivator Shoals region on Georges Bank. In a second interaction, five pilot whales were encircled in a set. The net was opened prior to pursing to let the whales swim free, apparently uninjured. This set occurred on the Cultivator Shoals region on Georges Bank. No trips were observed during 1997 through 1999. Four trips were observed in September 2001, with no marine mammals observed taken during these trips.

No pilot whales were taken in observed mid-Atlantic coastal gillnet trips during 1993-1997. One pilot whale was observed taken in 1998, and none were observed taken during 1999-2003. Observed effort was scattered between New York and North Carolina from 1 to 50 miles off the beach. All bycatches were documented during January to April. Using the observed takes, the estimated annual mortality attributed to this fishery was 7 (CV=1.10) in 1998.

One pilot whale take was observed in the *Illex* squid portion of the southern New England/mid-Atlantic squid, mackerel, butterfish trawl fisheries in 1996 and 1 in 1998. The estimated fishery-related mortality to pilot whales in the U.S. Atlantic attributable to this fishery was 45 in 1996 (CV=1.27), 0 in 1997, 85 in 1998 (CV=0.65) and 0 in 1999. However, these estimates should be viewed with caution due to the extremely low (<1%) observer coverage. After 1999 this fishery was included as a component of the mid-Atlantic bottom trawl fishery.

One pilot whale take was observed in the *Loligo* squid portion of the southern New England/mid-Atlantic squid, mackerel, butterfish trawl fisheries in 1999. The estimated fishery-related mortality to pilot whales in the U.S. Atlantic attributable to this fishery was 0 between 1996 and 1998, and 49 in 1999 (CV=0.97). However, these estimates should be viewed with caution due to the extremely low (<1%) observer coverage. After 1999 this fishery was included as a component of the mid-Atlantic bottom trawl fishery.

There was 1 observed take in the southern New England/mid-Atlantic bottom trawl fishery reported in 1999. The estimated fishery-related mortality for pilot whales attributable to this fishery was 0 in 1996-1998, and 228 (CV=1.03) in 1999. After 1999 this fishery was included as a component of the mid-Atlantic bottom trawl fishery.

A U.S. joint venture (JV) mid-water (pelagic) trawl fishery was conducted on Georges Bank from August to December 2001. Eight pilot whales were incidentally captured in a single mid-water trawl during JV fishing operations. Three pilot whales were incidentally captured in a single mid-water trawl during foreign fishing operations (TALFF).

Seven pilot whales were observed taken in the mid-Atlantic bottom trawl fishery during 2000-2006. No pilot whales were observed taken during 2007-2012. The estimated fishery-related mortality to pilot whales in the U.S. Atlantic attributable to this fishery was: 47 (CV = 0.32) in 2000, 39 (CV = 0.31) in 2001, 38 (CV = 0.36) in 2002, 31 (CV = 0.31) in 2003, 35 (CV = 0.33) in 2004, 31 (CV = 0.31) in 2005, 37 (CV = 0.34) in 2006, 36 (CV = 0.38) in 2007, 0 in 2008-2012. Fishery related bycatch rates for years 2008-2012 were estimated using an annual stratified ratio-estimator. These mortality estimates replace the 2008-2011 annual estimates reported in the 2013 stock assessment report that were generated using a different method.

In March 2007 a pilot whale was observed bycaught in the single mid-water fishery south of Rhode Island in a haul targeting herring. Estimated annual fishery-related mortalities was 12.1 (CV = 0.99) in 2007.

For more details on earlier fishery interactions see Waring *et al.* (2007).

Northeast Sink Gillnet

One pilot whale was caught in this fishery in 2010. According to modeled species distribution, this whale was a long-finned pilot whale. The expanded bycatch estimate was 3 (0.82) in 2010, resulting in a 2008-2012 annual average serious injury and mortality of 0.6 (0.82).

Pelagic Longline

Most of the estimated marine mammal bycatch in the U.S. pelagic longline fishery was recorded in U.S. Atlantic EEZ waters between South Carolina and Cape Cod (Garrison 2007). Pilot whales are frequently observed to

feed on hooked fish, particularly big-eye tuna (NMFS unpublished data). Between 1992 and 2012, 204 pilot whales were released alive, including 123 that were considered seriously injured, and 6 mortalities were observed (Johnson *et al.* 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; Garrison and Stokes 2012a; Garrison and Stokes 2012b, Garrison and Stokes 2013). January-March bycatch was concentrated on the continental shelf edge northeast of Cape Hatteras. Bycatch was recorded in this area during April-June, and takes also occurred north of Hydrographer Canyon in water over 1,000 fathoms (1830 m) deep during April-June. During the July-September period, takes occurred on the continental shelf edge east of Cape Charles, Virginia, and on Block Canyon slope in over 1,000 fathoms of water. October-December bycatch occurred between the 20- and 50-fathom (37- and 92-m) isobaths between Barnegat Bay and Cape Hatteras. Available seasonal biopsy data and genetic analyses indicate that pilot whale bycatch in the pelagic longline fishery is restricted to short-finned pilot whales, therefore the mortality and serious injury due to the pelagic longline fishery is not included in the estimated mortality of the long-finned pilot whale.

Northeast Bottom Trawl

New serious injury criteria were applied to all observed interactions retroactive to 2007 (Waring *et al.* 2014). Observed serious injuries and mortalities of pilot whales included 5 in 2008, 3 in 2009, 10 in 2010, 12 in 2011, and 10 in 2012. In addition to takes observed by fisheries observers, the Marine Mammal Authorization Program (MMAP) included 2 self-reported incidental takes (mortalities) of pilot whales in bottom trawl gear off Maine and Massachusetts during 2008, and 2 self-reported incidental takes (mortalities) in trawl gear off Maine and Rhode Island during 2011. These reports do not contribute to the estimate of mortality from the observer program. The estimated fishery-related serious injury and mortality to pilot whales in the U.S. Atlantic attributable to this fishery was: 21 (CV = 0.51) in 2008, 13 (CV = 0.70) in 2009, 30 (CV = 0.43) in 2010, 55 (CV = 0.18) in 2011, and 33 (CV = 0.32) in 2012. Fishery related bycatch rates for years 2008-2012 were estimated using an annual stratified ratio-estimator. These mortality estimates replace the 2008-2011 annual estimates reported in the 2013 stock assessment report that were generated using a different method described in Rossman 2010. The 2008–2012 average mortality attributed to the Northeast bottom trawl was 31 animals (CV = 0.16; Table 2).

Northeast Mid-Water Trawl (Including Pair Trawl)

In April 2008, six pilot whale takes were observed in the single mid-water trawl fishery in hauls targeting mackerel and located on the southern edge of Georges Bank. In September 2011, one pilot whale was taken in the mid-water trawl fishery on the northern flank of Georges Bank. Another pilot whale was taken in Northeast mid-water trawl in 2012. Using model-based predictions, these takes have all been assigned as long-finned pilot whales. Due to small sample sizes, the ratio method was used to estimate the bycatch rate (observed takes per observed hours the gear was in the water) for each year, where the paired and single Northeast mid-water trawls were pooled and only hauls that targeted herring or mackerel were used. The VTR herring and mackerel data were used to estimate the total effort (NMFS unpublished data). Estimated annual fishery-related mortalities were 16 (CV = 0.61) in 2008 and 0 in 2009 to 2010 (Table 2). Expanded estimates of fishery mortality for 2011 and 2012 are not available, and so for those years the raw number is provided. The average annual estimated mortality during 2008-2012 was 3.6 (CV = 0.61; Table 2).

CANADA

Unknown numbers of long-finned pilot whales have also been taken in Newfoundland, Labrador, and Bay of Fundy groundfish gillnets; Atlantic Canada and Greenland salmon gillnets; and Atlantic Canada cod traps (Read 1994).

Between January 1993 and December 1994, 36 Spanish deep-water trawlers, covering 74 fishing trips (4,726 fishing days and 14,211 sets), were observed in NAFO Fishing Area 3 (off the Grand Banks) (Lens 1997). A total of 47 incidental catches was recorded, which included 1 long-finned pilot whale. The incidental mortality rate for pilot whales was 0.007/set.

In Canada, the fisheries observer program places observers on all foreign fishing vessels, on between 25% and 40% of large Canadian vessels (greater than 100 ft), and on approximately 5% of small vessels (Hooker *et al.* 1997). Fishery observer effort off the coast of Nova Scotia during 1991-1996 varied on a seasonal and annual basis, reflecting changes in fishing effort (see Figure 3, Hooker *et al.* 1997). During the 1991-1996 period, long-finned pilot whales were bycaught (number of animals in parentheses) in bottom trawl (65); midwater trawl (6); and longline (1) gear. Recorded bycatches by year were: 16 in 1991, 21 in 1992, 14 in 1993, 3 in 1994, 9 in 1995 and 6 in 1996. Pilot whale bycatches occurred in all months except January-March and September (Hooker *et al.* 1997).

There was 1 record of incidental catch in the offshore Greenland halibut fishery that involved 1 long-finned pilot whale in 2001; no expanded bycatch estimate was calculated (Benjamins *et al.* 2007).

Table 2. Summary of the incidental mortality and serious injury of long-finned pilot whales (*Globicephala melas*) by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Est. CVs) and the mean of the combined estimates (CV in parentheses). These are minimum observed counts as expanded estimates are not available.

Fishery	Years	Data Type[a]	Observer Coverage	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Est. CVs	Mean Annual Mortality
Northeast Sink Gillnet	08-12	Obs. Data, Logbook, Dealer Data	.05, .04, .17, .19, .15	0, 0, 0, 0, 0	0, 0, 1, 0, 0	0, 0, 0, 0, 0	0, 0, 3, 0, 0	0, 0, 3, 0, 0	0, 0, .82, 0, 0	0.6 (.82)
Northeast Bottom Trawl [b]	08-12	Obs. Data Logbook	.08, .09, .16, .26, .17	0,2,1,3,3	5,1,9,9, 7	4, 3, 6, 12, 10	17, 10, 24, 43, 23	21, 13, 30, 55, 33	.51, .70, .43, .18, .32	31 (.16)
Northeast Mid-Water Trawl - Including Pair Trawl [c]	08-12	Obs. Data Dealer Data VTR Data	.20, .42, .41, .17, .45	0,0,0,0,0	6,0,0,1, 1	0,0,0,0,0	16,0,0, 1, 1	16,0,0, 1, 1	.61,0,0, na, na	3.6 (.61)
TOTAL										35 (0.15)

[a] Observer data (Obs. Data) are used to measure bycatch rates and the data are collected within the Northeast Fisheries Observer Program (NEFOP) and the Southeast Pelagic Longline Observer Program. The NEFOP collects landings data (Weighout), and total landings are used as a measure of total effort for the coastal gillnet fishery. Total observer coverage reported for gillnet and bottom trawl gear in the years 2010-2012 includes samples collected from traditional fisheries observers in addition to fishery at-sea monitors. For 2010 only the NEFOP observed data were reported in this table, since the at-sea monitoring program just started in May 2010.

[b] Fishery related bycatch rates for years 2008-2012 were estimated using an annual stratified ratio-estimator. These estimates replace the 2008-2011 annual estimates reported in the 2013 stock assessment report that were generated using a different method.

[c] The paired and single trawl data were pooled. Ratio estimation methods were used within each year to estimate the total the annual bycatch. Expanded estimates for 2011 or 2012 are not available for these fisheries.

Other Mortality

Pilot whales have a propensity to mass strand throughout their range, but the role of human activity in these events is unknown. Between 2 and 168 pilot whales have stranded annually, either individually or in groups, along the eastern U.S. seaboard since 1980 (NMFS 1993, stranding databases maintained by NMFS NER, NEFSC and SEFSC). From 2008 to 2012, 46 short-finned pilot whales (*Globicephala macrorhynchus*), 37 long-finned pilot whales (*Globicephala melas melas*), and 7 pilot whales not specified to the species level (*Globicephala* sp.) were reported stranded between Maine and Florida, including the Exclusive Economic Zone (EEZ) (Table 3).

Long-finned pilot whales have been reported stranded as far south as Florida, where 2 long-finned pilot whales were reported stranded in Florida in November 1998, though their flukes had been apparently cut off, so it is unclear where these animals actually may have died. One additional long-finned pilot whale stranded in South Carolina in 2003, though the confidence in the species identification was only moderate. A genetic sample from this animal has subsequently been sequenced and mitochondrial DNA analysis supports the long-finned pilot whale identification.

During 2008-2012, several human and/or fishery interactions were documented in stranded pilot whales. In 2008, 1 Massachusetts stranding mortality was deemed a fishery interaction due to line markings and cut flukes. Also in 2008, 2 of the New York strandings of long-finned pilot whales were classified as human interactions. One

long-finned pilot whale that stranded in Massachusetts in 2009 was classified as a fishery interaction because it had a piece of monofilament line in its stomach.

Two long-finned pilot whale stranding mortalities in 2011 in Massachusetts were classified as human interaction cases, one due to onlookers trying to refloat animal, and another with tow rope around the tail most likely tied on postmortem.

Table 3. Pilot whale (*Globicephala macrorhynchus* [SF], *Globicephala melas melas* [LF] *and Globicephala* sp. [Sp]) strandings along the Atlantic coast, 2008-2012. Strandings which were not reported to species have been reported as *Globicephala* sp. The level of technical expertise among stranding network personnel varies, and given the potential difficulty in correctly identifying stranded pilot whales to species, reports to specific species should be viewed with caution.

STATE	2008			2009			2010			2011			2012			TOTALS		
	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp
Nova Scotia[a]	0	0	0	0	0	15	0	0	11	0	0	19	0	0	3	0	0	48
Newfoundland and Labrador[b]	0	0	2	0	0	1	0	0	1	0	0	8	0	0	6	0	0	18
Maine	0	1	0	0	3	0	0	0	0	0	1	0	0	1	0	0	6	0
Massachusetts[c]	0	1	0	0	4	0	0	2	0	3	4	0	0	3	0	3	14	0
Rhode Island	0	2	0	0	2	0	0	0	0	0	2	0	0	0	0	0	6	0
New York	0	5	0	0	1	0	0	0	0	0	1	0	0	1	0	0	8	0
New Jersey	0	1	0	1	1	0	0	0	0	1	0	1	0	0	0	2	2	1
Delaware	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Virginia[d]	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	1	2
North Carolina[d]	3	0	1	2	0	0	1	0	0	1	0	0	1	0	0	8	0	1
South Carolina[d]	0	0	1	0	0	0	0	0	1	0	0	0	3	0	1	3	0	3
Florida[e]	0	0	0	0	0	0	4	0	0	2	0	0	23	0	0	29	0	0
TOTALS - U.S. & EEZ	3	10	2	4	11	0	5	2	3	7	8	1	27	6	1	46	37	7

[a] Data supplied by Nova Scotia Marine Animal Response Society (pers. comm.). Strandings in 2011 include one mass stranding on 6-8 whales (one of which died) and two animals with ropes tied around their tail stocks.

[b] (Ledwell and Huntington 2009, 2010, 2011, 2012, 2013). 2011 included 2 mom/calf pairs. Not included in 2011 total was group of 6 pilot whales shepherded out of a narrow channel.

[c] One of the 2009 animals was classified as a fishery interaction. One of the 2010 animals released alive.

[d] Signs of fishery interaction observed on a short-finned pilot whale stranded in North Carolina Feb 2010. Signs of fishery interaction observed on one short-finned pilot whale in North Carolina and two in South Carolina in 2012.

[e] One of the 2010 animals released alive.

In eastern Canada, 37 strandings of long-finned pilot whales (173 individuals) were reported on Sable Island, Nova Scotia, from 1970 to 1998 (Lucas and Hooker 2000). This included 130 animals that mass stranded in December 1976, and 2 smaller groups (<10 each) in autumn 1979 and summer 1992. Fourteen strandings were also recorded along Nova Scotia in 1991-1996 (Hooker *et al.* 1997). Several live mass-strandings occurred in Nova Scotia, including 14 in 2000, 3 in 2001 in Judique, Inverness County, and 4 at Point Tupper, Inverness County, in 2002, though no specification to species was made.

Mass strandings of long-finned pilot whales were more frequent several decades ago in Newfoundland (Table

4). Recent Newfoundland and Labrador strandings are reported in Table 3.

Table 4. Pilot whale mass strandings along the Newfoundland, Canada coast.

Year	Date	Number of Pilot Whales Stranded	Place in Newfoundland
1979	July 14	135	Pt. au Gaul
1980	October 19	70	Pt. Leamington
	October 25	18	Grand Beach
1982	July 27	23	Grand Bank
	August 18	3	Bonavista
1983	early January	10	Piccadilly
1984	July 15	5	Middle Cove
1990	December 14	4	St. Anthony

Stranding data probably underestimate the extent of fishery-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other fishery interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interaction.

A potential human-caused source of mortality is from polychlorinated biphenyls (PCBs) and chlorinated pesticides (DDT, DDE, dieldrin, etc.), moderate levels of which have been found in pilot whale blubber (Taruski *et al.* 1975; Muir *et al.* 1988; Weisbrod *et al.* 2000). Weisbrod *et al.* (2000) reported that bioaccumulation levels were more similar in whales from the same stranding group than animals of the same sex or age. Also, high levels of toxic metals (mercury, lead, cadmium) and selenium were measured in pilot whales harvested in the Faroe Island drive fishery (Nielsen *et al.* 2000). Similarly, Dam and Bloch (2000) found very high PCB levels in pilot whales in the Faroes. The population effect of the observed levels of such contaminants is unknown.

STATUS OF STOCK

The long-finned pilot whale is not listed as threatened or endangered under the Endangered Species Act, and the western North Atlantic stock is not considered strategic under the Marine Mammal Protection Act. The total U.S. fishery-related mortality and serious injury for long-finned pilot whales does not exceed PBR. The total U.S. fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. The status of this stock relative to OSP in the U.S. Atlantic EEZ is unknown. There are insufficient data to determine the population trends for this stock.

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SHORT-FINNED PILOT WHALE (*Globicephala macrorhynchus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

There are 2 species of pilot whales in the western North Atlantic - the long-finned pilot whale, *Globicephala melas melas*, and the short-finned pilot whale, *G. macrorhynchus*. These species are difficult to differentiate at sea and cannot be reliably visually identified during either abundance surveys or observations of fishery mortality; therefore, the ability to separately assess the 2 species in U.S. Atlantic waters is complex and requires additional information on seasonal spatial distribution. Undifferentiated pilot whales (*Globicephala* sp.) in the western North Atlantic occur primarily near the continental shelf break ranging from Florida to the Nova Scotia Shelf (Mullin and Fulling 2003). Long-finned and short-finned pilot whales overlap spatially along the mid-Atlantic shelf break between New Jersey and the southern flank of Georges Bank (Payne and Heinemann 1993; NMFS unpublished data). Long-finned pilot whales have occasionally been observed stranded as far south as South Carolina, and short-finned pilot whales have occasionally been observed stranded as far north as Massachusetts. The latitudinal ranges of the two species therefore remain uncertain, although south of Cape Hatteras, most pilot whale sightings are expected to be short-finned pilot whales, while north of ~42°N most pilot whale sightings are expected to be long-finned pilot whales (Figure 1). In addition, short-finned pilot whales are documented along the continental shelf and continental slope in the northern Gulf of Mexico (Hansen *et al.* 1996; Mullin and Hoggard 2000; Mullin and Fulling 2003), and they are also known from the wider Caribbean. A May 2011 mass stranding of 23 short-finned pilot whales in the Florida keys has been considered to be Gulf of Mexico stock whales based on stranding location, yet two tagged and released individuals from this stranding travelled directly into the Atlantic (Wells et al. 2013). Studies are currently being conducted at the Southeast Fisheries Science Center to evaluate genetic population structure in short-finned pilot whales. Pending these results, the *Globicephala macrorhynchus* population occupying U.S. Atlantic waters is considered separate from both the northern Gulf of Mexico stock and short-finned pilot whales occupying Caribbean waters.

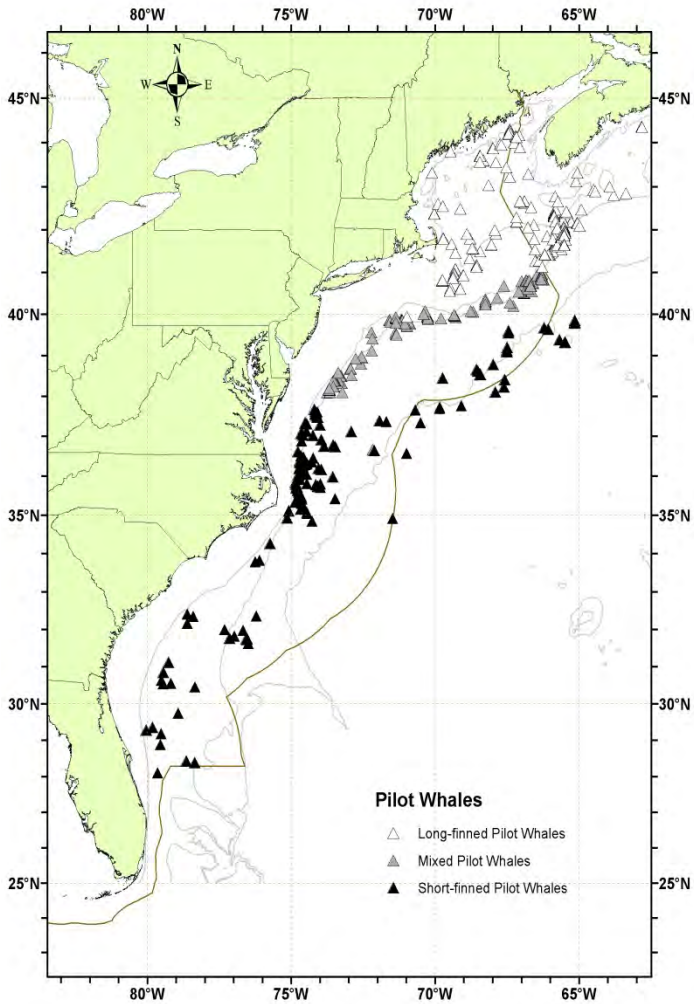

Figure 1. *Distribution of long-finned (open symbols), short-finned (black symbols), and possibly mixed (gray symbols; could be either species) pilot whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1998, 1999, 2002, 2004, 2006, 2007 and 2011. The inferred distribution of the two species is preliminary and is valid for June-August only. Isobaths are the 100-m, 1,000-m, and 4,000-m depth contours.*

POPULATION SIZE

The best available estimate for short-

finned pilot whales in the western North Atlantic is 21,515 (CV=0.37; Table 1). This estimate is from summer 2011 surveys covering waters from central Florida to the lower Bay of Fundy. Because long-finned and short-finned pilot whales are difficult to distinguish at sea, sightings data are reported as *Globicephala sp.* Sightings from vessel and aerial surveys were strongly concentrated along the continental shelf break; however, pilot whales were also observed over the continental slope in waters associated with the Gulf Stream (Figure 1). Combined abundance estimates for the 2 species have previously been derived from line transect surveys. The best available abundance estimates are from aerial and shipboard surveys conducted during the summer of 2011 because these are the most recent surveys covering the full range of pilot whales in U.S. Atlantic waters. These survey data have been combined with an analysis of the spatial distribution of the 2 species based on genetic analyses of biopsy samples to derive separate abundance estimates (NMFS unpublished data).

Earlier Estimates

Please see appendix IV for a summary of abundance estimates including earlier estimates and survey descriptions. Due to changes in survey methodology, these historical data should not be used to make comparisons with more current estimates.

Recent surveys and abundance estimates for *Globicephala* sp.

An abundance estimate of 26,535 (CV=0.35) *Globicephala* sp. was obtained from an aerial survey conducted in August 2006 that covered 10,676 km of trackline in the region from the 2,000-m depth contour on the southern edge of Georges Bank north to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; NMFS unpublished data). This survey covered habitats that are expected to exclusively contain long-finned pilot whales.

An abundance estimate of 6,134 (95% CI=2,774-10,573) pilot whales was generated from the Canadian Trans North Atlantic Sighting Survey (TNASS) in July-August 2007. This aerial survey covered the area from northern Labrador to the Scotian Shelf, providing full coverage of the Atlantic Canadian coast. Estimates from this survey have not yet been corrected for availability and perception biases (Lawson and Gosselin 2009). This survey covered habitats that are expected to exclusively contain long-finned pilot whales.

An abundance estimate of 11,865 (CV=0.57) *Globicephala* sp. was generated from aerial and shipboard surveys conducted during June-August 2011 between central Virginia and the lower Bay of Fundy. The aerial portion covered 6,850 km of tracklines over waters north of New Jersey between the coastline and the 100-m depth contour through the U.S. and Canadian Gulf of Maine, and up to and including the lower Bay of Fundy. Pilot whales were not observed during the aerial portion of the survey. The shipboard portion covered 3,811 km of tracklines between central Virginia and Massachusetts in waters deeper than the 100-m depth contour out to beyond the U.S. EEZ. Both sighting platforms used a double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). The vessel portion of this survey included habitats where both short-finned and long-finned pilot whales occur. The estimated abundance of short-finned pilot whales from this survey was 4,569 (CV=0.57).

An abundance estimate of 16,946 (CV=0.43) *Globicephala* sp. was generated from a shipboard survey conducted concurrently (June-August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25x bigeye binoculars. A total of 4,445 km of tracklines was surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break north of Cape Hatteras, North Carolina, with a lower number of sightings over the continental slope in the southern portion of the survey. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). This survey included habitats that are expected to exclusively contain short-finned pilot whales.

Spatial Distribution and Abundance Estimates for *Globicephala macrorhynchus*

Pilot whale biopsy samples were collected during summer months (June-August) from South Carolina to the southern flank of Georges Bank between 1998 and 2007. These samples were identified to species using genetic analysis of mitochondrial DNA sequences. A portion of the mtDNA genome was sequenced from each biopsy sample collected in the field, and genetic species identification was performed through phylogenetic reconstruction of the haplotypes. Samples from stranded specimens that were morphologically identified to species were used to assign clades in the phylogeny to species and thereby identify all survey samples. The probability of a sample being

from a short-finned (or long-finned) pilot whale was evaluated as a function of sea surface temperature and water depth using logistic regression. This analysis indicated that the probability of a sample coming from a short-finned pilot whale was near 0 at water temperatures <22°C, and near 1 at temperatures >25°C. The probability of a short-finned pilot whale also increased with increasing water depth. Spatially, during summer months, this regression model predicts that all pilot whales observed in offshore waters near the Gulf Stream are most likely short-finned pilot whales. The area of overlap between the 2 species occurs primarily along the shelf break off the coast of New Jersey between 38°N and 40°N latitude. This model was used to partition the abundance estimates from surveys conducted during the summer of 2011. The sightings from the southeast shipboard survey covering waters from Florida to central Virginia were predicted to consist entirely of short-finned pilot whales. The aerial portion of the northeast surveys covered the Gulf of Maine and the Bay of Fundy where the model predicted that only long-finned pilot whales would occur, but no pilot whales were observed. The vessel portion of the northeast survey recorded a mix of both species along the shelf break, and the sightings in offshore waters near the Gulf Stream were predicted to consist predominantly of short-finned pilot whales. The best abundance estimate for short-finned pilot whales is thus the sum of the southeast survey estimate (16,946 [CV=0.43]) and the estimated number of short-finned pilot whales from the northeast vessel survey (4,569 [CV=0.57]). The best available abundance estimate is thus 21,515 (CV=0.37).

Table 1. Summary of abundance estimates for the western North Atlantic short-finned pilot whale by month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Jun-Aug 2011	central Virginia to Lower Bay of Fundy	4,569	0.57
Jun-Aug 2011	central Florida to central Virginia	16,946	0.43
Jun-Aug 2011	central Florida to lower Bay of Fundy (COMBINED)	21,515	0.37

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for western North Atlantic *Globicephala macrorhnychus* is 21,515 animals (CV=0.37). The minimum population estimate is 15,913.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a “recovery” factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for short-finned pilot whales is 15,913. The maximum productivity rate is 0.04, the default value for cetaceans. The “recovery” factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because the CV of the average mortality estimate is less than 0.3 (Wade and Angliss 1997). PBR for the western North Atlantic short-finned pilot whale is 159.

ANNUAL HUMAN-CAUSED SERIOUS INJURY AND MORTALITY

Total annual estimated average fishery-related mortality or serious injury during 2008-2012 was 140 short-finned pilot whales (CV=0.21; Table 2). All bycatch from the pelagic longline fishery in the Atlantic was assigned to the short-finned pilot whale stock. The highest bycatch rates of undifferentiated pilot whales in the pelagic longline fishery were observed during September–November along the mid-Atlantic coast (Garrison 2007). Biopsy samples and photo-identification data collected during October-November 2011 in this region indicated that all of the animals observed within the region of pelagic longline bycatch during these months were short-finned pilot whales (NMFS unpublished data). During the remainder of the year, pilot whale bycatch in the pelagic longline fishery was likewise restricted to waters where short-finned pilot whales are expected to occur almost exclusively. Therefore, it is likely that the bycatch of pilot whales in the pelagic longline fishery is restricted to short-finned pilot whales. In bottom trawls and mid-water trawls and in the gillnet fisheries, mortalities are more generally observed north of 40°N latitude and in areas expected to have a higher proportion of long-finned pilot whales. Takes and bycatch estimates for these fisheries are attributed to the long-finned pilot whale stock.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Detailed fishery information is reported in Appendix III. Total fishery-related mortality and serious injury cannot be estimated separately for the 2 species of pilot whales in the U.S. Atlantic EEZ because of the uncertainty in species identification by fishery observers. The Atlantic Scientific Review Group advised adopting the risk-averse strategy of assuming that either species might have been subject to the observed fishery-related mortality and serious injury.

Earlier Interactions

For more details on earlier fishery interactions see Waring *et al.* (2007).

Pelagic Longline

Most of the estimated marine mammal bycatch in the U.S. pelagic longline fishery was recorded in U.S. Atlantic EEZ waters between South Carolina and Cape Cod (Garrison 2007). Pilot whales are frequently observed to feed on hooked fish, particularly big-eye tuna (NMFS unpublished data). Between 1992 and 2012, 204 pilot whales were observed released alive, including 123 that were considered seriously injured, and 6 mortalities were observed (Johnson *et al.* 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; Garrison and Stokes 2012a; Garrison and Stokes 2012b, Garrison and Stokes 2013). January-March bycatch was concentrated on the continental shelf edge northeast of Cape Hatteras. Bycatch was recorded in this area during April-June, and takes also occurred north of Hydrographer Canyon in water over 1,000 fathoms (1830 m) deep during April-June. During the July-September period, takes occurred on the continental shelf edge east of Cape Charles, Virginia, and on Block Canyon slope in over 1,000 fathoms of water. October-December bycatch occurred between the 20- and 50-fathom (37- and 92-m) isobaths between Barnegat Bay and Cape Hatteras.

The estimated fishery-related mortality to short-finned pilot whales in the U.S. Atlantic (excluding the Gulf of Mexico) attributable to this fishery was 0 in 2008-2010, 19 (CV=1.00) in 2011, and 0 in 2012. The estimated serious injuries were 98 (CV=0.42) in 2008, 17 (CV=0.70) in 2009, 127 (CV=0.78) in 2010, 286 (CV=0.29) in 2011, and 170 (CV=0.33) in 2012. The average annual total mortality and serious injury in 2008-2012 was 140 pilot whales (CV=0.21) (Table 2). Available seasonal biopsy data and genetic analyses indicate that pilot whale bycatch in the pelagic longline fishery is restricted to short-finned pilot whales.

Table 2. Summary of the incidental mortality and serious injury of short-finned pilot whales (*Globicephala macrorhynchus*) by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).

Fishery	Years	Data Type[a]	Observer Coverage	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Est. CVs	Mean Annual Mortality
Pelagic Longline	08-12	Obs. Data Logbook	.07, .10, .08, .09, .07	2,5,5, 18, 14	0,0,0,1, 0	80, 17, 127, 286, 170	0,0,0, 19, 0	80,17, 127, 305, 170	.50,.70,.78, .29, .33	140 (.21)
TOTAL										140 (.21)

[a] Observer data (Obs. Data) are used to measure bycatch rates and the data are collected within the Northeast Fisheries Observer Program (NEFOP) and the Southeast Pelagic Longline Observer Program.

Other Mortality

Pilot whales have a propensity to mass strand throughout their range, but the role of human activity in these events is unknown. Between 2 and 168 pilot whales have stranded annually, either individually or in groups, along the eastern U.S. seaboard since 1980 (NMFS 1993, stranding databases maintained by NMFS NER, NEFSC and SEFSC). From 2008-2012, 46 short-finned pilot whales (*Globicephala macrorhynchus*), 37 long-finned pilot whales (*Globicephala melas melas*), and 7 pilot whales not specified to the species level (*Globicephala* sp.) were reported stranded between Maine and Florida, including the Exclusive Economic Zone (EEZ) (Table 3).

Table 3. Pilot whale (*Globicephala macrorhynchus* [SF], *Globicephala melas melas* [LF] *and Globicephala* sp. [Sp]) strandings along the Atlantic coast, 2008-2012. Strandings which were not reported to species have been reported as *Globicephala* sp. The level of technical expertise among stranding network personnel varies, and given the potential difficulty in correctly identifying stranded pilot whales to species, reports to specific species should be viewed with caution.

STATE	2008			2009			2010			2011			2012			TOTALS		
	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp
Nova Scotia[a]	0	0	0	0	0	15	0	0	11	0	0	19	0	0	3	0	0	48
Newfoundland and Labrador[b]	0	0	2	0	0	1	0	0	1	0	0	8	0	0	6	0	0	18
Maine	0	1	0	0	3	0	0	0	0	0	1	0	0	1	0	0	6	0
Massachusetts[c]	0	1	0	0	4	0	0	2	0	3	4	0	0	3	0	3	14	0
Rhode Island	0	2	0	0	2	0	0	0	0	0	2	0	0	0	0	0	6	0
New York	0	5	0	0	1	0	0	0	0	0	1	0	0	1	0	0	8	0
New Jersey	0	1	0	1	1	0	0	0	0	1	0	1	0	0	0	2	2	1
Delaware	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Virginia[d]	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	1	2
North Carolina[d]	3	0	1	2	0	0	1	0	0	1	0	0	1	0	0	8	0	1
South Carolina[d]	0	0	1	0	0	0	0	0	1	0	0	0	3	0	1	3	0	3
Florida[e]	0	0	0	0	0	0	4	0	0	2	0	0	23	0	0	29	0	0

TOTALS - U.S. & EEZ	3	10	2	4	11	0	5	2	3	7	8	1	27	6	1	46	37	7

[a] Data supplied by Nova Scotia Marine Animal Response Society (pers. comm.). Strandings in 2011 include one mass stranding on 6-8 whales (one of which died) and 2 animals with ropes tied around their tail stocks.
[b] (Ledwell and Huntington 2009, 2010, 2011, 2012, 2013). 2011 included 2 mom/calf pairs. Not included in 2011 total was group of 6 pilot whales shepherded out of a narrow channel.

[c] One of the 2009 animals was classified as a fishery interaction. One of the 2010 animals released alive.
[d] Signs of fishery interaction observed on a short-finned pilot whale stranded in North Carolina Feb 2010. Signs of fishery interaction observed on one short-finned pilot whale in North Carolina and two in South Carolina in 2012.

[e] One of the 2010 animals released alive.

Short-finned pilot whales strandings (*Globicephala macrorhynchus*) have been reported as far north as Block Island, Rhode Island (2001), and Cape Cod, Massachusetts (2011), though the majority of the strandings occurred from North Carolina southward (Table 3).

During 2008-2012, several human and/or fishery interactions were documented in stranded pilot whales. A short-finned pilot whale stranded in North Carolina in 2010 had evidence of longline interaction. In 2011, a short-finned pilot whale in North Carolina was classified as a fishery interaction and a short-finned pilot whale in New Jersey was found with a healed but abscessed bullet wound. In 2012, 3 short-finned pilot whales had evidence of fishery interaction, two of them in South Carolina and one in North Carolina.

Stranding data probably underestimate the extent of fishery-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other fishery-interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interaction.

A potential human-caused source of mortality is from polychlorinated biphenyls (PCBs) and chlorinated pesticides (DDT, DDE, dieldrin, etc.), moderate levels of which have been found in pilot whale blubber (Taruski *et al.* 1975; Muir *et al.* 1988; Weisbrod *et al.* 2000). Weisbrod *et al.* (2000) reported that bioaccumulation levels were more similar in whales from the same stranding group than animals of the same sex or age. Also, high levels of toxic metals (mercury, lead, cadmium) and selenium were measured in pilot whales harvested in the Faroe Island drive fishery (Nielsen *et al.* 2000). Similarly, Dam and Bloch (2000) found very high PCB levels in pilot whales in the Faroes. The population effect of the observed levels of such contaminants is unknown.

STATUS OF STOCK

The short-finned pilot whale is not listed as threatened or endangered under the Endangered Species Act, and the western North Atlantic stock is not considered strategic under the Marine Mammal Protection Act. The 2008–2012 average annual human-related mortality and serious injury does not exceed PBR. The total mortality and serious injury attributed to short-finned pilot whales exceeds 10% of the calculated PBR and therefore cannot be considered to be insignificant and approaching zero mortality and serious injury rate. The status of this stock relative to OSP in the U.S. Atlantic EEZ is unknown. There are insufficient data to determine the population trends for this stock.

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ATLANTIC WHITE-SIDED DOLPHIN (*Lagenorhynchus acutus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

White-sided dolphins are found in temperate and sub-polar waters of the North Atlantic, primarily in continental shelf waters to the 100-m depth contour. In the western North Atlantic the species inhabits waters from central West Greenland to North Carolina (about 35˚N) and perhaps as far east as 29˚W in the vicinity of the mid-Atlantic Ridge (Evans 1987; Hamazaki 2002; Doksaeter *et al.* 2008; Waring *et al.* 2008). Distribution of sightings, strandings and incidental takes suggest the possible existence of three stock units: Gulf of Maine, Gulf of St. Lawrence and Labrador Sea stocks (Palka *et al.* 1997). Evidence for a separation between the population in the southern Gulf of Maine and the Gulf of St. Lawrence population comes from the reduced density of summer sightings along the Atlantic side of Nova Scotia. This was reported in Gaskin (1992), is evident in Smithsonian stranding records and in Canadian/west Greenland bycatch data (Stenson *et al.* 2011) and was obvious during summer abundance surveys that covered waters from Virginia to the Gulf of St. Lawrence and during the Canadian component of the Trans-North Atlantic Sighting Survey in the summer of 2007 (Lawson and Gosselin 2009). White-sided dolphins were seen frequently in Gulf of Maine waters and in waters at the mouth of the Gulf of St. Lawrence, but only a relatively few sightings were recorded between these two regions. This trend seems to be less obvious in recent years, since 2007.

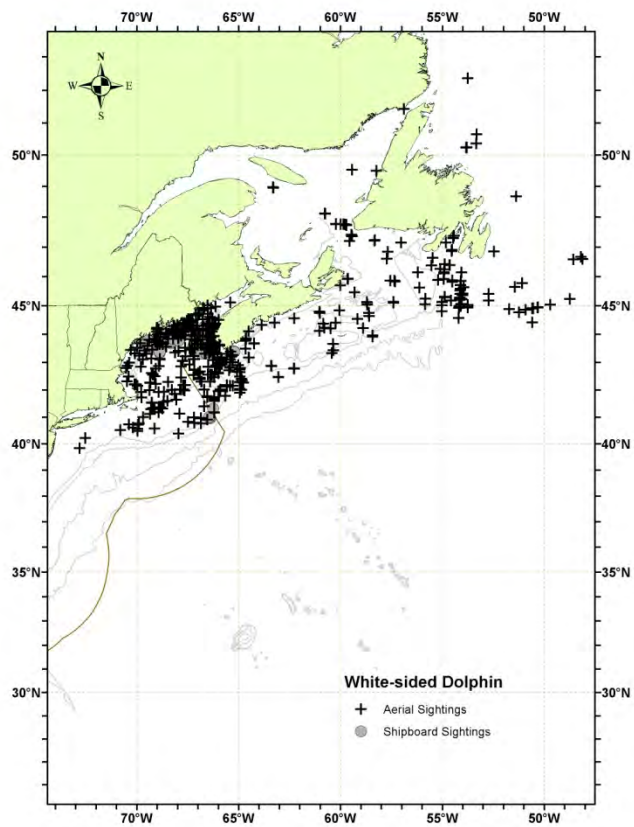

Figure 1. *Distribution of white-sided dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008, 2010, and 2011, and DFO's 2007 TNASS survey. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

The Gulf of Maine population of white-sided dolphins is most common in continental shelf waters from Hudson Canyon (approximately 39˚N) to Georges Bank, and in the Gulf of Maine and lower Bay of Fundy. Sighting data indicate seasonal shifts in distribution (Northridge *et al.* 1997). During January to May, low numbers of white-sided dolphins are found from Georges Bank to Jeffreys Ledge (off New Hampshire), with even lower numbers south of Georges Bank, as documented by a few strandings collected on beaches of Virginia to South Carolina. From June through September, large numbers of white-sided dolphins are found from Georges Bank to the lower Bay of Fundy. From October to December, white-sided dolphins occur at intermediate densities from southern Georges Bank to southern Gulf of Maine (Payne and Heinemann 1990). Sightings south of Georges Bank, particularly around Hudson Canyon, occur year round but at low densities. The Virginia and North Carolina observations appear to represent the southern extent of the species' range during the winter months. On 4 May 2008 a stranded 17-year old male white-sided dolphin with severe pulmonary distress and reactive lymphadenopathy stranded in South Carolina (Powell *et al.* 2011). In the absence of additional strandings or sightings, this stranding seems to be an out-of-range anomaly. The seasonal spatial distribution of this species appears to be changing during the last few years. These spatial-temporal patterns are currently being investigated to document the magnitude of these apparent changes.

Recent stomach-content analysis of both stranded and incidentally caught white-sided dolphins in U.S. waters determined that the predominant prey were silver hake (*Merluccius bilinearis*), spoonarm octopus (*Bathypolypus bairdii*) and haddock (*Melanogrammus aeglefinus*). Sand lances (*Ammodytes* spp.) were only found in the stomach of one stranded white-sided dolphin. Seasonal variation in diet was indicated; pelagic Atlantic herring (*Clupea harengus*) was the most important prey in summer, but was rare in winter (Craddock *et al.* 2009).

POPULATION SIZE

Abundance estimates of white-sided dolphins from various portions of their range are available from: spring, summer and autumn 1978–1982; July–September 1991–1992; June–July 1993; July–September 1995; July–August 1999; August 2002; June–July 2004; August 2006; July–August 2007; and July–August 2011. The best available current abundance estimate for white-sided dolphins in the western North Atlantic stock is the result of the 2011 survey: 48,819 (CV= 0.61).

Earlier abundance estimates

Please see Appendix IV for earlier abundance estimates.

Recent surveys and abundance estimates

An abundance estimate of 17,594 (CV=0.30) white-sided dolphins was generated from an aerial survey conducted in August 2006 that surveyed 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence. Data were collected using the Hiby circle-back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005). The value of *g(0)* was derived from the pooled 2002, 2004 and 2006 aerial survey data (Table 1; NMFS 2006).

An abundance estimate of 24,422 (CV=0.49) white-sided dolphins was generated from the Canadian Trans-North Atlantic Sighting Survey in July–August 2007. This aerial survey covered waters from northern Labrador to the Scotian Shelf, providing full coverage of the Atlantic Canadian coast (Lawson and Gosselin 2009). The abundance estimates from this survey have been corrected for perception and availability bias, when possible. In general this involved correcting for perception bias using mark-recapture distance sampling (MRDS), and correcting for availability bias using dive/surface times, as reported in the literature, and the Laake et al. (1997) analysis method (Lawson and Gosselin 2011).

An abundance estimate of 48,819 (CV=0.61) white-sided dolphins was generated from a shipboard and aerial survey conducted during June–August 2011 (Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters north of New Jersey from the coastline to the 100-m depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in waters offshore of central Virginia to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the MRDS option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

No white-sided dolphins were detected in the aerial and ship abundance surveys that were conducted concurrently (June-August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed the double-platform methodology searching with 25x bigeye binoculars. A total of 4,445 km of tracklines was surveyed, yielding 290 cetacean sightings.

Table 1. Summary of recent abundance estimates for western North Atlantic stock of white-sided dolphins (*Lagenorhynchus acutus*). Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	17,594	0.30
Jul-Aug 2007	N. Labrador to Scotian Shelf	24,422	0.49

Jun-Aug 2011	Central Virginia to lower Bay of Fundy	48,819	0.61

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by (Wade and Angliss 1997). The best estimate of abundance for the western North Atlantic stock of white-sided dolphins is 48,819 (CV=0.61). The minimum population estimate for these white-sided dolphins is 30,403.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. Life history parameters that could be used to estimate net productivity include: calving interval is 2-3 years; lactation period is 18 months; gestation period is 10-12 months and births occur from May to early August, mainly in June and July; length at birth is 110 cm; length at sexual maturity is 230-240 cm for males, and 201-222 cm for females; age at sexual maturity is 8-9 years for males and 6-8 years for females; mean adult length is 250 cm for males and 224 cm for females (Evans 1987); and maximum reported age for males is 22 years and for females, 27 years (Sergeant *et al.* 1980).

For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 30,403. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because the CV of the average mortality estimate is less than 0.3 and the status of the stock relative to OSP is unknown (Wade and Angliss 1997). PBR for the western North Atlantic stock of white-sided dolphin is 304.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual estimated average fishery-related mortality or serious injury to this stock during 2008–2012 was 116 (CV=0.17) white-sided dolphins (Table 2).

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*." Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Detailed fishery information is reported in Appendix III.

Earlier Interactions

NMFS observers in the Atlantic foreign mackerel fishery reported 44 takes of Atlantic white-sided dolphins incidental to fishing activities in the continental shelf and continental slope waters between March 1977 and December 1991 (Waring *et al.* 1990; NMFS unpublished data). Of these animals, 96% were taken in the Atlantic

mackerel fishery. This total included 9 documented takes by U.S. vessels involved in joint-venture (JV) fishing operations in which U.S. captains transferred their catches to foreign processing vessels. No incidental takes of white-sided dolphins were observed in the Atlantic mackerel JV fishery when it was observed in 1998.

During 1991 to 1998, two white-sided dolphins were observed taken in the Atlantic pelagic drift gillnet fishery, both in 1993. Estimated annual fishery-related mortality and serious injury (CV in parentheses) was 4.4 (.71) in 1989, 6.8 (.71) in 1990, 0.9 (.71) in 1991, 0.8 (.71) in 1992, 2.7 (0.17) in 1993 and 0 in 1994, 1995, 1996, and 1998. There was no fishery during 1997 and the fishery was permanently closed in 1999.

A U.S. JV mid-water (pelagic) trawl fishery was conducted during 2001 on Georges Bank from August to December. No white-sided dolphins were incidentally captured. Two white-sided dolphins were incidentally captured in a single mid-water trawl during foreign fishing operations (TALFF). During TALFF fishing operations all nets fished by the foreign vessel are observed. The total mortality attributed to the Atlantic herring JV and TALFF mid-water trawl fisheries in 2001 was two animals.

The mid-Atlantic gillnet fishery occurs year round from New York to North Carolina and has been observed since 1993. One white-sided dolphin was observed taken in this fishery during 1997. None were observed taken in other years. The estimated annual mortality (CV in parentheses) attributed to this fishery was 0 for 1993 to 1996, 45 (0.82) for 1997, 0 for 1998 to 2001, unknown in 2002 and 0 in 2003-2012.

Three white-sided dolphins were observed taken in northeast mid-water paired trawls. Estimated annual fishery-related mortalities (CV in parentheses) were unknown in 2001–2002, 22 (0.97) in 2003, 0 in 2004, 9.4 (1.03) in 2005, and 0 in 2006 - 2012.

The Mid-Atlantic bottom trawl fishery occurs year round from south of Cape Cod, Massachusetts to Cape Hatteras, North Carolina and has been observed since 1995. One white-sided dolphin incidental take was observed in 1997, resulting in a mortality estimate of 161 (CV=1.58) animals. No takes were observed from 1998 through 2004 or in 2006 or 2008–2012; one take was observed in 2005 and 2 in 2007. New serious injury criteria were applied to all observed interactions retroactive back to 2007. There were no observed serious injuries of white-sided dolphins in the Mid-Atlantic region. Although there were no observed takes in the last decade with the exception of 2005 and 2007, a predictive model estimated the following annual fishery-related mortalities (CV in parentheses): 27 (0.17) in 2000, 27 (0.19) in 2001, 25 (0.17) in 2002, 31 (0.25) in 2003, 26 (0.20) in 2004, 38 (0.29) in 2005, 3 (0.53) in 2006, and 2 (1.03) in 2007 (Rossman 2010).

U.S.

Northeast Sink Gillnet

Estimated annual white-sided dolphin mortalities (CV in parentheses) attributed to the Northeast sink gillnet fishery were 81 (0.57) in 2008, 0 in 2009, 66 (0.90) in 2010, 18 (0.43) in 2011, and 9 (0.92) in 2012 (Table 2; Orphanides 2013; Hatch and Orphanides 2014). Average annual estimated fishery-related mortality during 2008–2012 was 35 white-sided dolphins per year (0.44; Table 2).

Northeast Bottom Trawl

Estimated fishery-related serious injury and mortality were 13 (0.57) in 2008, 168 (0.28) in 2009, 36 (0.32) in 2010, 138 (0.24) in 2011 and 27 (0.47) in 2012. The 2008–2012 average mortality attributed to the Northeast bottom trawl was 77 animals (0.16; Table 2).

Mid-Atlantic Mid-water Trawl Fishery (Including Pair Trawl)

In March 2005, five white-sided dolphins were observed taken in paired trawls targeting mackerel that were off Virginia. In February 2006, three animals were observed taken in mackerel paired mid-water trawls north of Hudson Canyon. In March 2007, an animal was observed taken in a mackerel single mid-water trawl near Hudson Canyon. In January and February 2008 three animals were observed in herring single mid-water trawls north of Hudson Canyon. In March 2009 an animal was observed in a pair trawl targeting mackerel south of Hudson Canyon. No white-sided dolphin interactions with this fishery were observed in 2010–2012. Due to small sample sizes, the ratio method was used to estimate the bycatch rate (observed white-sided dolphin takes per observed hours the gear was in the water) for each year, where the paired and single mid-Atlantic mid-water trawls were pooled and only hauls that targeted herring and mackerel were used. The VTR herring and mackerel data were used to estimate the total effort in the bycatch estimate (Palka, pers. comm.). Estimated annual fishery-related mortalities (CV in parentheses) were 15 (0.73) in 2008, 4 (0.92) in 2009, and 0 in 2010–2012. (Table 2; Palka pers. comm.). The average annual estimated fishery-related mortality during 2008–2012 was 3.8 (0.61; Table 2).

Table 2. Summary of the incidental mortality of white-sided dolphins (*Lagenorhynchus acutus*) by commercial fishery including the years sampled, the type of data used , the annual observer coverage, the serious injuries and mortalities recorded by on-board observers, the estimated annual serious injury and mortality, the estimated CV of the combined annual mortality and the mean annual mortality (CV in parentheses).

Fishery	Years	Data Type [a]	Observer Coverage [b]	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Combined Annual Mortality
Northeast Sink Gillnet[d]	08-12	Obs. Data Weighout Trip Logbook	.05, .04, .17, .19, .15	0, 0, 1, 0, 0	4, 0, 6, 5, 1	5, 0, 4, 1, 0	76, 0, 62, 17, 9	81, 0, 66,18, 9	.57, 0, .90, .43, .92	35 (0.44)
Northeast Bottom Trawl[c]	08-12	Obs. Data Trip Logbook	.08, .09, .16, .26, 0.17	0, 0, 0, 2, 0	3, 31, 10, 47, 9	0, 3, 1, 3, 0	13, 168, 36, 138, 27	13, 168, 36, 138, 27	.57, .28, .32, .24, .47	77 (0.16)
Mid-Atlantic Mid-water Trawl - Including Pair Trawl	08-12	Obs. Data Weighout Trip Logbook	.13, .13, .25, .41, .21	0, 0, 0, 0, 0	3, 1, 0, 0, 0	0, 0, 0, 0, 0	15, 4, 0, 0, 0	15, 4, 0, 0, 0	.73, .92, 0, 0, 0	3.8 (0.61)
Total										116(0.17)

a Observer data (Obs. Data), used to measure bycatch rates, are collected within the Northeast Observer Program and At-sea Monitoring Program. NEFSC collects seafood dealer landings data (Weighout) that are used as a measure of total effort in the Northeast gillnet fishery. Mandatory Vessel Trip Report (VTR) (Trip Logbook) data are used to determine the spatial distribution of fishing effort in the sink gillnet, bottom trawl and mid-water trawl fisheries. In addition, the Trip Logbooks are the primary source of the measure of total effort (tow duration) in the mid-water and bottom trawl fisheries.

b Observer coverage is defined as the ratio of observed to total metric tons of fish landed and the ratio of observed to total trips for the gillnet and bottom trawl fisheries, respectively. Beginning in May 2010 total observer coverage reported for bottom trawl and gillnet gear includes samples collected from the at-sea monitoring program in addition to traditional observer coverage through the Northeast Fisheries Observer Program (NEFOP).

c Fishery related bycatch rates for years 2008-2012 were estimated using an annual stratified ratio-estimator. These estimates replace the 2008-2010 annual estimates reported in the 2013 stock assessment report that were generated using a different method.

d After 1998, a weighted bycatch rate was applied to effort from both pingered and non-pingered hauls within the stratum where white-sided dolphins were observed taken. During the years 1997, 1999, 2001, 2002, and 2004, respectively, there were 2, 1, 1, 1, and 1 observed white-sided dolphins taken on pingered trips. No takes were observed on pinger trips during 1995, 1996, 1998, 2000, 2005 through 2007. Three of the 2008 takes were on non-pingered hauls and the fourth take was recorded as pinger condition unknown. Of the six 2010 observed takes, 4 were in pingered nets and 2 in non-pingered nets. Four of the 2011 takes were in pingered nets. The 2012 take was in a non-pingered net.

CANADA

There is little information available that quantifies fishery interactions involving white-sided dolphins in Canadian waters. Two white-sided dolphins were reported caught in groundfish gillnet sets in the Bay of Fundy during 1985 to 1989, and 9 were reported taken in West Greenland between 1964 and 1966 in the now non-operational salmon drift nets (Gaskin 1992). Several (number not specified) were also taken during the 1960s in the now non-operational Newfoundland and Labrador groundfish gillnets. A few (number not specified) were taken in an experimental drift gillnet fishery for salmon off West Greenland which took place from 1965 to 1982 (Read 1994).

Hooker *et al.* (1997) summarized bycatch data from a Canadian fisheries observer program that placed observers on all foreign fishing vessels operating in Canadian waters, on 25-40% of large Canadian fishing vessels (greater than 100 feet long), and on approximately 5% of smaller Canadian fishing vessels. Bycaught marine mammals were noted as weight in kilos rather than by the numbers of animals caught. Thus the number of individuals was estimated by dividing the total weight per species per trip by the maximum recorded weight of each species. During 1991 through 1996, an estimated 6 white-sided dolphins were observed taken. One animal was from

a longline trip south of the Grand Banks (43º 10'N 53º 08'W) in November 1996 and the other 5 were taken in the bottom trawl fishery off Nova Scotia in the Atlantic Ocean; 1 in July 1991, 1 in April 1992, 1 in May 1992, 1 in April 1993, 1 in June 1993 and 0 in 1994 to 1996.

Estimation of small cetacean bycatch for Newfoundland fisheries using data collected during 2001 to 2003 (Benjamins *et al*. 2007) indicated that, while most of the estimated 862 to 2,228 animals caught were harbor porpoises, a few were white-sided dolphins caught in the Newfoundland nearshore gillnet fishery and offshore monkfish/skate gillnet fisheries.

Herring Weirs

During the last several years, one white-sided dolphin was released alive and unharmed from a herring weir in the Bay of Fundy (A. Westgate, pers. comm.). Due to the formation of a cooperative program between Canadian fishermen and biologists, it is expected that most dolphins and whales will be able to be released alive. Fishery information is available in Appendix III.

Other Mortality

U.S.

During 2008–2012 there were 187 documented Atlantic white-sided dolphin strandings on the U.S. Atlantic coast (Table 3). Forty-three of these animals were released alive. Human interaction was indicated in 11 records during this period. Of these, one was classified as a fishery interaction.

Mass strandings involving up to a hundred or more animals at one time are common for this species. The causes of these strandings are not known. Because such strandings have been known since antiquity, it could be presumed that recent strandings are a normal condition (Gaskin 1992). It is unknown whether human causes, such as fishery interactions and pollution, have increased the number of strandings. In an analysis of mortality causes of stranded marine mammals on Cape Cod and southeastern Massachusetts between 2000 and 2006, Bogomolni *et al.* (2010) found 69% (46 of 67) of stranded white-sided dolphins were involved in mass-stranding events with no significant cause determined, and 21% (14 of 67) were classified as disease related.

An Unusual Mortality Event was declared in 2008 due to a relatively high number of strandings between January and April 2008, from New Jersey to North Carolina. Five white-sided dolphins were involved in this event (http://www.nmfs.noaa.gov/pr/health/mmume/midatlantic2008.htm, accessed 19 April 2011).

Stranding data probably underestimate the extent of fishery-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other fishery-interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interaction.

CANADA

Small numbers of white-sided dolphins have been hunted off southwestern Greenland and they have been taken deliberately by shooting elsewhere in Canada (Reeves *et al.* 1999). The Nova Scotia Stranding Network documented whales and dolphins stranded on the coast of Nova Scotia during 1991 to 1996 (Hooker *et al.* 1997). Researchers with Dept. of Fisheries and Oceans, Canada documented strandings on the beaches of Sable Island during 1970 to 1998 (Lucas and Hooker 2000). Sable Island is approximately 170 km southeast of mainland Nova Scotia. White-sided dolphins stranded at nearly all times of the year on the mainland and on Sable Island. On the mainland of Nova Scotia, a total of 34 stranded white-sided dolphins was recorded between 1991 and 1996: 2 in 1991 (August and October), 26 in July 1992, 1 in Nov 1993, 2 in 1994 (February and November), 2 in 1995 (April and August) and 2 in 1996 (October and December). During July 1992, 26 white-sided dolphins stranded on the Atlantic side of Cape Breton. Of these, 11 were released alive and the rest were found dead. Among the rest of the Nova Scotia strandings, one was found in Minas Basin, two near Yarmouth and the rest near Halifax. On Sable Island, 10 stranded white-sided dolphins were documented between 1991 and 1998; all were males, 7 were young males (< 200 cm), 1 in January 1993, 5 in March 1993, 1 in August 1995, 1 in December 1996, 1 in April 1997 and 1 in February 1998.

Whales and dolphins stranded between 1997 and 2012 on the coast of Nova Scotia as recorded by the Marine Animal Response Society and the Nova Scotia Stranding Network are as follows (Table 3): 0 white-sided dolphins stranded in 1997 to 2000, 3 in September 2001 (released alive), 5 in November 2002 (4 were released alive), 0 in 2003, 19-24 in 2004 (some (unspecified) of 15-20 in October were released alive and 4 in November were released alive), 0 in 2005, and 1 in 2006, 8-10 in 2007 (all but 3 released alive), 3 (one released alive) in 2008, 4 (3 released alive) in 2009, 2 in 2010, 6 (2 released alive) in 2011, and 5 (1 released alive) in 2012 (Marine Animal Response Society, pers. comm.).

White-sided dolphins recorded by the Whale Release and Strandings Program in Newfoundland and Labrador are as follows: 1 animal (released alive) in 2004, 1 in 2005 (dead), 3 in 2006 (all dead), 1 in 2007 (released alive) 2 in 2008 (one released alive and one dead), 3 (all dead) in 2009, 2 (one released alive and one dead) in 2010, 0 in 2011, and 3 in 2012 (Ledwell and Huntington 2004; 2006; 2007; 2008; 2009; 2010; 2011; 2012; 2013).

Table 3. White-sided dolphin (*Lagenorhynchus acutus*) reported strandings along the U.S. and Canadian Atlantic coast, 2008-2012.

Area	Year					**Total**
	2008	2009	2010	2011	2012	
Maine	1	1	1	2	1	6
New Hampshire	0	1	0	0	2	3
Massachusetts[a,b]	33	22	50	42	3	150
Rhode Island	0	1	0	1	1	3
Connecticut	1	1	0	0	0	2
New York	1	3	1	0	3	8
New Jersey	0	2	0	1	0	3
Delaware	0	1	0	1	0	2
Maryland	1	0	0	1	0	2
Virginia	1	0	0	0	0	1
North Carolina	3	1	0	1	0	5
South Carolina[b]	1	0	0	0	0	1
Georgia	0	0	0	1	0	1
TOTAL US	**42**	**33**	**52**	**50**	**10**	**187**
Nova Scotia[c]	3	4	2	6	5	20
Newfoundland and Labrador[d]	2	3	2	0	3	10
GRAND TOTAL	47	40	56	56	18	217

[a] Records of mass strandings in Massachusetts during this period are: January 2008 -17 animals, February 2008 - 3 animals (2 released alive); September 2009 - 3 events of 2, 3 and 4 animals (all but 1 released alive); April 2009 - 3 animals (all released alive); March 2010 - 7 animals (one dead calf, 6 adults released alive), 16 animals (5 dead, 11 released alive) and 3 animals (one released alive); April 2010 - 2 animals (released alive); July 2010 - 2 animals (released alive); March 2011 - 4 animals (2 released alive), 2 animals (released alive) .

[b] In 2008, 2 animals from Massachusetts and one from South Carolina were classified as human interactions. In 2009, the 4 animals that mass-stranded in September were released alive, as well as a March stranding that a bystander had attempted to rescue were classified at human interactions. In 2010, 2 animals in Massachusetts were classified as human interactions, one of them a fishery interaction. In 2011, one animal was classified as human

interaction due to post-mortem mutilation.
[c] Data supplied by Nova Scotia Marine Animal Response Society (pers. comm.).
[d] (Ledwell and Huntington 2009, 2010, 2011, 2012, 2013).

STATUS OF STOCK

White-sided dolphins are not listed as threatened or endangered under the Endangered Species Act, and the Western North Atlantic stock is not considered strategic under the Marine Mammal Protection Act. The 2008–2012 estimated average annual human related mortality does not exceed PBR. The total U.S. fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. The status of white-sided dolphins, relative to OSP, in the U.S. Atlantic EEZ is unknown. A trend analysis has not been conducted for this species.

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SHORT-BEAKED COMMON DOLPHIN (*Delphinus delphis delphis*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The common dolphin may be one of the most widely distributed species of cetaceans, as it is found world-wide in temperate and subtropical seas. In the North Atlantic, common dolphins are commonly found along the shoreline of Massachusetts in mass-stranding events (Bogomolni et al. 2010; Sharp et al. 2013), as well as found occurring over the continental shelf between the 100-2000-m isobaths and over prominent underwater topography and east to the mid-Atlantic Ridge (29˚W) (Doksaeter *et al.* 2008; Waring *et al*. 2008). The species is less common south of Cape Hatteras, although schools have been reported as far south as the Georgia/South Carolina border (32º N) (Jefferson *et al*. 2009). In waters off the northeastern USA coast, common dolphins are distributed along the continental shelf between the 100-2000-m isobaths and are associated with Gulf Stream features (CETAP 1982; Selzer and Payne 1988; Waring *et al.* 1992; Hamazaki 2002). They occur from Cape Hatteras northeast to Georges Bank (35˚ to 42˚N) during mid-January to May (Hain *et al*. 1981; CETAP 1982; Payne *et al.* 1984). Common dolphins move onto Georges Bank, Gulf of Maine, and the Scotian Shelf from mid-summer to autumn. Selzer and Payne (1988) reported very large aggregations (greater than 3,000 animals) on Georges Bank in autumn. Common dolphins were occasionally found in the Gulf of Maine (Selzer and Payne 1988), more often in the last few years (Figure 1). Migration onto the Scotian Shelf and continental shelf off Newfoundland occurs during summer and autumn when water temperatures exceed 11ºC (Sergeant *et al.* 1970; Gowans and Whitehead 1995).

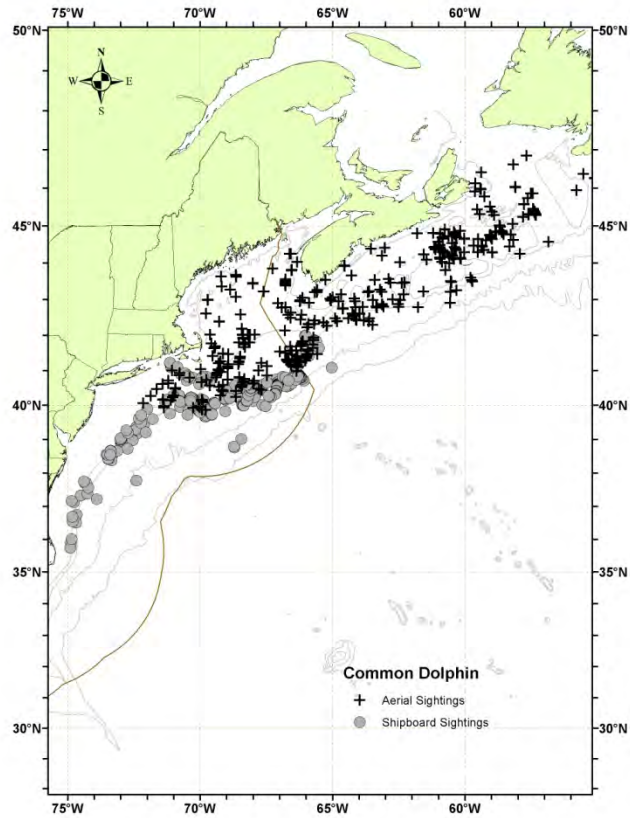

Figure 1. *Distribution of common dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1998, 1999, 2002, 2004, 2006, 2007, 2010 and 2011 and DFO's 2007 TNASS survey. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

Westgate (2005) tested the proposed one-population-stock model using a molecular analysis of mitochondrial DNA (mtDNA), as well as a morphometric analysis of cranial specimens. Both genetic analysis and skull morphometrics failed to provide evidence ($p>0.05$) of more than a single population in the western North Atlantic, supporting the proposed one-stock model. However, when western and eastern North Atlantic common dolphin mtDNA and skull morphology were compared, both the cranial and mtDNA results showed evidence of restricted gene flow ($p<0.05$) indicating that these two areas are not panmictic. Cranial specimens from the two sides of the North Atlantic differed primarily in elements associated with the rostrum. These results suggest that common dolphins in the western North Atlantic are composed of a single panmictic group whereas gene flow between the western and eastern North Atlantic is limited (Westgate 2005; 2007).

There is a peak in parturition during July and August with an average birth day of 28 July. Gestation lasts about 11.7 months and lactation lasts at least a year. Given these results western North Atlantic female common dolphins are likely on a 2-3 year calving interval. Females become sexually mature earlier (8.3 years and 200 cm) than males (9.5 years and 215 cm) as males continue to increase in size and mass. There is significant sexual dimorphism present with males being on average about 9% larger in body length (Westgate 2005; Westgate and Read 2007).

POPULATION SIZE

Several abundance estimates are available for common dolphins from selected regions for selected time periods. The current best abundance estimate for common dolphins off the U.S. or Canadian Atlantic coast is 173,486 (CV=0.55). This is the estimate derived from the Canadian Trans-North Atlantic Sighting Survey (TNASS) in July–August 2007 and is considered best because it covered more of the common dolphin range than the other surveys.

An abundance estimate of 84,000 (CV=0.36) common dolphins was obtained from an aerial survey conducted in August 2006, which covered 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; Palka pers. comm.).

An abundance estimate of 173,486 (CV=0.55) common dolphins was generated from the TNASS in July–August 2007 (Lawson and Gosselin 2009). This aerial survey covered waters from northern Labrador to the Scotian Shelf, providing full coverage of the Atlantic Canadian coast. The abundance estimates from this survey have been corrected for perception and availability bias, when possible. In general this involved correcting for perception bias using mark-recapture distance sampling (MRDS), and correcting for availability bias using dive/surface times, as reported in the literature, and the Laake (1997) analysis method (Lawson and Gosselin in 2011).

An abundance estimate of 67,191 (CV=0.29) common dolphins was generated from a shipboard and aerial survey conducted during June–August 2011 (Palka 2012). The aerial portion that contributed to the estimate covered 5,313 km of tracklines that were over waters north of New Jersey from the coastline to the 100-m depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines between central Virginia and Massachusetts in waters deeper than the 100-m depth contour out to beyond the U.S. EEZ. Both sighting platforms used a double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the MRDS option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

An abundance estimate of 2,993 (CV=0.87) common dolphins was generated from a shipboard survey conducted concurrently (June–August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed a double-platform visual team procedure searching with 25× bigeye binoculars. A total of 4,445 km of tracklines was surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Please see appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable and should not be used for PBR determinations.

Table 1. Summary of abundance estimates for western North Atlantic short-beaked common dolphin. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	84,000	0.36
July-Aug 2007	N. Labrador to Scotian Shelf	173,486	0.55
Jul-Aug 2011	Central Virginia to lower Bay of Fundy	67,191	0.29
Jun-Aug 2011	Central Florida to Central Virginia	2,993	0.87
Jun-Aug 2011	Central Florida to lower Bay of Fundy (COMBINED)	70,184	0.28

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for common dolphins is 173,486 animals (CV=0.55) derived from the 2007 TNASS survey. The minimum population estimate for the western North Atlantic common dolphin is 112,531.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 112,531 animals. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor is 0.5, the default value for stocks of unknown status relative to optimum sustainable population (OSP), and because the CV of the average mortality estimate is less than 0.3 (Wade and Angliss 1997). PBR for the western North Atlantic stock of common dolphin is 1,125.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual estimated average fishery-related mortality or serious injury to this stock during 2008–2012 was 289 (CV=0.12) common dolphins.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery information

Detailed fishery information is reported in Appendix III.

Earlier Interactions

For more details on the historical fishery interactions prior to 1999 see Waring *et al.* (2007).

In the Atlantic pelagic longline fishery between 1990 and 2008, 20 common dolphins were observed hooked and released alive.

The estimated fishery-related mortality of common dolphins attributable to the *Loligo* squid portion of the Southern New England/mid-Atlantic Squid, Mackerel, Butterfish Trawl fisheries was 0 between 1997-1998 and 49 in 1999 (CV=0.97). After 1999 this fishery is included as a component of the mid-Atlantic bottom trawl fishery.

In the Atlantic mackerel portion of the Southern New England/mid-Atlantic Squid, Mackerel, Butterfish Trawl fisheries, the estimated fishery-related mortality was 161 (CV=0.49) animals in 1997 and 0 in 1998 and 1999. However, the estimates in both the mackerel and *Loligo* fisheries should be viewed with caution due to the extremely low (<1%) observer coverage. After 1999 this fishery is included as a component of the mid-Atlantic bottom trawl and mid-Atlantic mid-water trawl fisheries.

There was one observed take in the Southern New England/mid-Atlantic Bottom Trawl fishery reported in

1997. The estimated fishery-related mortality for common dolphins attributable to this fishery was 93 (CV=1.06) in 1997 and 0 in 1998 and 1999. After 1999 this fishery is included as a component of the mid-Atlantic bottom trawl fishery.

There was one observed take in the mid-Atlantic mid-water trawl fishery in 2007. The resultant estimated annual fishery-related mortality and serious injury was 3.2 (CV = 0.70) for this fishery in 2007. There have been no observed common dolphin takes in the mid-Atlantic midwater trawl fishery in the past 5 years.

Northeast Sink Gillnet

In 1990, an observer program was started by NMFS to investigate marine mammal takes in the Northeast sink gillnet fishery (Appendix III). Bycatch in the northern Gulf of Maine occurs primarily from June to September, while in the southern Gulf of Maine, bycatch occurs from January to May and September to December. Two common dolphins were observed taken in northeast sink gillnet fisheries in 2008, 3 in 2009, 4 in 2010, 6 in 2011 and 6 in 2012. The estimated annual fishery-related mortality and serious injury attributable to the northeast sink gillnet fishery (CV in parentheses) was 34 (0.77) in 2008, 43 (0.77) in 2009, 69 (0.81) in 2010, 49 (0.71) in 2011 and 95 (0.40) in 2012 (Table 2; Orphanides 2013; Hatch and Orphanides 2014). The 2008–2012 average annual mortality attributed to the northeast sink gillnet was 56 animals (CV=0.29).

A study of the effects of two different hanging ratios in the bottom-set monkfish gillnet fishery on the bycatch of cetaceans and pinnipeds was conducted by NEFSC in 2009 and 2010 with 100% observer coverage. Commercial fishing vessels from Massachusetts and New Jersey were used for the study, which took place south of the Harbor Porpoise Take Reduction Team Cape Cod South Management Area (south of 40° 40´N) in February–April. Researchers purposely picked an area of historically high bycatch rates in order to have a chance of finding a significant difference. Eight research strings of fourteen nets each were fished and 159 hauls were completed during the course of the 2009–2010 study. Results showed that while a 0.33 mesh performed better at catching commercially important finfish than a 0.50 mesh, there was no statistical difference in cetacean or pinniped bycatch rates between the two hanging ratios. One common dolphin was caught in this study south of New England in 72 hauls during 2009 and one animal was caught in 72 hauls during the 2010 experiment in themid-Atlantic (A.I.S., Inc. 2010). These 2 takes are included in the observed interactions and added to the total estimates in Table 2, though these animals and the fishing effort from this experiment were not included in the estimation of the bycatch rate that was expanded to the rest of the fishing effort.

Mid-Atlantic Gillnet

While no common dolphins were taken in observed trips during 2008–2009, 10 were taken in 2010, 3 in 2011, and 1 in 2012. Using the observed takes, the estimated annual mortality (CV in parentheses) attributed to this fishery was 0 in 2008–2009, 30 (0.48) in 2010, 29 (0.53) in 2011 and 15 (0.93) in 2012. Average annual estimated fishery-related mortality attributable to this fishery during 2008–2012 was 15 (CV=0.34) common dolphins (Table 2; Orphanides 2013, Hatch and Orphanides 2014). A study of the effects of tie-downs and bycatch rates of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) in both control and experimental gillnet gear operating in Statistical Area 612 (off NY and NJ) between 14 November 2010 and 18 December 2010 had 100% observer coverage. This experimental fishery captured 6 common dolphins and 3 unidentified dolphins, (unidentified due to lack of photos) during this time period (Fox *et al.* 2011). These 6 takes are included in the observed interactions and added to the total estimates, though these interactions and their associated fishing effort were not included in bycatch rate calculations that was expanded to the rest of the fishery (Table 2).

Northeast Bottom Trawl

This fishery is active in New England waters in all seasons. Revised serious injury guidelines were applied for this period (Waring *et al.* 2014, 2015). Common dolphin mortalities (and serious injuries in parentheses) observed by both at-sea monitors and traditional fisheries observers in this fishery were 1 (0) in 2008, 5 (0) in 2009, 29 (2) in 2010, 22 (0) in 2011, and 10 (0) in 2012 (Table 2). Fishery related bycatch rates for years 2008-2012 were estimated using an annual stratified ratio-estimator. These mortality estimates replace the 2008-2011 annual estimates reported in the 2013 stock assessment report that were generated using a different method. The estimated annual fishery-related mortality and serious injury attributable to the northeast bottom trawl fishery (CV in parentheses) was 6 (0.99) in 2008, 24 (0.60) in 2009, 114 (0.32) in 2010, 72 (0.37) in 2011, and 40 (0.54) in 2012. The 2008–2012 average annual mortality attributed to the northeast bottom trawl was 55 animals (CV=0.21).

Mid-Atlantic Bottom Trawl

Revised serious injury guidelines were applied for this period (Waring *et al.* 2014, 2015). Common dolphin

mortalities (and serious injuries in parentheses) observed in this fishery were, 1 (0) in 2008, 12 (0) in 2009, 2 (0) in 2010, 29 (1) in 2011, and 32 (1) in 2012 (Table 2). Fishery related bycatch rates for years 2008-2012 were estimated using an annual stratified ratio-estimator. These mortality estimates replace the 2008-2011 annual estimates reported in the 2013 stock assessment report that were generated using a different method. The estimated annual fishery-related mortality and serious injury attributable to the mid-Atlantic bottom trawl fishery (CV in parentheses) was 23 (1.0) in 2008, 167 (0.46) in 2009, 21 (0.96) in 2010, 271 (0.25) in 2011, and 323 (0.26) in 2012. The 2008–2012 average annual mortality attributed to the mid-Atlantic bottom trawl was 161 animals (CV=0.17).

Northeast Mid-water Trawl Fishery (Including Pair Trawl)

A short-beaked common dolphin mortality was observed in this fishery in 2010, and another in 2012 (Table 2). An expanded bycatch estimate has not been calculated so the minimum raw count is reported.

Pelagic Longline

In 2009, a common dolphin mortality was observed in the pelagic longline fishery, mid-Atlantic Bight fishing area (Garrison and Stokes 2010). The expanded estimate (CV in parentheses) for common dolphin bycatch attributed to this fishery was 8.5 (1.0) for 2009. The 2008–2012 average annual mortality was 1.7 (1.0).

Table 2. Summary of the incidental mortality of short-beaked common dolphins (*Delphinus delphis delphis*) by commercial fishery including the years sampled, the type of data used, the annual observer coverage, the serious injuries and mortalities recorded by on-board observers, the estimated annual serious injury and mortality, the combined serious injury and mortality estimate, the estimated CV of the annual combined serious injury and mortality and the mean annual serious injury and mortality estimate (CV in parentheses).

Fishery [a]	Years	Data Type [b]	Observer Coverage [c]	Observed Serious Injury [f]	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Annual Combined Mortality
Northeast Sink Gillnet [e]	08-12	Obs. Data, Trip Logbook, Allocated Dealer Data	.05, .04, .17, .19, .15	0, 0, 0, 0, 0	2, 3, 4, 6, 6	0, 0, 0, 0, 0	34, 43, 69, 49, 95	34, 43, 69, 49, 95	.77, .77, .81, .71, .40	56 (.29)
Mid-Atlantic Gillnet [e]	08-12	Obs. Data, Trip Logbook, Allocated Dealer Data	.03, .03, .04, .02, .02	0, 0, 0, 0, 0	0, 0, 10, 3, 1	0, 0, 0, 0, 0	0, 0, 30, 29, 15	0, 0, 30, 29, 15	0, 0, .48, .53, .93	15(.34)
Northeast Mid-water Trawl - Including Pair Trawl	08-12	Obs. Data Trip Logbook	.199, .42, .54, .41, .45	0, 0, 0, 0, 0	0, 0, 1, 0, 1	0, 0, 0, 0, 0	0, 0, na, 0, na	0, 0, 1, 0, 1	0, 0, 1, 0, 1	0.4
Northeast Bottom Trawl [d]	08-12	Obs. Data Trip Logbook	.08, .09, .16, .26, .17	0, 0, 2, 0, 0	1, 5, 29, 22, 10	0, 1, 3, 2, 0	6, 23, 111, 70, 40	6, 24, 114, 72, 40	.99, .60, .32, .37, .54	55 (.21)
Mid-Atlantic Bottom Trawl [d]	08-12	Obs. Data Trip Logbook	.03, .05, .06, .08, .05	0, 0, 0, 1, 1	1, 12, 2, 29, 32	1, 5, 1, 8, 7	22, 162, 20, 263, 316	23, 167, 21, 271, 323	1.0, .46, .96, .25, .26	161 (.17)

Pelagic Longline [b]	08-12	Obs. Data Logbook	.07, .10, .08, .09, .07	0, 0, 0, 0, 0	0, 1, 0, 0, 0	0, 0, 0, 0, 0	0, 8.5, 0, 0, 0	0, 8.5, 0, 0, 0	0, 1.0, 0, 0, 0	1.7 (1.0)
TOTAL										289 (.12)

a. The fisheries listed in Table 2 reflect new definitions defined by the proposed List of Fisheries for 2005 (FR Vol. 69, No. 231, 2004). The 'North Atlantic bottom trawl' fishery is now referred to as the 'Northeast bottom trawl.' The Illex, Loligo and Mackerel fisheries are now part of the 'mid-Atlantic bottom trawl' and 'mid-Atlantic midwater trawl' fisheries.

b. Observer data (Obs. Data), used to measure bycatch rates, are collected within the Northeast Fisheries Observer Program. NEFSC collects landings data (unallocated Dealer Data or Allocated Dealer Data) which are used as a measure of total landings and mandatory Vessel Trip Reports (VTR) (Trip Logbook) are used to determine the spatial distribution of landings and fishing effort.

c. The observer coverages for the Northeast sink gillnet fishery are ratios based on tons of fish landed. Northeast bottom trawl, mid-Atlantic bottom trawl, Northeast mid-water and mid-Atlantic mid-water trawl fishery coverages are ratios based on trips. Total observer coverage reported for bottom trawl gear and gillnet gear in the year 2010 includes only samples collected from traditional fisheries observer, but not the fishery monitors. Monitor trips were incorporated for 2011, the first full year of monitor coverage.

d. Fishery related bycatch rates for years 2008-2012 were estimated using an annual stratified ratio-estimator. These estimates replace the 2008-2011 annual estimates reported in the 2013 stock assessment report that were generated using a different method.

e. One common dolphin was incidentally caught in 2009 in the northeast gillnet fishery and one in 2010 in the mid-Atlantic gillnet fishery as part of a NEFSC hanging ratio study to examine the impact of gillnet hanging ratio on harbor porpoise bycatch. Six common dolphins were caught in a study of the effects of tie-downs on Atlantic Sturgeon bycatch rates conducted in the mid-Atlantic gillnet fishery in 2010. All research takes are included in the observed interactions and added to the total estimates, though these interactions and their associated fishing effort were not included in bycatch rate calculations that was expanded to the rest of the fishery.

f. Serious injuries were evaluated using new guidelines and include both at-sea monitor and traditional observer data (Waring *et al.* 2014, 2015)

CANADA

Between January 1993 and December 1994, 36 Spanish deep water trawlers, covering 74 fishing trips (4,726 fishing days and 14,211 sets), were observed in NAFO Fishing Area 3 (off the Grand Banks) (Lens 1997). A total of 47 incidental catches were recorded, which included one common dolphin. The incidental mortality rate for common dolphins was 0.007/set. One common dolphin was reported as a bycatch mortality in Canadian bottom otter trawl fishing on Georges Bank in 2012 (pers. comm. Marine Animal Response Society, Nova Scotia).

Other Mortality

Two common dolphins were reported as incidental mortalities in NEFSC Atlantic herring monitoring activities in 2004. In 2007, one common dolphin was reported taken in a NEFSC spring bottom trawl survey.

From 2008 to 2012, 645 common dolphins were reported stranded between Maine and Florida (Table 3). The total includes mass stranded common dolphins in Massachusetts during 2008 (one event of 5 animals and one of 2 animals), 2009 (a total of 26 in 6 events), 2010 (a total of 30 in 8 events), 2011 (a total of 30 animals in 5 events), and 2012 (23 group stranding events) and one mass stranding in North Carolina in 2011 (4 animals). Two animals in 2008, 5 animals in 2009, 11 animals in 2010, 15 animals in 2011, and 71 animals in 2012 were released or last sighted alive. In 2008, seven common dolphins had indications of human interactions, four which were fishery interactions. In 2009, six common dolphins had indications of human interaction, 3 of which were classified as fishery interactions. In 2010, 7 animals were classified as human interactions, 2 of which were fishery interactions (all Massachusetts mass-stranded animals) and 2 of which (Rhode Island) involved animals last sighted free-swimming. In 2011, 3 animals were classified as having human interactions, 2 of which were fishery interactions (one of these was satellite-tagged and released). Twelve human interaction cases were reported in 2012 (7 in Massachusetts, 3 in New York and 2 in New Jersey), 6 of which (2 in Massachusetts, 2 in New York and 1 in New Jersey) were classified as fisheries interactions. An Unusual Mortality Event (UME) was declared in 2008 due to a relatively high number of strandings between January and April 2008, from New Jersey to North Carolina. Twenty seven common dolphins were involved in this event (http://www.nmfs.noaa.gov/pr/health/mmume/midatlantic2008.htm accessed 19 April 2011). In Bogomolni's 2010 analysis of mortality causes of stranded marine mammals on Cape Cod and southeastern Massachusetts between 2000 and 2006, 61% of stranded common dolphins were involved in mass-stranding events, and 37% of all the common dolphin stranding mortalities were disease related (Bogomolni 2010).

Four common dolphin strandings (6 individuals) were reported on Sable Island, Nova Scotia from 1996 to 1998 (Lucas and Hooker 1997; 2000). The Marine Animal Response Society of Nova Scotia reported one common

dolphin stranded in 2008, one in 2009, one (released alive) in 2010, and 2 (one a fisheries interaction) in 2011 (Tonya Wimmer, pers. comm.).

Table 3. Short-beaked common dolphin (*Delphinus delphis delphis*) reported strandings along the U.S. Atlantic coast, 2008-2012 (Data from the NOAA Marine Mammal Health and Stranding Response Program. 2012 records accessed 16 July 2013).

STATE	2008	2009	2010	2011	2012	TOTALS
Maine	0	0	1	0	2	**3**
Massachusetts[a]	19	53	71	64	221	**428**
Rhode Island[c]	3	6	7	5	6	**27**
Connecticut	0	0	1	0	0	**1**
New York [b, c]	2	7	9	17	13	**48**
New Jersey[c]	9	6	14	9	14	**52**
Delaware[c]	2	4	0	1	1	**8**
Maryland	2	2	0	1	1	**6**
Virginia[c]	20	2	5	9	4	**40**
North Carolina[a],[c]	1	7	6	18	0	**32**
TOTALS	**58**	**87**	**114**	**124**	**262**	**645**

a. Massachusetts mass strandings (2008 - 5,2; 2009 - 2,3,3,4,6,8, 2010 - 2,2,3,3,3,4,5,8; 2011-3,3,4,7,13; 2012-23 group events ranging from 2 to 22 animals each). North Carolina mass stranding of 4 animals in 2011.

b. Twenty (12 dead, 8 rescued; one of the mortalities classified as human interaction) animals involved in a mass stranding in Suffolk county in 2007. Seven animals involved in 2 mass stranding events in March 2009 (six euthanized, 1 died at site, 2 had signs of fishery interation). In addition, in 2008 3 animals were relocated from the Nansemond River. Three animals (one released alive) involved in mass stranding in NJ in 2012.

c. Seven records with signs of human interaction in 2008 - 3 from Virginia, 1 from Massachusetts, one from North Carolina, and one from Delaware. Of these, 4 were fishery interactions. Six human interaction cases in 2009 (2 Massachusetts, 3 Rhode Island, 1 New York), 3 of which were classified as fishery interactions (2 in Rhode Island and one in Massachusetts). Seven HI cases in 2010 (4 mortalities in MA, 2 released alive in RI, and 1 mortality in New Jersey), 2 of which (Massachusetts) were classified as fishery interactions. Three HI cases in 2011, all in Massachusetts, 2 of which were classified as fishery interactions (but one of those fishery interaction animals was released alive). Twelve HI cases in 2012 (7 in Massachusetts, 3 in New York and 2 in New Jersey), 6 of which (2 in Massachusetts, 2 in New York and 1 in New Jersey) were classified as fisheries interactions.

Stranding data probably underestimate the extent of fishery-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other fishery interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interaction. However a recently published human interaction manual (Barco and Moore 2013) and case criteria for human interaction (Moore *at al.* 2013) should help with this.

STATUS OF STOCK

Short-beaked common dolphins are not listed as threatened or endangered under the Endangered Species Act, and the Western North Atlantic stock is not considered strategic under the Marine Mammal Protection Act. The 2008–2012 average annual human-related mortality does not exceed PBR. The total U.S. fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore, cannot be considered to

be insignificant and approaching zero mortality and serious injury rate. The status of short-beaked common dolphins, relative to OSP, in the U.S. Atlantic EEZ is unknown. Population trends for this species have not been investigated.

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Western North Atlantic Offshore Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

There are two morphologically and genetically distinct common bottlenose dolphin morphotypes (Duffield *et al.* 1983; Duffield 1986; Mead and Potter 1995; Rosel *et al.* 2009) described as the coastal and offshore forms. Both inhabit waters in the western North Atlantic Ocean (Hersh and Duffield 1990; Mead and Potter 1995; Curry and Smith 1997; Rosel *et al.* 2009) along the U.S. Atlantic coast. The two morphotypes are genetically distinct based upon both mitochondrial and nuclear markers (Hoelzel *et al.* 1998; Rosel *et al.* 2009). The offshore form is distributed primarily along the outer continental shelf and continental slope in the Northwest Atlantic Ocean from Georges Bank (Figure 1; CETAP 1982; Kenney 1990) to the Florida Keys, where dolphins with characteristics of the offshore type have stranded. However, bottlenose dolphins have occasionally been sighted in Canadian waters, on the Scotian Shelf, particularly in the Gully (Gowans and Whitehead 1995; NMFS unpublished data), and these animals are thought to be of the offshore form.

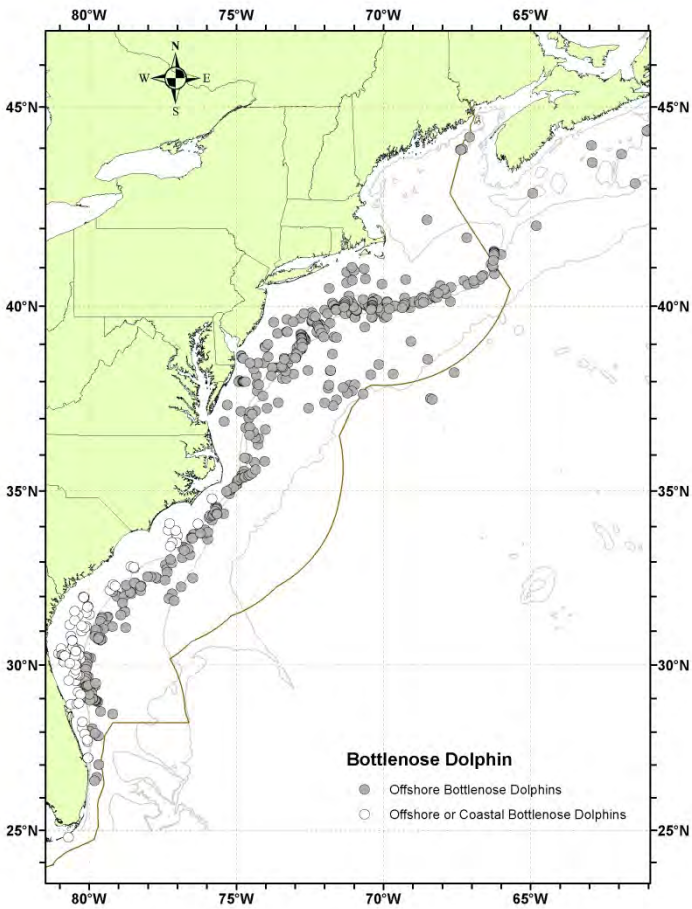

Figure 1. *Distribution of bottlenose dolphin sightings from NEFSC and SEFSC aerial surveys during summer in 1998, 1999, 2002, 2004, 2006 and 2011. Isobaths are the100-m, 1,000-m, and 4,000-m depth contours.*

North of Cape Hatteras, there is separation of the two morphotypes across bathymetry during summer months. Aerial surveys flown during 1979-1981 indicated a concentration of bottlenose dolphins in waters < 25 m deep corresponding to the coastal morphotype, and an area of high abundance along the shelf break corresponding to the offshore stock (CETAP 1982; Kenney 1990). Biopsy tissue sampling and genetic analysis demonstrated that bottlenose dolphins concentrated close to shore were of the coastal morphotype, while those in waters > 40 m depth were from the offshore morphotype (Garrison *et al.* 2003). However, during winter months south of Cape Hatteras, North Carolina, the ranges of the coastal and offshore morphotypes overlap to some degree. Torres *et al.* (2003) found a statistically significant break in the distribution of the morphotypes at 34 km from shore based upon the genetic analysis of tissue samples collected in nearshore and offshore waters. The offshore morphotype was found exclusively seaward of 34 km and in waters deeper than 34 m. Within 7.5 km of shore, all animals were of the coastal morphotype. More recently, offshore morphotype animals have been sampled as close as 7.3 km from shore in water depths of 13 m (Garrison *et al.* 2003). Systematic biopsy collection surveys were conducted coastwide during the summer and winter between 2001 and 2005 to evaluate the degree of spatial overlap between the two morphotypes. Over the continental shelf south of Cape Hatteras, North Carolina, the two morphotypes overlap spatially, and the probability of a sampled group being from the offshore morphotype increased with increasing depth based upon a logistic regression analysis (Garrison *et al*. 2003). In southeastern Florida, Hersh and Duffield (1990) examined bottlenose dolphins that stranded along the southeast coast of Florida and found four that had hemoglobin profiles matching that of the offshore morphotype. These strandings suggest the offshore form

occurs as far south as southern Florida. The range of the offshore bottlenose dolphin includes waters beyond the continental slope (Kenney 1990), and offshore bottlenose dolphins may move between the Gulf of Mexico and the Atlantic (Wells *et al.* 1999).

The western North Atlantic Offshore Stock of bottlenose dolphins is being considered separate from the Gulf of Mexico Oceanic Stock of bottlenose dolphins for management purposes. One line of evidence to support this decision comes from Baron *et al.* (2008), who found that Gulf of Mexico bottlenose dolphin whistles (collected from oceanic waters) were significantly different from those in the western North Atlantic Ocean (collected from continental shelf and oceanic waters) in duration, number of inflection points and number of steps.

POPULATION SIZE

The best available estimate for the offshore stock of bottlenose dolphins in the western North Atlantic is 77,532 (CV=0.40; Table 1). This estimate is from summer 2011 surveys covering waters from central Florida to the lower Bay of Fundy.

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions. Distance

Recent surveys and abundance estimates

An abundance estimate of 2,989 (CV=1.11) bottlenose dolphins was generated from an aerial survey conducted in August 2006, which surveyed 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; NMFS 2006). The survey was conducted on the NOAA Twin Otter using the circle-back data collection methods, which allow the estimation of *g(0)* (Palka 2005).

An abundance estimate of 26,766 (CV=0.52) offshore bottlenose dolphins was generated from aerial and shipboard surveys conducted during June-August 2011 between central Virginia and the lower Bay of Fundy. The aerial portion covered 6,850 km of tracklines over waters north of New Jersey between the coastline and the 100-m depth contour through the U.S. and Canadian Gulf of Maine, and up to and including the lower Bay of Fundy. The shipboard portion covered 3,811 km of tracklines between central Virginia and Massachusetts in waters deeper than the 100-m depth contour out to beyond the U.S. EEZ. Both sighting platforms used a double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

An abundance estimate of 50,766 (CV=0.55) offshore bottlenose dolphins was generated from a shipboard survey conducted concurrently (June-August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25x bigeye binoculars. A total of 4,445 km of tracklines was surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Table 1. Summary of abundance estimates for western North Atlantic offshore stock of bottlenose dolphins. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	2,989	1.11
Jun-Aug 2011	central Virginia to lower Bay of Fundy	26,766	0.52

Jun-Aug 2011	central Florida to central Virginia	50,766	0.55
Jun-Aug 2011	central Florida to lower Bay of Fundy (COMBINED)	77,532	0.40

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best abundance estimate is 77,532 (CV=0.40). The minimum population estimate for western North Atlantic offshore bottlenose dolphin is 56,053.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long intervals between surveys. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al*. 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for offshore bottlenose dolphins is 56,053. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because this stock is of unknown status. PBR for the western North Atlantic offshore bottlenose dolphin is therefore 561.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual human-caused mortality and serious injury of offshore bottlenose dolphins was 45.1 (CV=0.24; Table 2) due to interactions with the Northeast bottom trawl, mid-Atlantic bottom trawl, and pelagic longline fisheries.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fisheries Information

The commercial fisheries that could potentially interact with this stock in the Atlantic Ocean are the Category I Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline; mid-Atlantic gillnet; and Northeast sink gillnet fisheries; the Category II mid-Atlantic bottom trawl and Northeast bottom trawl fisheries; and the Category III Gulf of Maine, U.S. mid-Atlantic tuna, shark, swordfish hook and line/harpoon fishery. Detailed fishery information is reported in Appendix III.

Earlier Interactions

Prior to 1977, there was no documentation of marine mammal bycatch in distant-water fleet activities off the northeast coast of the U.S. A fishery observer program, which has collected fishery data and information on

incidental bycatch of marine mammals, was established in 1977 with the implementation of the Magnuson Fisheries Conservation and Management Act (MFCMA).

Bottlenose dolphin mortalities were observed in the pelagic drift gillnet fishery in 1989-1998. Bycatch mortality estimates extrapolated for each year (CV in parentheses) were 72 in 1989 (0.18), 115 in 1990 (0.18), 26 in 1991 (0.15), 28 in 1992 (0.10), 22 in 1993 (0.13), 14 in 1994 (0.04), 5 in 1995 (0), 0 in 1996, and 3 in 1998 (0).

Thirty-two bottlenose dolphin mortalities were observed in the pelagic pair trawl fishery between 1991 and 1995. Estimated annual fishery-related mortality (CV in parentheses) was 13 dolphins in 1991 (0.52), 73 in 1992 (0.49), 85 in 1993 (0.41), 4 in 1994 (0.40) and 17 in 1995 (0.26).

Although there were reports of bottlenose dolphin mortalities in the foreign squid mackerel butterfish fishery during 1977-1988, there were no fishery-related mortalities of bottlenose dolphins reported in the self-reported fisheries information from the mackerel trawl fishery during 1990-1992.

One bottlenose dolphin mortality was documented in the North Atlantic bottom trawl in 1991 and the total estimated mortality in this fishery in 1991 was 91 (CV=0.97). Since 1992 there were no bottlenose dolphin mortalities observed in this fishery.

The first observed mortality of bottlenose dolphins in the Northeast sink gillnet fishery was recorded in 2000. This was genetically identified as an offshore morphotype animal. The estimated annual fishery-related serious injury and mortality attributable to this fishery (CV in parentheses) was 0 from 1996-1999, and 132 (CV=1.16) in 2000. There was one additional observed mortality of a bottlenose dolphin presumed to be from the offshore morphotype in this fishery during 2004.

Bottlenose dolphin mortalities were observed in the mid-Atlantic gillnet fishery during 1998, 2001, and 2005. In each case, the dolphin was presumed to be of the offshore morphotype based upon its location in deep water over the outer continental shelf. The only prior estimate of total mortality in the fishery was 4 (CV=0.7) for 1998.

Pelagic Longline

The pelagic longline fishery operates in the U.S. Atlantic (including Caribbean) and Gulf of Mexico EEZ. The estimated annual average serious injury and mortality attributable to the Atlantic Ocean pelagic longline fishery for the 5-year period from 2008 to 2012 was 14.1 bottlenose dolphins (CV=0.61; Table 2). During 2008-2012, 4 serious injuries to bottlenose dolphins were observed. During 2012, 3 serious injuries were observed: 2 during quarter 1 in the South Atlantic Bight (SAB) region, and 1 during quarter 3 in the Northeast Coastal (NEC) region (Garrison and Stokes 2013). One serious injury of a bottlenose dolphin was observed during quarter 4 of 2009 in the Mid-Atlantic Bight (MAB) region (Garrison and Stokes 2010; see also Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2012a, 2012b). During 2009 (1 animal), 2010 (1 animal), 2011 (2 animals) and 2012 (2 animals), 6 bottlenose dolphins were observed entangled and released alive in the SAB, MAB and NEC regions (Garrison and Stokes 2010; 2012a,b; 2013). The animals were presumed to have no serious injuries. No bottlenose dolphin mortalities or serious injuries were observed between 2002 and 2007 (Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008). However, one bottlenose dolphin was observed entangled and released alive, presumed to have no serious injuries, in 2005 in the SAB region.

Table 2. Summary of the incidental mortality and serious injury of Atlantic Ocean offshore bottlenose dolphins by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).

Fishery	Years	Vessels[a]	Data Type[b]	Observer Coverage	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Est. CVs	Mean Annual Mortality
Northeast Bottom Trawl [c]	08-12	297,277, 264,226, 218	Obs. Data Logbook	.08, .09, .16, .26, .17	0,0,0,0,0	0,4,1,0, 0	0,0,0,0,0	19, 18,4,10, 0	19, 18,4,10, 0	.88,.92, .53,.84, .00	10 (.49)
Mid-Atlantic Bottom Trawl [c]	08-12	374,358, 345,325, 328	Obs. Data Logbook	.03, .05, .06, .08, .05	0,0,0,0,0	0,1,5,2, 1	0,0,0,0,0	16, 21,20,34, 16	16, 21,20,34, 16	.36,.45, .34,.31, 1.0	21 (.22)

Pelagic Longline	08-12	78, 75,80, 83,82	Obs. Data Logbook	.07, .10, .08, .09, .07	0,1,0,0,3	0,0,0,0,0	0,8.8,0,0, 61.8	0,0,0,0,0	0,8.8,0,0, 61.8	NA, 1.00, NA, NA, 0.68	14.1 (.61)
TOTAL											45.1 (.24)

[a] Number of vessels in the fishery is based on vessels reporting effort to the pelagic longline logbook and vessel trip reports in the Northeast and Mid-atlantic bottom trawl fisheries.
[b] Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC).
[c] Fishery related bycatch rates for 2012 were estimated using an annual stratified ratio-estimator using only data from 2012. The 2007-2011 estimates reported in the 2013 stock assessment report were generated using a different method, pooling observer data over the five year time period (2007-2011). Pooled stratified bycatch rates were applied to annual fishing effort data resulting in annual mortality estimates across the 2007-2011 time period.

Northeast Bottom Trawl

During 2008-2012, 5 mortalities were observed in the Northeast bottom trawl fishery. No takes were observed in 2008, 2011, and 2012; 4 mortalities were observed in 2009, and 1 mortality in 2010. New serious injury criteria were applied to all observed interactions retroactive back to 2007. There were no observed serious injuries of bottlenose dolphins in the Northeast region. Estimated annual fishery-related mortalities (CV in parentheses) were 19 (0.88) in 2008, 18 (0.92) in 2009, 4 (0.53) in 2010, 10 (0.84) in 2011, and 0 in 2012. The 2008-2012 average mortality attributed to the Northeast bottom trawl was 10 animals (0.49; Table 2).

Mid-Atlantic Bottom Trawl

During 2008-2012, 9 mortalities were observed in the mid-Atlantic bottom trawl fishery. No takes were observed in 2007 or 2008; 1 mortality was observed in 2009, 5 in 2010, 2 in 2011, and 1 in 2012. New serious injury criteria were applied to all observed interactions retroactive back to 2007. There were no observed serious injuries of bottlenose dolphins in the Mid-Atlantic region. Estimated annual fishery-related mortalities (CV in parentheses) were 11 (0.42) in 2007, 16 (0.36) in 2008, 21 (0.45) in 2009, 20 (0.34) in 2010, 34 (0.31) in 2011, and 16 (1.0) in 2012. The 2008-2012 average mortality attributed to the Northeast bottom trawl was 21 animals (0.22; Table 2).

Through the Marine Mammal Authorization Program (MMAP), there were 2 self-reported incidental takes (mortalities) of bottlenose dolphins during 2011 off Rhode Island and New Jersey by fishers trawling for *Loligo* squid.

U.S. Mid-Atlantic Tuna Hook and Line Fishery

Through the MMAP, there was 1 self-reported incidental take (serious-injury) of a bottlenose dolphin during 2010 off North Carolina by a fisher using hook and line targeting tuna.

Other Mortality

Bottlenose dolphins are among the most frequently stranded small cetaceans along the Atlantic coast. Many of the animals show signs of human interaction (*i.e.*, net marks, mutilation, etc.); however, it is unclear what proportion of these stranded animals is from the offshore stock because most strandings are not identified to morphotype, and when they are, animals of the offshore form are uncommon. For example, only 19 of 185 *Tursiops* strandings in North Carolina were genetically assigned to the offshore form (Byrd *et al.* 2014).

STATUS OF STOCK

The western North Atlantic bottlenose dolphin is not listed as threatened or endangered under the Endangered Species Act, and the offshore stock is not considered strategic under the Marine Mammal Protection Act. Total U.S. fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching the zero mortality and serious injury rate. The status of this stock relative to OSP in the U.S. Atlantic EEZ is unknown. There are insufficient data to determine the population trends for this stock.

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*)
Central Georgia Estuarine System Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The coastal morphotype of common bottlenose dolphins is continuously distributed along the Atlantic coast south of Long Island, New York, to the Florida peninsula, including inshore waters of the bays, sounds and estuaries. Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present in the inshore waters of the bays, sounds and estuaries. Photo-identification (photo-ID) and genetic studies support the existence of resident estuarine animals in several inshore areas of the southeastern United States (Caldwell 2001; Gubbins 2002; Zolman 2002; Mazzoil *et al.* 2005; Litz *et al.* 2012), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (Wells *et al.* 1987; Balmer *et al.* 2008). Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied in coastal and estuarine areas along the Atlantic coast (Rosel *et al.* 2009), and between those biopsied in coastal and estuarine waters at the same latitude (NMFS unpublished data). Similar results have been found off the west coast of Florida (Sellas *et al.* 2005).

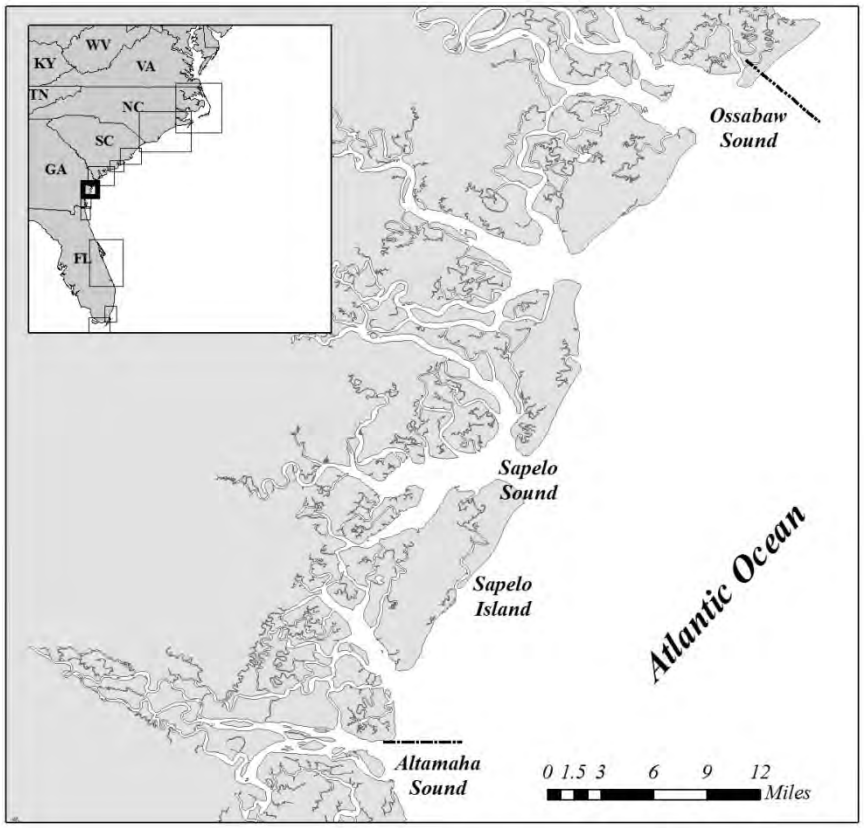

Figure 1. *Geographic extent of the Central Georgia Estuarine System (CGES) Stock. Dashed lines denote the boundaries.*

Coastal central and northern Georgia contains an extensive estuarine tidal marsh system in which bottlenose dolphins are documented. The primary river drainages in this region are the Altamaha in central Georgia and the Savannah River at the Georgia-South Carolina border. Much of the coastal marsh and islands in the area have been privately owned since the early 19th century and have therefore experienced little development and the marshes and coastal region are therefore relatively undisturbed. The Sapelo Island National Estuarine Research Reserve, part of NOAA's Estuarine Reserve System, lies in this section of the Georgia coast and includes 4,000 acres of tidal salt marsh.

The Central Georgia Estuarine System Stock (CGES) is delineated in the estuarine waters of central Georgia (Figure 1). It extends from the northern extent of Ossabaw Sound, where it meets the border with the Northern Georgia/Southern South Carolina Estuarine System Stock, south to the Altamaha River, which provides the border between the CGES and the Southern Georgia Estuarine System Stock. Nearshore (≤ 1km from shore) coastal waters are also included in the CGES Stock boundaries.

The boundaries of this stock are supported by photo-ID and genetic data. Balmer *et al.* (2011) conducted photo-ID studies between 2004 and 2009 in the Turtle/Brunswick River estuary (TBRE) in southern Georgia and in estuarine habitats north of the Altamaha Sound to Sapelo Sound. Photo-ID data revealed strong site fidelity to the

two regions and supported Altamaha Sound as an appropriate boundary between the two sites as 85.4% of animals identified did not cross Altamaha Sound (Balmer *et al.* 2013). Just over half the animals that did range across Altamaha Sound had low site fidelity and were believed to be members of the South Carolina/Georgia Coastal Stock. Genetic analysis of mitochondrial DNA control region sequences and microsatellite markers of dolphins biopsied in southern Georgia showed significant genetic differentiation from animals biopsied in northern Georgia and southern South Carolina estuaries as well as from animals biopsied in coastal waters >1 km from shore at the same latitude (NMFS unpublished data). In addition, bottlenose dolphins sampled within the Sapelo Island area exhibited contaminant burdens significantly lower than those sampled to the south in the TBRE (Balmer *et al.* 2011; Kucklick *et al.* 2011) consistent with long-term fidelity to these separate areas.

POPULATION SIZE

During 2008-2009, seasonal, mark-recapture photo-ID surveys were conducted to estimate abundance in a portion of the CGES area from Altamaha Sound north to Sapelo Sound. Estimates from winter were chosen as the best representation of the resident estuarine stock in the area surveyed, and a Markovian emigration model was chosen as the best fit based on the lowest Akaike's Information Criterion value. The estimated average abundance, based on winter 2008 and winter 2009 surveys, was 192 (CV=0.04; Balmer *et al.* 2013). Estimates were adjusted to include the 'unmarked' (not distinctive) as well as 'marked' (distinctive) portion of the population for each winter survey. It is important to note this estimate covered approximately half of the entire range of the CGES Stock, and therefore, the abundance estimate is negatively biased.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). Though negatively biased, the best estimate for the CGES Stock is 192 (CV=0.04). The resulting minimum population estimate is 185.

Current Population Trend

There are insufficient data to determine the population trends for this stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a “recovery” factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the CGES Stock of bottlenose dolphins is 185. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is of unknown status. PBR for this stock of bottlenose dolphins is 1.9.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury within the CGES Stock of bottlenose dolphins during 2008-2012 is unknown. One interaction with commercial crab trap/pot gear was documented; however, it is not possible to estimate the total number of interactions or mortalities associated with crab pots since there is no systematic observer program.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an “*injury that is more likely than not to result in mortality*”. Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

There is a potential for the CGES Stock to interact with the Category II Atlantic blue crab trap/pot fishery (Appendix III).

Crab Pots

During 2008-2012 there was 1 documented interaction with crab trap/pot gear in the CGES area. This interaction occurred during 2011 and involved an animal that was disentangled from commercial crab trap/pot gear, likely blue crab, and released alive without serious injury (Maze-Foley and Garrison in prep). This animal was included in the stranding database and in the totals in Table 1 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 [for 2008-2011 data] and 15 April 2013 [for 2012 data]). Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab pots.

Other Mortality

From 2008 to 2012, 15 bottlenose dolphins were reported stranded within the CGES (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, 13 September 2012 and 15 April 2013). It was not possible to make any determination of possible human interaction for 13 of these strandings due to most (80%) were in a state of moderate or advanced decomposition when first observed. For 1 dolphin, no evidence of human interactions was detected. The remaining stranding was a fishery interaction with commercial crab trap/pot gear, described above. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals that die or are seriously injured in fishery interactions are discovered, reported or investigated, nor will all of those that are found necessarily show signs of entanglement or other fishery interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interactions.

Illegal feeding or provisioning of wild bottlenose dolphins has been documented in Georgia, particularly near Brunswick and Savannah (Kovacs and Cox 2014; Perrtree *et al.* 2014; Wu 2013). Feeding wild dolphins is defined under the MMPA as a form of 'take' because it can alter the natural behavior and increase the risk of injury or death to wild dolphins.

Table 1. Bottlenose dolphin strandings occurring in the Central Georgia Estuarine System Stock area during 2008 to 2012, as well as number of strandings for which evidence of human interactions (HI) was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interactions. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 13 September 2012 [for 2008-2011 data] and 15 April 2013 [for 2012 data]). Please note human interaction does not necessarily mean the interaction caused the animal's death.

Stock	Category	2008	2009	2010	2011	2012	Total
Central Georgia Estuarine System Stock	Total Stranded	3	1	1	5	5	15
	Human Interaction						
	---Yes	0	0	0	1[a]	0	1
	---No	0	0	0	0	1	1
	---CBD	3	1	1	4	4	13

[a] This HI was an animal disentangled from commercial crab pot gear and released alive without serious injury.

STATUS OF STOCK

Bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act. However, because the abundance of the CGES Stock is small and relatively few mortalities and serious injuries would exceed PBR, NMFS considers this to be a strategic stock under the Marine Mammal Protection Act. PBR for this stock is 1.9, and the zero mortality rate goal, 10% of PBR, is 0.2. There were no documented human-caused mortalities to this stock during 2008 – 2012. However, a recent entanglement and entanglements in prior years in both commercial and recreational crab trap/pot fisheries have been documented. While the impact of crab trap/pot fisheries on estuarine bottlenose dolphins is currently unknown, it has been shown previously to be considerable in the similar Charleston Estuarine System Stock area (Burdett and McFee 2004). Therefore, documented mortalities must be considered minimum estimates of total fishery-related mortality. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this

stock is insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP is unknown. There are insufficient data to determine the population trends for this stock.

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HARBOR PORPOISE (*Phocoena phocoena phocoena*): Gulf of Maine/Bay of Fundy Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

This stock is found in U.S. and Canadian Atlantic waters. The distribution of harbor porpoises has been documented by sighting surveys, strandings and takes reported by NMFS observers in the Sea Sampling Programs. During summer (July to September), harbor porpoises are concentrated in the northern Gulf of Maine and southern Bay of Fundy region, generally in waters less than 150 m deep (Gaskin 1977; Kraus *et al.* 1983; Palka 1995a; Palka 1995b), with a few sightings in the upper Bay of Fundy and on Georges Bank (Palka 2000). During fall (October-December) and spring (April-June), harbor porpoises are widely dispersed from New Jersey to Maine, with lower densities farther north and south. They are seen from the coastline to deep waters (>1800 m; Westgate *et al.* 1998), although the majority of the population is found over the continental shelf. During winter (January to March), intermediate densities of harbor porpoises can be found in waters off New Jersey to North Carolina, and lower densities are found in waters off New York to New Brunswick, Canada. There does not appear to be a temporally coordinated migration or a specific migratory route to and from the Bay of Fundy region. However, during the fall, several satellite tagged harbor porpoises did favor the waters around the 92-m isobath, which is consistent with observations of high rates of incidental catches in this depth range (Read and Westgate 1997). There were two stranding records from Florida during the 1980s (Smithsonian strandings database) and one in 2003 (NE Regional Office/NMFS strandings and entanglement database).

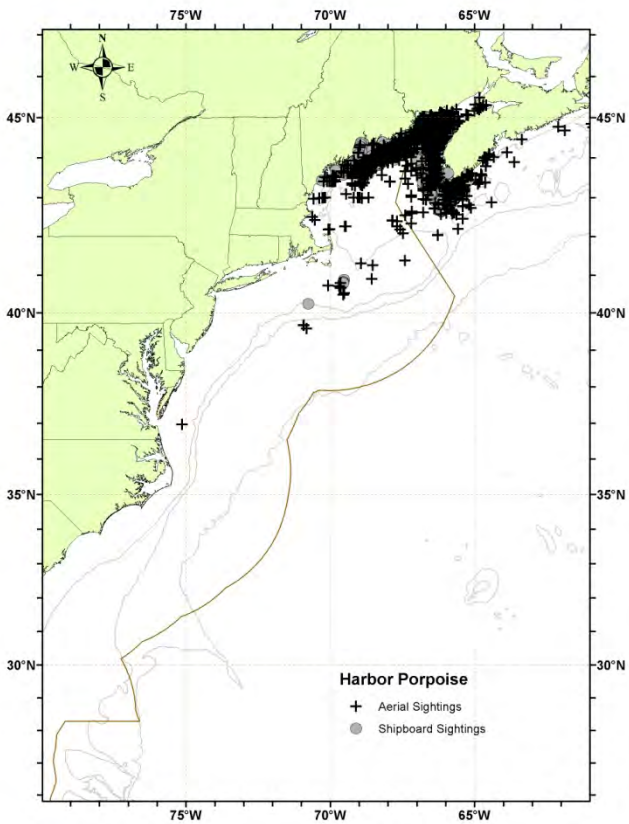

Figure 1. *Distribution of harbor porpoises from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008, 2010, and 2011 and DFO's 2007 TNASS survey. Isobaths are the 100-m, 1000-m, and 4000-m depth contours.*

Gaskin (1984, 1992) proposed that there were four separate populations in the western North Atlantic: the Gulf of Maine/Bay of Fundy, Gulf of St. Lawrence, Newfoundland, and Greenland populations. Analyses involving mtDNA (Wang *et al.* 1996; Rosel *et al.* 1999a; 1999b), organochlorine contaminants (Westgate *et al.* 1997; Westgate and Tolley 1999), heavy metals (Johnston 1995), and life history parameters (Read and Hohn 1995) support Gaskin's proposal. Genetic studies using mitochondrial DNA (Rosel *et al.* 1999a) and contaminant studies using total PCBs (Westgate and Tolley 1999) indicate that the Gulf of Maine/Bay of Fundy females were distinct from females from the other populations in the Northwest Atlantic. Gulf of Maine/Bay of Fundy males were distinct from Newfoundland and Greenland males, but not from Gulf of St. Lawrence males according to studies comparing mtDNA (Palka *et al.* 1996; Rosel *et al.* 1999a) and CHLORs, DDTs, PCBs and CHBs (Westgate and Tolley 1999). Nuclear microsatellite markers have also been applied to samples from these four populations, but this analysis failed to detect significant population sub-division in either sex (Rosel *et al.* 1999a). These patterns may be indicative of female philopatry coupled with dispersal of males. Both mitochondrial DNA and microsatellite

analyses indicate that the Gulf of Maine/Bay of Fundy stock is not the sole contributor to the aggregation of porpoises found off the mid-Atlantic states during winter (Rosel *et al.* 1999a; Hiltunen 2006). Mixed-stock analyses using twelve microsatellite loci in both Bayesian and likelihood frameworks indicate that the Gulf of Maine/Bay of Fundy is the largest contributor (~60%), followed by Newfoundland (~25%) and then the Gulf of St. Lawrence (~12%), with Greenland making a small contribution (<3%). For Greenland, the lower confidence interval of the likelihood analysis includes zero. For the Bayesian analysis, the lower 2.5% posterior quantiles include zero for both Greenland and the Gulf of St. Lawrence. Intervals that reach zero provide the possibility that these populations contribute no animals to the mid-Atlantic aggregation. This report follows Gaskin's hypothesis on harbor porpoise stock structure in the western North Atlantic, where the Gulf of Maine and Bay of Fundy harbor porpoises are recognized as a single management stock separate from harbor porpoise populations in the Gulf of St. Lawrence, Newfoundland, and Greenland.

POPULATION SIZE

To estimate the population size of harbor porpoises in the Gulf of Maine/Bay of Fundy region, line-transect sighting surveys were conducted during the summers of 1991, 1992, 1995, 1999, 2002, 2004, 2006, 2007, and 2011. The best current abundance estimate of the Gulf of Maine/Bay of Fundy harbor porpoise stock is the result of the 2011 survey: 79,883 (CV=0.32).

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions.

Recent surveys and abundance estimates

An abundance estimate of 89,054 (CV=0.47) harbor porpoises was generated from an aerial survey conducted in August 2006 using the Hiby circle-back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005).. This survey covered 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence. (Table 1; NMFS 2006).

An abundance estimate of 12,732 (CV=0.61) harbor porpoises on the Scotian Shelf and in the Gulf of St. Lawrence was generated from the Canadian Trans North Atlantic Sighting Survey in July–August 2007 (and see Lawson and Gosselin 2009). The total estimate of harbor porpoises from the Gulf of Maine/Bay of Fundy, Gulf of St. Lawrence, and Newfoundland stocks was 16,058 (CV=0.50). This aerial survey covered waters from northern Labrador to the Scotian Shelf, providing full coverage of the Atlantic Canadian coast. The abundance estimates from this survey have been corrected for perception and availability bias, when possible. In general, this involved correcting for perception bias using mark-recapture distance sampling (MCDS), and correcting for availability bias using dive/surface times, as reported in the literature, and the Laake et al. (1997) analysis method (Lawson and Gosselin 2011).

An abundance estimate of 79,883 (CV=0.32) harbor porpoises was generated from a shipboard and aerial survey conducted during June–August 2011 (Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters north of New Jersey from the coastline to the 100-m depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in waters offshore of central Virginia to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a double-platform team data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

No harbor porpoises were detected in an abundance survey that was conducted concurrently (June-August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed the double-platform methodology searching with 25x bigeye binoculars. A total of 4,445 km of tracklines were surveyed, yielding 290 cetacean sightings.

Table 1. Summary of recent abundance estimates for the Gulf of Maine/Bay of Fundy harbor porpoise (*Phocoena phocoena phocoena*). Month, year, and area covered during each abundance survey and the resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	89,054	0.47
Jul-Aug 2007[a]	Scotian Shelf and Gulf of St. Lawrence	12,732	0.61
Jul-Aug 2011	Central Virginia to lower Bay of Fundy	79,883	0.32

a. A portion of this survey covered habitat of the Gulf of Maine/Bay of Fundy stock. The estimate also includes animals from the Gulf of St. Lawrence and Newfoundland stocks.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for harbor porpoises is 79,883 (CV=0.32). The minimum population estimate for the Gulf of Maine/Bay of Fundy harbor porpoise is 61,415.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Several attempts have been made to estimate potential population growth rates. Barlow and Boveng (1991), who used a re-scaled human life table, estimated the upper bound of the annual potential growth rate to be 9.4%. Woodley and Read (1991) used a re-scaled Himalayan tahr life table to estimate a likely annual growth rate of 4%. In an attempt to estimate a potential population growth rate that incorporates many of the uncertainties in survivorship and reproduction, Caswell *et al.* (1998) used a Monte Carlo method to calculate a probability distribution of growth rates. The median potential annual rate of increase was approximately 10%, with a 90% confidence interval of 3-15%. This analysis underscored the considerable uncertainty that exists regarding the potential rate of increase in this population. Moore and Read (2008) conducted a Bayesian population modeling analysis to estimate the potential population growth of harbor porpoise in the absence of bycatch mortality. Their method used fertility data, in combination with age-at-death data from stranded animals and animals taken in gillnets, and was applied under two scenarios to correct for possible data bias associated with observed bycatch of calves. Demographic parameter estimates were 'model averaged' across these scenarios. The Bayesian posterior median estimate for potential natural growth rate was 0.046. This last, most recent, value will be the one used for the purpose of this assessment.

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 61,415. The maximum productivity rate is 0.046. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because the CV of the average mortality estimate is less than 0.3 (Wade and Angliss 1997). PBR for the Gulf of Maine/Bay of Fundy harbor porpoise is 706.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Data to estimate the mortality and serious injury of harbor porpoise come from U.S. and Canadian Sea Sampling Programs, from records of strandings in U.S. and Canadian waters, and from records in the Marine Mammal Authorization Program (MMAP). See Appendix III for details on U.S. fisheries and data sources.

Estimates using Sea Sampling Program and MMAP data are discussed by fishery under the Fishery Information section (Table 2). Strandings records are discussed under the Other Mortality section (Table 3).

The total annual estimated average human-caused mortality is 683 harbor porpoises per year. This is derived from two components: 640 harbor porpoise per year (CV=0.17) from U.S. fisheries using observer and MMAP data, and 43 per year (unknown CV) from Canadian fisheries using observer data.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Recently, Gulf of Maine/Bay of Fundy harbor porpoise takes have been documented in the U.S. Northeast sink gillnet, mid-Atlantic gillnet, and Northeast bottom trawl fisheries and in the Canadian herring weir fisheries (Table 2). Detailed U.S. fishery information is reported in Appendix III.

Earlier Interactions

One harbor porpoise was observed taken in the Atlantic pelagic drift gillnet fishery during 1991-1998; the fishery ended in 1998. This observed bycatch was notable because it occurred in continental shelf edge waters adjacent to Cape Hatteras (Read *et al.* 1996). Estimated annual fishery-related mortality (CV in parentheses) attributable to this fishery was 0.7 in 1989 (7.00), 1.7 in 1990 (2.65), 0.7 in 1991 (1.00), 0.4 in 1992 (1.00), 1.5 in 1993 (0.34), 0 during 1994-1996 and 0 in 1998. The fishery was closed during 1997. Information on Canadian fisheries that interact with stocks other than the Gulf of Maine/Bay of Fundy stock can be found in Hooker (1997), Lesage *et al*. (2006) and Benjanims *et al*. (2007).

U.S.

Northeast Sink Gillnet

In 1990, an observer program was started by NMFS to investigate marine mammal takes in the Northeast sink gillnet fishery (Appendix III). Bycatch in the northern Gulf of Maine occurs primarily from June to September, while in the southern Gulf of Maine, bycatch occurs from January to May and September to December. During 2008-2012 no serious injuries were observed (Table 2). Estimated annual bycatch (CV in parentheses) from this fishery was 2,900 in 1990 (0.32), 2,000 in 1991 (0.35), 1,200 in 1992 (0.21), 1,400 in 1993 (0.18) (CUD 1994; Bravington and Bisack 1996), 2,100 in 1994 (0.18), 1,400 in 1995 (0.27) (Bisack 1997), 1,200 in 1996 (0.25), 782 in 1997 (0.22), 332 in 1998 (0.46), 270 in 1999 (0.28) (Rossman and Merrick 1999), 507 in 2000 (0.37), 53 (0.97) in 2001, 444 (0.37) in 2002, 592 (0.33) in 2003, 654 (0.36) in 2004, 630 (0.23) in 2005, 514 (0.31) in 2006, 395 (0.37) in 2007, 666 (0.48) in 2008, 591 (0.23) in 2009, 387 (0.27) in 2010, 273 (0.20) in 2011, and 277 (0.59) in 2012 (Table 2; Orphanides 2013, Hatch and Orphanides 2014). There appeared to be no evidence of differential mortality in U.S. or Canadian gillnet fisheries by age or sex in animals collected before 1994, although there was substantial inter-annual variation in the age and sex composition of the bycatch (Read and Hohn 1995). Using observer data collected during 1990-1998 and a logit regression model, females were 11 times more likely to be caught in the offshore southern Gulf of Maine region, males were more likely to be caught in the south Cape Cod region, and the overall proportion of males and females caught in a gillnet and brought back to land were not significantly different from 1:1 (Lamb 2000).

Scientific experiments that demonstrated the effectiveness of pingers in the Gulf of Maine were conducted during 1992 and 1993 (Kraus *et al.* 1997). After the scientific experiments, experimental fisheries were allowed in the general fishery during 1994 to 1997 in various parts of the Gulf of Maine and south of Cape Cod areas. During these experimental fisheries, bycatch rates of harbor porpoises in pingered nets were less than in non-pingered nets.

A study on the effects of two different hanging ratios in the bottom-set monkfish gillnet fishery on the bycatch of cetaceans and pinnipeds was conducted by NEFSC in 2009 and 2010 with 100% observer coverage which took place in both the Northeast and mid-Atlantic gillnet fisheries. Commercial fishing vessels from Massachusetts and New Jersey were used for the study, which took place south of the Harbor Porpoise Take Reduction Cape Cod South Management Area (south of 40° 40´N) in February-April. Researchers purposely picked an area of historically high bycatch rates in order to have a chance of finding a significant difference. Eight research strings of fourteen nets

each were fished and 159 hauls were completed during the course of the 2009–2010 study. Results showed that while a 0.33 mesh performed better at catching commercially important finfish than a 0.50 mesh, there was no statistical difference in cetacean or pinniped bycatch rates between the two hanging ratios. Twelve harbor porpoises were caught in this project in 79 hauls during 2009 and one animal was caught in 72 hauls during the 2010 experiment in the Northeast (A.I.S., Inc. 2010). These animals were included in the observed interactions and added into the total estimates (Table 2), though these animals and the fishing effort from this experiment were not included in the estimation of the bycatch rate that was expanded to the rest of the fishing effort.

Average estimated harbor porpoise mortality and serious injury in the Northeast sink gillnet fishery during 1994-1998, before the Take Reduction Plan, was 1,163 (0.11). The average annual harbor porpoise mortality and serious injury in the Northeast sink gillnet fishery from 2008 - 2012 was 439 (0.18; Table 2).

Mid-Atlantic Gillnet

Before an observer program was in place for this fishery, Polacheck *et al.* (1995) reported one harbor porpoise incidentally taken in shad nets in the York River, Virginia. In July 1993 an observer program was initiated in the mid-Atlantic gillnet fishery by the NEFSC Sea Sampling program (Appendix III). Documented bycatch after 1995 was from December to May. Bycatch estimates were calculated using methods similar to that used for bycatch estimates in the Northeast sink gillnet fishery (Bravington and Bisack 1996; Bisack 1997). During 2008-2012 no serious injuries were observed (Table 2). The estimated annual mortality (CV in parentheses) attributed to this fishery was 103 (0.57) for 1995, 311 (0.31) for 1996, 572 (0.35) for 1997, 446 (0.36) for 1998, 53 (0.49) for 1999, 21 (0.76) for 2000, 26 (0.95) for 2001, unknown in 2002, 76 (1.13) in 2003, 137 (0.91) in 2004, 470 (0.51) in 2005, 511 (0.32) in 2006, 58 (1.03) in 2007, 350 (0.75) in 2008, 201 (0.55) in 2009, 259 (0.88) in 2010, 123 (0.41) in 2011 and 63(0.83;Orphanides 2013; Hatch and Orphanides 2014).

In the Northeast gillnet fishery section above, see the description of the study on the effects of two different hanging rations in the bottom-set gillnet fishery which took place in both the Northeast and mid-Atlantic gillnet fisheries. Ten harbor porpoises were caught in 8 hauls in the mid-Atlantic as part of this experiment (A.I.S., Inc. 2010). Harbor porpoises that were caught in this study were included in the observed interactions and added into the total estimates (Table 2), though these animals and the fishing effort from this experiment were not included in the estimation of the bycatch rate that was expanded to the rest of the fishing effort.

Annual average estimated harbor porpoise mortality and serious injury from the mid-Atlantic gillnet fishery during 1995 to 1998, before the Take Reduction Plan, was 358 (CV=0.20). The average annual harbor porpoise mortality and serious injury in the mid-Atlantic gillnet fishery from 2008–2012 was 199 (0.37) (Table 2).

Northeast Bottom Trawl

This fishery is active in New England waters in all seasons. Twenty harbor porpoise mortalities were observed in the Northeast bottom trawl fishery between 1989 and 2008, but many of these are not attributable to this fishery. Decomposed animals are presumed to have been dead prior to being taken by the trawl. One fresh dead take was observed in the Northeast bottom trawl fishery in 2003, 4 in 2005, 1 in 2006, 1 in 2008, and 1 in 2011. Revised serious injury guidelines were applied for this period (Waring *et al.* 2014, 2015). One serious injury was observed in 2011. Fishery related bycatch rates for years 2008-2012 were estimated using an annual stratified ratio-estimator. These estimates replace the 2008-2010 annual estimates reported in the 2013 stock assessment report that were generated using a different method. The estimated annual mortality (CV in parentheses) attributed to this fishery was 7.2 (0.48) for 2005, 6.5 (0.49) for 2006, 5.6 (0.46) for 2007, 5.6 (0.97) for 2008, 0 for 2009 and 2010, 5.9 (0.71) for 2011, and 0 for 2012. Annual average estimated harbor porpoise mortality and serious injury from the Northeast bottom trawl fishery from 2008-2012 is 2.3 (0.60) (Table 2).

CANADA

Bay of Fundy Sink Gillnet

During the early 1980s, harbor porpoise bycatch in the Bay of Fundy sink gillnet fishery, based on casual observations and discussions with fishermen, was thought to be low. The estimated harbor porpoise bycatch in 1986 was 94-116 and in 1989 it was 130 (Trippel *et al.* 1996). The Canadian gillnet fishery occurs mostly in the western portion of the Bay of Fundy during the summer and early autumn months, when the density of harbor porpoises is highest. Polacheck (1989) reported there were 19 gillnetters active in 1986, 28 active in 1987, and 21 in 1988.

An observer program implemented in the summer of 1993 provided a total bycatch estimate of 424 harbor porpoises (± 1 SE: 200-648) from 62 observed trips, (approximately 11.3% coverage of the Bay of Fundy trips) (Trippel *et al.* 1996). During 1994, the observer program was expanded to cover 49% of the gillnet trips (171

observed trips). The bycatch was estimated to be 101 harbor porpoises (95% confidence limit: 80-122), and the fishing fleet consisted of 28 vessels (Trippel *et al.* 1996). During 1995, due to groundfish quotas being exceeded, the gillnet fishery was closed from July 21 to August 31. During the open fishing period of 1995, 89% of the trips were observed, all in the Swallowtail region. Approximately 30% of these observed trips used pingered nets. The estimated bycatch was 87 harbor porpoises (Trippel *et al.* 1996). No confidence interval was computed due to lack of coverage in the Wolves fishing grounds. During 1996, the Canadian gillnet fishery was closed during 20-31 July and 16-31 August due to groundfish quotas. From the 107 monitored trips, the bycatch in 1996 was estimated to be 20 harbor porpoises (DFO 1998; Trippel *et al.* 1999). Trippel *et al.* (1999) estimated that during 1996, gillnets equipped with acoustic alarms reduced harbor porpoise bycatch rates by 68% over nets without alarms in the Swallowtail area of the lower Bay of Fundy. During 1997, the fishery was closed to the majority of the gillnet fleet during 18-31 July and 16-31 August, due to groundfish quotas. In addition a time-area closure to reduce porpoise bycatch in the Swallowtail area occurred during 1-7 September. From the 75 monitored trips, 19 harbor porpoises were observed taken. After accounting for total fishing effort, the estimated bycatch in 1997 was 43 animals (DFO 1998). Trippel *et al.* (1999) estimated that during 1997, gillnets equipped with acoustic alarms reduced harbor porpoise bycatch rates by 85% over nets without alarms in the Swallowtail area of the lower Bay of Fundy. The number of monitored trips (and observed harbor porpoise mortalities were 111 (5) for 1998, 93 (3) for 1999, 194 (5) for 2000, and 285 (39) for 2001. The estimated annual mortality estimates were 38 for 1998, 32 for 1999, 28 for 2000, and 73 for 2001 (Trippel and Shepherd 2004). Estimates of variance are not available.

Since 2002 there has been no observer program in the Bay of Fundy region, but the fishery is still active. Bycatch for these years is unknown. The annual average of most recent five years with available data (1997-2001) was 43 animals, so this value is used to estimate the annual average for more recent years. However, in 2011 there was little gillnet effort in New Brunswick waters in the summer; thus the Canadian porpoise by-catch estimates could have been near zero. The fishermen that sought groundfish went into the mid-Bay of Fundy where traditionally by-catch levels were extremely low. Trippel (pers. comm.) estimated that less than 10 porpoise were bycaught in the Canadian fisheries in the Bay of Fundy in 2011. Analysis of port catch records might allow estimation of bycatch for more recent times, however, it would be difficult to also accurately account for the changes in the spatial distribution of the harbor porpoises and fisheries. .

Herring Weirs

Harbor porpoises are taken in Canadian herring weirs, but there have been no recent efforts to observe takes in the U.S. component of this fishery. Smith *et al.* (1983) estimated that in the 1980s approximately 70 harbor porpoises became trapped annually and, on average, 27 died annually. In 1990, at least 43 harbor porpoises were trapped in Bay of Fundy weirs (Read *et al.* 1994). In 1993, after a cooperative program between fishermen and Canadian biologists was initiated, over 100 harbor porpoises were released alive (Read *et al.* 1994). Between 1992 and 1994, this cooperative program resulted in the live release of 206 of 263 harbor porpoises caught in herring weirs. Mortalities (and releases) were 11 (50) in 1992, 33 (113) in 1993, and 13 (43) in 1994 (Neimanis *et al.* 1995). Since that time, additional harbor porpoises have been documented in Canadian herring weirs: mortalities (releases and unknowns) were 5 (60, 0) in 1995; 2 (4, 0) in 1996; 2 (24, 0) in 1997; 2 (26, 0) in 1998; 3 (89, 0) in 1999; 0 (13, 0) in 2000 (A. Read, pers. comm), 14 (296, 0) in 2001, 3 (46, 4) in 2002, 1 (26, 3) in 2003, 4 (53, 2) in 2004; 0 (19, 5) in 2005; 2 (14, 0) in 2006; 3 (9, 3) in 2007, 0 (8, 6) in 2008, 0 (3,4) in 2009, 1 in 2010 (7, 0), 0 (2, 3) in 2011, and 0 (2, 3) in 2012. (Neimanis *et al.* 2004; H. Koopman and A. Westgate, pers. comm.).

Average estimated harbor porpoise mortality in the Canadian herring weir fishery during 2008–2012 was 0.2 (Table 2). An estimate of variance is not possible.

Table 2. From observer program data, summary of the incidental mortality of Gulf of Maine/Bay of Fundy harbor porpoise (*Phocoena phocoena phocoena*) by commercial fishery including the years sampled, the type of data used, the annual observer coverage, the mortalities and serious injuries recorded by on-board observers, the estimated annual serious injury and mortality, the estimated CV of the annual mortality, and the mean annual combined mortality (CV in parentheses).

Fishery	Years	Data Type [a]	Observer Coverage [b]	Observed Serious Injury[i]	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Combined Serious Injury	Estimated CVs	Mean Annual Combined Mortality
U.S.										
Northeast	08-12	Obs. Data,	.05, .04, .17, .19,	0, 0, 0, 0, 0	30, 45, 50, 66, 34	0, 0, 0, 0, 0	666, 591, 387, 273, 277	666, 591, 387, 273,	.48, .23, .27, .20, .59	439 (0.18)

Sink Gillnet [c, h]		Weighout, Trip Logbook	.15					277		
Mid-Atlantic Gillnet	08-12	Obs. Data Weighout	.03, .03, .04, .02, .02	0, 0, 0, 0, 0	9, 7, 18, 11, 2	0, 0, 0, 0	350, 201, 259, 123, 63	350, 201, 259, 123, 63	.75, .55, .88, .41, .83	199 (0.37)
Northeast bottom trawl [g]	08-12	Obs. Data Weighout	.08, .09, .16, .26, .17	0, 0, 0, 1, 0	1, 0, 0, 1, 0	1.9, 0, 0, 2.0, 0	3.7, 0, 0, 3.9, 0	5.6, 0, 0, 5.9, 0	.97, 0, 0, .71, 0	2.3 (0.60)[g]
U.S. TOTAL	2008-2012									640 (0.17)
CANADA										
Bay of Fundy Sink Gillnet [f]	1997-2001	Can. Trips	unk		19, 5, 3, 5, 39		43, 38, 32, 28, 73		unk	43 [f] (unk)
Herring Weir [d,e]	08-12	Coop. Data	unk		0, 0, 1, 0, 0		0, 0, 1, 0, 0		NA	0.2 (unk)
CANADIAN TOTAL	2008-2012									43 (unk)
GRAND TOTAL										683 (unk)

NA = Not available.

a. Observer data (Obs. Data) are used to measure bycatch rates; the U.S. data are collected by the Northeast Fisheries Science Center (NEFSC) Sea Sampling Program and At-Sea Monitoring Program; the Canadian data are collected by DFO. NEFSC collects Weighout (Weighout) landings data that are used as a measure of total effort for the U.S. gillnet fisheries. The Canadian DFO catch and effort statistical system collected the total number of trips fished by the Canadians (Can. Trips), which was the measure of total effort for the Canadian groundfish gillnet fishery. Mandatory vessel trip report (VTR) (Trip Logbook) data are used to determine the spatial distribution of fishing effort in the Northeast sink gillnet fishery. Observed mortalities from herring weirs are collected by a cooperative program between fishermen and Canadian biologists (Coop. Data).

b. Observer coverage for the U.S. Northeast and mid-Atlantic coastal gillnet fisheries, is based on tons of fish landed. Northeast bottom trawl fishery coverages are ratios based on trips. Total observer coverage reported for bottom trawl gear and gillnet gear in the year 2010 includes only samples collected from traditional fisheries observer, but not the fishery monitors. Monitor trips were incorporated starting in 2011, the first full year of monitor coverage.

c. Since 2002 in the Northeast gillnet fishery, harbor porpoises were taken on pingered strings within strata that required pingers but that stratum also had observed strings without pingers. For estimates made during 1998 and after, a weighted bycatch rate was applied to effort from both pingered and non-pingered hauls within a stratum. The weighted bycatch rate was:

$$\sum_{i}^{ping,non-ping} \frac{\#\,porpoise_i}{sslandings_i} \cdot \frac{\#\,hauls_i}{total\#\,hauls}$$

There were 10, 33, 44, 0, 11, 0, 2, 8, 6, 2, 26, 2, 4, 12, 2, 9, 6, 11, 23, 11 and 30 observed harbor porpoise takes on pinger trips from 1992 to 2012, respectively, that were included in the observed mortality column. In addition, there were 9, 0, 2, 1,1, 4, 0, 1, 7, 21, 33, 24, 7, 13, 20, 41, 11, and 31 observed harbor porpoise takes in 1995 to 2012, respectively, on trips dedicated to fish sampling versus dedicated to watching for marine mammals; these were also included in the observed mortality column.

d. There were 255 licenses for herring weirs in the Canadian Bay of Fundy region.

e. Data provided by H. Koopman pers. comm.

f. The Canadian gillnet fishery was not observed during 2002 and afterwards, but the fishery is still active; thus, the current bycatch estimate for this fishery is assumed to be the average estimate using last five years that the fishery was observed in (1997-2001).

g. Fishery related bycatch rates for years 2008-2012 were estimated using an annual stratified ratio-estimator.

These estimates replace the 2008-2010 annual estimates reported in the 2013 stock assessment report that were generated using a different method.

h. Thirteen harbor porpoises in the Northeast area and 10 in the mid-Atlantic area were incidentally caught as part of a 2009-2010 NEFSC gillnet hanging ratio study to examine the impact of hanging ratio on harbor porpoise bycatch in gillnets. These animals were included in the observed interactions and added to the total estimates, though these interactions and their associated fishing effort were not included in the estimation of the bycatch rate that was expanded to the rest of the fishery.

i. Serious injuries were evaluated for the 2008–2012 period using new guidelines and include both at-sea monitor and traditional observer data (Waring *et al.* 2014, 2015)

Other Mortality

U.S.

There is evidence that harbor porpoises were harvested by natives in Maine and Canada before the 1960s, and the meat was used for human consumption, oil, and fish bait (NMFS 1992). The extent of these past harvests is unknown, though it is believed to have been small. Up until the early 1980s, small kills by native hunters (Passamaquoddy Indians) were reported. In recent years it was believed to have nearly stopped (Polacheck 1989) until media reports in September 1997 depicted a Passamaquoddy tribe member dressing out a harbor porpoise. Further articles describing use of porpoise products for food and other purposes were timed to coincide with ongoing legal action in state court.

During 2008, 58 harbor porpoises were reported stranded on Atlantic U.S. beaches. Of these, four were reported as having signs of human interaction. One of these was classified as a fishery interaction.

During 2009, 65 harbor porpoises were reported stranded on Atlantic U.S. beaches. Of these, three stranding mortalities were reported as having signs of human interaction, all of which were fishery interactions.

During 2010, 82 harbor porpoises were reported stranded on Atlantic U.S. beaches. Of these, six stranding mortalities were reported as having signs of human interaction, three of which were reported to be fishery interactions.

During 2011, 164 harbor porpoises were reported stranded on Atlantic U.S. beaches. Of these, nine stranding mortalities were reported as having signs of human interaction, three of which were reported to be fishery interactions.

During 2012, 45 harbor porpoises were reported stranded on Atlantic U.S. beaches. Of these, four stranding mortalities were reported as having signs of human interaction, one of which was reported to be a fishery interaction.

Stranding data probably underestimate the extent of fishery-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other fishery-interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interaction.

Table 4. Harbor Porpoise (*Phocoena phocoena phocoena*) reported strandings along the U.S. and Canadian Atlantic coast, 2008-2012.

Area	Year					**Total**
	2008	2009	2010	2011	2012	
Maine[a,f, h]	7	4	7	15	7	**40**
New Hampshire	0	0	5	1	3	**9**
Massachusetts[a, f, g, h]	25	19	28	102	25	**199**
Rhode Island[b]	1	1	0	4	0	**6**
New York[c,g, h]	3	9	1	11	3	**27**
New Jersey[e, f]	8	4	7	1	2	**22**
Pennsylvania	0	1	0	0	0	**1**
Delaware	0	0	2	0	0	**2**

Maryland	2	5	4	0	1	**12**
Virginia[e,g]	6	8	10	2	2	**28**
North Carolina[d]	6	14	18	28	2	**68**
TOTAL U.S.	**58**	**65**	**82**	**164**	**45**	**414**
Nova Scotia/Prince Edward Island[i]	6	6	5	13	6	**36**
Newfoundland and New Brunswick[j]	4	2	1	0	0	**7**
GRAND TOTAL	**68**	**73**	**88**	**177**	**51**	**457**

a. In Massachusetts one animal was taken to a rehab facility in 2008. In 2011, 5 animals were released alive and one taken to rehab. One Maine animal taken to rehab in 2012.

b. In Rhode Island in 2011, one animal classified as human interaction (HI) due to fluke amputation.

c. One of the 2012 New York strandings classified as human interaction due to interaction with marine debris.

d. In North Carolina one animal was immediately released in 2008.

e. In 2009, 3 harbor porpoises were classified as fishery interactions, 2 in VA and a third in NJ.
f. Six total HI cases in 2010; 2 in Massachusetts, 1 in Maine, 1 in North Carolina and 2 in New Jersey. One of the New Jersey records, one of the North Carolina records, and the Maine record were fishery interactions.
g. Nine total HI cases in 2011; 5 in Massachusetts, 1 in Rhode Island, 2 in New York and 1 in Virginia. Two of these Massachusetts animals and the Virginia animal were fishery interactions.

h. Four HI cases in 2012. One of these was a fishery interaction (Massachusetts).
i. Data supplied by Nova Scotia Marine Animal Response Society (pers. comm.). One of the 2012 animals was trapped in a mackerel net.

j. (Ledwell and Huntington 2009, 2010, 2011, 2012, 2013).

CANADA

The Nova Scotia Stranding Network documented whales and dolphins stranded between 1991 and 1996 on the coast of Nova Scotia (Hooker *et al.* 1997). Researchers with the Canadian Department of Fisheries and Oceans documented strandings on the beaches of Sable Island during 1970 to 1998 (Lucas and Hooker 2000). Sable Island is approximately 170 km southeast of mainland Nova Scotia. On the mainland of Nova Scotia, a total of 8 stranded harbor porpoises were recorded between 1991 and 1996: 1 in May 1991, 2 in 1993 (July and September), 1 in August 1994 (released alive), 1 in August 1994, and 3 in 1996 (March, April, and July (released alive)). On Sable Island, 8 stranded dead harbor porpoises were documented, most in January and February; 1 in May 1991, 1 in January 1992, 1 in January 1993, 3 in February 1997, 1 in May 1997, and 1 in June 1997. Two strandings during May-June 1997 were neonates (> 80 cm). The harbor porpoises that stranded in the winter (January-February) were on Sable Island, those in the spring (March to June) were in the Bay of Fundy (2 in Minas Basin and 1 near Yarmouth) and on Sable Island (2), and those in the summer (July to September) were scattered along the coast from the Bay of Fundy to Halifax.

Whales and dolphins stranded since 1997 on the coast of Nova Scotia were recorded by the Marine Animal Response Society and the Nova Scotia Stranding Network, including 3 harbor porpoises stranded in 1997 (1 in April, 1 in June and 1 in July), 2 stranded in June 1998, 1 in March 1999, 3 in 2000 (1 in February, 1 in June, and 1 in August); 2 in 2001 (1 in July and 1 in December), 5 in 2002 (3 in July (1 released alive), 1 in August, and 1 in September (released alive)), 3 in 2003 (2 in May (1 was released alive) and 1 in June (disentangled and released alive)), 4 in 2004 (1 in April, 1 in May, 1 in July (released alive) and 1 in November), 6 in 2005 (1 in April (released alive), 1 in May, 3 in June and 1 in July), 4 in 2006 (1 in June, 1 in August, 1 in September, and 1 in December), 4 in 2007, 6 in 2008, 6 in 2009 (2 released alive), 5 (1 released alive) in 2010, 13 (4 released alive) in 2011, and 6 in 2012; Table 3).

Five dead stranded harbor porpoises were reported in 2005 by the Newfoundland and Labrador Whale Release and Strandings Program, 1 in 2007 and 4 in 2008, 2 in 2009 (one dead entangled and one live release), 1 in 2010 and 0 in 2011 and 2012 (Ledwell and Huntington 2004; 2006; 2007; 2008; 2009; 2010, 2011, 2012, 2013; Table 3).

U.S. management measures taken to reduce bycatch

A ruling to reduce harbor porpoise bycatch in U.S. Atlantic gillnets was published in the Federal Register (63 FR 66464) on 02 December 1998 and became effective 01 January 1999. The Gulf of Maine portion of the Harbor Porpoise Take Reduction Plan (HPTRP) pertains to all fishing with sink gillnets and other gillnets capable of catching regulated groundfish in New England waters, from Maine through Rhode Island. For more information on this rule, please see http://www.greateratlantic.fisheries.noaa.gov/protected/porptrp/.

STATUS OF STOCK

This is not a strategic stock because average annual human-related mortality and serious injury does not exceed PBR. The total U.S. fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. The status of harbor porpoises, relative to OSP, in the U.S. Atlantic EEZ is unknown. Population trends for this species have not been investigated. On 7 January 1993, NMFS proposed listing the Gulf of Maine harbor porpoise as threatened under the Endangered Species Act (NMFS 1993). On 5 January 1999, NMFS determined the proposed listing was not warranted (NMFS 1999). On 2 August 2001, NMFS made available a review of the biological status of the Gulf of Maine/Bay of Fundy harbor porpoise population. The determination was made that listing under the Endangered Species Act (ESA) was not warranted, and this stock was removed from the ESA candidate species list (NMFS 2001).

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HARBOR SEAL (*Phoca vitulina concolor*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The harbor seal is found in all nearshore waters of the North Atlantic and North Pacific Oceans and adjoining seas above about 30ºN (Burns 2009; Desportes *et al*. 2010). In the western North Atlantic, they are distributed from the eastern Canadian Arctic and Greenland south to southern New England and New York, and occasionally to the Carolinas (Mansfield 1967; Boulva and McLaren 1979; Katona *et al.* 1993; Gilbert and Guldager 1998; Baird 2001;Desportes *et al*. 2010). Stanley *et al.* (1996) examined worldwide patterns in harbor seal mitochondrial DNA, which indicate that western and eastern North Atlantic harbor seal populations are highly differentiated. Further, they suggested that harbor seal females are only regionally philopatric, thus population or management units are on the scale of a few hundred kilometers. High philopatry has been reported in other North Atlantic populations (Goodman 1998; Andersen and Olsen 2010). Although the stock structure of the western North Atlantic population is unknown, it is thought that harbor seals found along the eastern U.S. and Canadian coasts represent one population (Temte *et al.* 1991; Andersen and Olsen 2010). In U.S. waters, breeding and pupping normally occur in waters north of the New Hampshire/Maine border, although breeding occurred as far south as Cape Cod in the early part of the twentieth century (Temte *et al.* 1991; Katona *et al.* 1993).

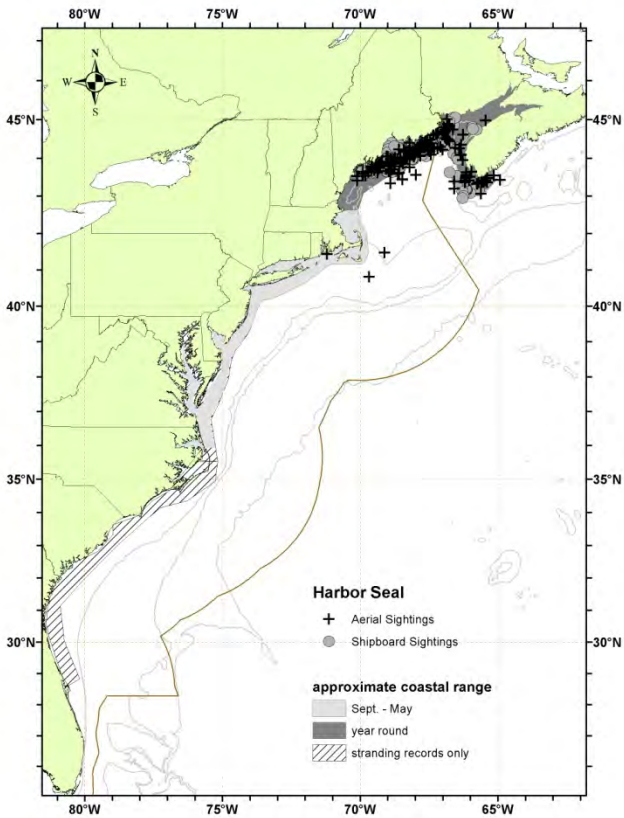

Figure 1. *Approximate coastal range of harbor seals, and distribution of harbor seal sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008, 2010, and 2011. Isobaths are the 100-m, 1000-m, and 4000-m depth contours.*

Harbor seals are year-round inhabitants of the coastal waters of eastern Canada and Maine (Katona *et al*. 1993), and occur seasonally along the southern New England to New Jersey coasts from September through late May (Schneider and Payne 1983; Barlas 1999; Schroeder 2000; deHart 2002). In recent years small numbers of seals (<50) have established winter haul-out sites in the Chesapeake Bay and near Oregon Inlet North Carolina (Todd Pusser, pers. comm. June 2011; Virginia Institute of Marine Science - http://www.vims.edu/bayinfo/faqs/marine_mammal.php, accessed 14 February, 2013). Scattered sightings and strandings have been recorded as far south as Florida (NMFS unpublished data). A general southward movement from the Bay of Fundy to southern New England waters occurs in autumn and early winter (Rosenfeld *et al.* 1988; Whitman and Payne 1990; Barlas 1999; Jacobs and Terhune 2000). A northward movement from southern New England to Maine and eastern Canada occurs prior to the pupping season, which takes place from mid-May through June along the Maine Coast (Richardson 1976; Wilson 1978; Whitman and Payne 1990; Kenney 1994; deHart 2002). Earlier research identified no pupping areas in southern New England (Payne and Schneider 1984; Barlas 1999); however, more recent anecdotal reports suggest that some pupping is occurring at high-use haulout sites off Manomet, Massachusetts and the Isles of Shoals. The overall geographic range throughout coastal New England has not changed significantly during the last century (Payne and Selzer 1989).

Prior to the spring 2001 live-capture and radio-tagging of adult harbor seals, it was believed that the majority of seals moving into southern New England and mid-Atlantic waters were subadults and juveniles (Whitman and Payne 1990; Katona *et al.* 1993). The 2001 study established that adult animals also made this migration. Seventy-five percent (9/12) of the seals tagged in March in Chatham Harbor were detected at least once during the May/June 2001 abundance survey along the Maine coast (Gilbert *et al.* 2005; Waring *et al.* 2006). Similar findings were made in spring 2011 and 2012 work.

POPULATION SIZE

Coast-wide aerial surveys along the Maine coast were conducted in May/June 1981, 1986, 1993, 1997, 2001, and 2012 during pupping (Gilbert and Stein 1981; Gilbert and Wynne 1983, 1984; Kenney 1994; Gilbert and Guldager 1998; Gilbert *et al.* 2005; Waring *et al*., in press). However, estimates older than eight years are deemed unreliable (Wade and Angliss 1997), and should not be used for PBR determinations. The 2001 survey, conducted in May/June, included replicate surveys and radio-tagged seals to obtain a correction factor for animals not hauled out. The 2012 survey was designed (Waring *et al*., in press) to sample bay units using a single aircraft, though it also included a radio-tracking aircraft and obtained a correction factor. The corrected estimates (pups in parenthesis) for 2001 and 2012, respectively, were 99,340 (23,722) and 75,834 (23,830) (Table 1). The 2001 observed count of 38,014 was 28.7% greater than the 1997 count, whereas the 2012 corrected estimate was 24% lower than the 2001 estimate. In addition, the Coefficient of Variation of the 2012 estimate is 0.153 compared to 0.091in 2001.

Although the 2012 population estimate is not significantly different from the 2001 estimate, there are four possible reasons for the perceived decline: First, the 2012 estimate may be biased by erroneous assumptions about seal distribution. The 2012 estimate was based on a sample of areas along part of the coast, while the 2001 estimate was based on counts along the entire coast. Second, the correction factor was different in the two surveys, being 2.54 in 2001 and 2.33 in 2012. Third, not all seals were in the study area during the survey period, and fourth, the population is no longer growing and has, in fact, declined.

Canadian scientists counted 3,500 harbor seals during an August 1992 aerial survey in the Bay of Fundy (Stobo and Fowler 1994), but noted that the survey was not designed to obtain a population estimate. The Sable Island population was the largest in eastern Canada in the late 1980s, however the number drastically declined in the late 1990s (Baird 2001). Similarly, pup production declined on Sable Island from 600 in 1989 to around a dozen pups or fewer by 2002 (Baird 2001; Bowen *et al.* 2003). A decline in the number of juveniles and adults did not occur immediately, but a decline was observed in these age classes as a result of the reduced number of pups recruiting into the older age classes (Bowen *et al*. 2003). Possible reasons for this decline may be increased use of the island by gray seals and increased predation by sharks (Stobo and Lucas 2000; Bowen *et al.* 2003). Helicopter surveys have also been flown to count hauled-out animals along the coast and around small islands in parts of the Gulf of St. Lawrence and the St. Lawrence estuary. In the estuary, surveys were flown in June 1995, 1996, and 1997, and in August 1994, 1995, 1996, and 1997; different portions of the Gulf were surveyed in June 1996 and 2001 (Robillard *et al.* 2005). Changes in counts over time in sectors that were flown under similar conditions were examined at nine sites that were surveyed in June and in August. Although all slopes were positive, only one was significant, indicating numbers are likely stable or increasing slowly. Overall, the June surveys resulted in an average of 469 (SD=60, N=3) hauled-out animals, which is lower than the average count of 621 (SD=41, N=3) hauled-out animals flown under similar conditions in August. Aerial surveys in the Gulf of St. Lawrence resulted in counts of 467 animals in 1996 and 423 animals in 2001 for a different area (Robillard *et al.* 2005). Further, approximately 200 harbor seals breed in the Grand Barachois on the islands of S. Pierre and Miquelon (France) off the southern coast of Newfoundland. This population has been declining since the mid 1980s, when there might have been more than 900 harbor seals there, due to disturbance by tourists and natural alterations of the tidal sand flats of the haul-out area (J. Lawson, pers. comm., DFO, St. Johns, Newfoundland, 21 March 2013).

Table 1. Summary of abundance estimates for the western North Atlantic harbor seal. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
May/June 2012	Maine coast	75,834(23,830)	0.15

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the long-normal distribution

as specified by Wade and Angliss (1997). The best estimate of abundance for harbor seals is 75,834 (CV=0.15). The minimum population estimate is 66,884 based on corrected available counts along the Maine coast in 2012.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for this population.*et al* For purposes of this assessment, the maximum net productivity rate was assumed to be 0.12. This value is based on theoretical modeling showing that pinniped populations may not grow at rates much greater than 12% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 66,884 animals. The maximum productivity rate is 0.12, the default value for pinnipeds. The recovery factor (F_R) is 0.5, the default value for stocks of unknown status relative to optimum sustainable population (OSP), and because the CV of the average mortality estimate is less than 0.3 (Wade and Angliss 1997). PBR for the western North Atlantic stock of harbor seals is 2,006.

ANNUAL HUMAN-CAUSED SERIOUS INJURY AND MORTALITY

For the period 2008-2012 the total human caused mortality and serious injury to harbor seals is estimated to be 441 per year. The average was derived from two components: 1) 431 (CV=0.12; Table 2) from the 2008-2012 observed fishery; and 2) 10 from average 2008-2012 non-fishery-related, human interaction stranding and direct interaction mortalities (NMFS unpublished data).

Researchers and fishery observers have documented incidental mortality in several fisheries, particularly within the Gulf of Maine (see below). An unknown level of mortality also occurred in the mariculture industry (i.e., salmon farming), and by deliberate shooting (NMFS unpublished data). Between, 2008 and 2012, there are 3 records of harbor seals and 2 of unidentified seals with evidence of gunshot wounds in the Northeast Regional Office Marine Mammal Stranding Network database. In 2001, one harbor seal was killed as a result of entrainment in the intake pipes of the Seabrook New Hampshire power plant.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Detailed fishery information is given in Appendix III.

U.S.

Northeast Sink Gillnet:

Annual estimates of harbor seal bycatch in the Northeast sink gillnet fishery reflect seasonal distribution of the species and of fishing effort. The fishery has been observed in the Gulf of Maine and in southern New England (Williams 1999; NMFS unpublished data). Williams (1999) aged 261 harbor seals caught in this fishery from 1991 to 1997, and 93% were juveniles (i.e., less than four years old). Estimated annual mortalities (CV in parentheses) from this fishery were 92 in 2007, 242 (0.41) in 2008, 513 (0.28) in 2009, 540 (0.25) in 2010, 343 (0.19) in 2011, and 252 (0.26) in 2012 (Table 2; Orphanides 2013, Hatch and Orphanides 2014). The stratification design used is the same as that for harbor porpoise (Bravington and Bisack 1996). There were 14, 6, 8, 5, 9, and 6 unidentified

seals observed during 2008-2012, respectively. Since 1997, unidentified seals have not been prorated to a species. This is consistent with the treatment of other unidentified mammals that do not get prorated to a specific species. Average annual estimated fishery-related mortality and serious injury to this stock attributable to this fishery during 2008-2012 was 378 harbor seals (CV=0.13; Table 2).

Mid-Atlantic Gillnet

A study on the effects of two different hanging ratios in the bottom-set monkfish gillnet fishery on the bycatch of cetaceans and pinnipeds was conducted by NEFSC in 2009 and 2010 with 100% observer coverage. Commercial fishing vessels from Massachusetts and New Jersey were used for the study, which took place south of the Harbor Porpoise Take Reduction Team Cape Cod South Management Area (south of 40° 40´) in February, March and April. Eight research strings of fourteen nets each were fished, and 159 hauls were completed during the course of the study. Results showed that while a 0.33 mesh performed better at catching commercially important finfish than a 0.50 mesh. There was no statistical difference in cetacean or pinniped bycatch rates between the two hanging ratios. Four harbor seals (3 in mid-Atlantic gillnet and 1 in NE gillnet) were caught in this project during 2010 (AIS 2010).

Two harbor seals were observed taken in 2008, 2 in 2009, 9 in 2010, 2 in 2011, and 0 in 2012. Using the observed and experimental takes, the estimated annual mortality (CV in parentheses) attributed to this fishery was 88 (0.74) in 2008, 47 (0.68) in 2009, 89 (0.39) in 2010, 21 (0.67) in 2011, and 0 in 2012 (Table 2; Orphanides 2013, Hatch and Orphanides 2014). Average annual estimated fishery-related mortality and serious injury attributable to this fishery during 2008-2012 was 49 (CV =0.33) harbor seals (Table 2).

Northeast Bottom Trawl

No harbor seal mortalities were observed in 2008-2010, 3 were observed in 2011, and 1 in 2012 (Table 2). TThe average annual fishery-related mortality and serious injury for 2008-2012 is calculated as 2.4 (0.5) animals.

Mid-Atlantic Bottom Trawl

One harbor seal mortality was observed in this fishery in 2009, one in 2010 and 3 in 2012 (Table 2). The average annual fishery-related mortality and serious injury for 2008-2012 is calculated as 11.6 (0.59) animals.

Northeast Mid-water Trawl Fishery (Including Pair Trawl)

One harbor seal mortality was observed in this fishery in 2009, 2 in 2010 and 1 in 2012 (Table 2). The resultant estimated annual fishery-related mortality and serious injury (CV in parentheses) was 1.3 (0.81) in 2009 but an extended bycatch rate has not been calculated for 2010. Until this bycatch estimate can be developed, the average annual fishery-related mortality and serious injury for 2008-2012 is calculated as 0.9 animals (3 animals +1.3 animals/5 years).

Mid-Atlantic Mid-water Trawl Fishery (Including Pair Trawl)

A harbor seal mortality was observed in this fishery in 2010. An expanded bycatch estimate has not been generated. Until this bycatch estimate can be developed, the average annual fishery-related mortality and serious injury for 2008-2012 is calculated as 0.2 animals (1 animal/5 years).

Gulf of Maine Atlantic Herring Purse Seine Fishery

The Gulf of Maine Atlantic Herring Purse Seine Fishery is a Category III fishery. This fishery was not observed until 2003. No mortalities have been observed, but 11 harbor seals were captured and released alive in 2004, 4 in 2005, 1 in 2008, none in 2007 or 2009-2010, 3 in 2011 and 1 in 2012. In addition, 5 seals of unknown species were captured and released alive in 2004, 2 in 2005, 1 in 2007, and none in 2009-2010, 8 in 2011, and 0 in 2012. This fishery was not observed in 2006. Further, one harbor seal and two unknown species in were designated as serious injuries/mortalities in 2011, based on fisheries monitoring logs (Waring *et al*. 2014). An expanded bycatch estimate has not been generated. Until this bycatch estimate can be developed, the average annual fishery-related mortality and serious injury for 2008-2012 is calculated as 0.2 animals (1 animal/5 years).

CANADA

Currently, scant data are available on bycatch in Atlantic Canada fisheries due to a lack of observer programs (Baird 2001). An unknown number of harbor seals have been taken in Newfoundland, Labrador, Gulf of St. Lawrence and Bay of Fundy groundfish gillnets, Atlantic Canada and Greenland salmon gillnets, Atlantic Canada cod traps, and in Bay of Fundy herring weirs (Read 1994; Cairns *et al.* 2000). Furthermore, some of these mortalities (e.g., seals trapped in herring weirs) are the result of direct shooting under nuisance permits.

Table 2. Summary of the incidental mortality of harbor seals (*Phoca vitulina concolor*) by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the mortalities recorded by on-board observers (Observed Mortality), the estimated annual mortality (Estimated Mortality), the estimated CV of the annual mortality (Estimated CVs) and the mean annual mortality (CV in parentheses).

Fishery	Years	Data Type [a]	Observer Coverage [b]	Observed Serious Injury[e]	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Annual Mortality
Northeast [c] Sink Gillnet	08-12	Obs. Data, Weighout, Logbooks	.05, .04, .17, .19, .15	0, 0, 0, 0, 0	9, 21, 71, 91, 37	0, 0, 0, 0, 0	242, 513, 540, 343, 252	242, 513, 540, 343, 252	.41, .28, .25, .19, .26	378 (0.13)
Mid-Atlantic Gillnet	08-12	Obs. Data, Weighout	.03, .03, .04, .02, .02	0, 0, 0, 0, 0	2, 2, 9, 2, 0	0, 0, 0, 0, 0	88, 47, 89, 21, 0	88, 47, 89, 21, 0	.74, .68, .39, .67, 0	49 (0.33)
Northeast Bottom Trawl [d]	08-12	Obs. Data, Weighout	.08, .09, .16, .26, .17	0, 0, 0, 0, 0	0, 0, 0, 3, 1	0, 0, 0, 0, 0	0, 0, 0, 9, 3	0, 0, 0, 9, 3	0, 0, 0, .58, 1	2.4 (0.5)
Mid-Atlantic Bottom Trawl	08-12	Obs. Data Dealer	.03. .05, .06, .08, .05	0, 0, 0, 0, 0	0, 1 ,1, 0, 3	0, 0, 0, 0, 0	1, 24, 11, 0, 23	1, 24, 11, 0, 23	0, .92, 1.1, 0, 1	11.6 (0.59)
Northeast Mid-water Trawl - Including Pair Trawl	08-12	Obs. Data Weighout Trip Logbook	.199, .42, .53, .41, .45	0, 0, 0, 0, 0	0, 1, 2, 0, 1	0, 0, 0, 0, 0	0, 1.3, na, 0, na	0, 1.3, na, 0, na	0, .81, na, 0, na	0.9 (.81)
Mid-Atlantic Mid-water Trawl - Including Pair Trawl	08-12	Obs. Data Weighout Trip Logbook	.13, .13, .25, .41, .21	0, 0, 0, 0, 0	0, 0, 1, 0, 0	0, 0, 0, 0, 0	0, 0, na, 0, 0	0, 0, na, 0, 0	0, 0, na, 0, 0	0.2 (na) [d]
Herring Purse Seine	08-12	Obs. Data	.12, .21, .12 .33, .17	0, 0, 0, 1, 0	0, 0, 0, 0, 0	0, 0, 0, na, 0	0, 0, 0, 0, 0	0, 0, 0, na, 0	0, 0, 0, na, 0	0.2 (na)
TOTAL										431 (0.12)

[a] Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. NEFSC collects landings data (Weighout), and total landings are used as a measure of total effort for the sink gillnet fishery. Mandatory logbook (Logbook) data are used to determine the spatial distribution of fishing effort in the Northeast sink gillnet fishery.

[b] The observer coverages for the Northeast sink gillnet fishery and the mid-Atlantic gillnet fisheries are ratios based on tons of fish landed and coverages for the northeast bottom trawl are ratios based on trips. Total observer coverage reported for bottom trawl gear and gillnet gear in the year 2010 and 2011 includes samples collected from traditional fisheries observers in addition to fishery monitors through the Northeast Fisheries Observer Program (NEFOP).

[c] Since 1998, takes from pingered and non-pingered nets within a marine mammal time/area closure that required pingers, and takes from pingered and non-pingered nets not within a marine mammal time/area closure were pooled. The pooled bycatch rate was weighted by the total number of samples taken from the stratum and used to estimate the mortality. In 2008 - 2012, respectively, 0, 8, 23, 32 and 12 takes were observed in nets with pingers. In 2008 – 2012, respectively, 9, 13, 48, 59, and 25 takes were observed in nets without known pingers.

[d] Fishery related bycatch rates for years 2008-2012 were estimated using an annual stratified ratio-estimator. These estimates replace the 2008-2010 annual estimates reported in the 2013 stock assessment report that were generated using a different method.

[e] Analyses of bycatch mortality attributed to the mid-water trawl fisheries for 2010 – 2012 have not been generated.
f. Serious injuries were evaluated for the 2008–2012 period using new guidelines and include both at-sea monitor and traditional observer data (Waring *et al.* 2014, 2015)

Other Mortality

Canada: Aquaculture operations in eastern Canada are licensed to shoot nuisance seals, but the number of seals killed is unknown (Jacobs and Terhune 2000; Baird 2001). Small numbers of harbor seals are taken in subsistence hunting in northern Canada, and Canada also issues personal hunting licenses which allow the holder to take six seals annually (DFO 2008).

U.S.: Historically, harbor seals were bounty-hunted in New England waters, which may have caused a severe decline of this stock in U.S. waters (Katona *et al*. 1993; Lelli *et al*., 2009). Bounty-hunting ended in the mid-1960s.

Other sources of harbor seal mortality include human interactions, storms, abandonment by the mother, disease (Anthony *et al.* 2012), and predation (Katona *et al.* 1993; NMFS unpublished data; Jacobs and Terhune 2000). Mortalities caused by human interactions include boat strikes, fishing gear interactions, oil spill/exposure, harassment, boat strikes and shooting.

Harbor seals strand each year throughout their migratory range. Stranding data provide insight into some of these sources of mortality. From 2008-2012, 1,327 harbor seal stranding mortalities were reported between Maine and Florida (Table 3; NMFS unpublished data). Sixty-five (4.9%) of the dead seals stranded during this five-year period showed signs of human interaction (10 in 2008, 6 in 2009, 20 in 2010, 20 in 2011, and 9 in 2012), with 15 (1.1%) having some sign of fishery interaction (5 in 2008, 0 in 2009, 6 in 2010, 2 in 2011 and 2 in 2012). Three harbor seals during this period were reported as having been shot. An Unusual Mortality Event (UME) was declared for harbor seals in northern Gulf of Maine waters in 2003 and continued into 2004. No consistent cause of death could be determined. The UME was declared over in spring 2005 (MMC 2006). NMFS declared another UME in the Gulf of Maine in autumn 2006 based on infectious disease. A UME was declared in November of 2011 that involved 567 harbor seal stranding mortalities between June 2011 and October 2012 in Maine, New Hampshire and Massachusetts. The UME was declared closed in February 2013.

Stobo and Lucas (2000) have documented shark predation as an important source of natural mortality at Sable Island, Nova Scotia. They suggest that shark-inflicted mortality in pups, as a proportion of total production, was less than 10% in 1980-1993, approximately 25% in 1994-1995, and increased to 45% in 1996. Also, shark predation on adults was selective towards mature females. The decline in the Sable Island population appears to result from a combination of shark-inflicted mortality on both pups and adult females and inter-specific competition with the much more abundant gray seal for food resources (Stobo and Lucas 2000; Bowen *et al.* 2003).

Table 3. Harbor seal (*Phoca vitulina concolor*) stranding mortalities along the U.S. Atlantic coast (2008-2012) with subtotals of animals recorded as pups in parentheses[a].

State	2008	2009	2010	2011[b]	2012	Total
Maine	178 (152)	72 (61)	70 (64)	147 (115)	131 (101)	598
New Hampshire	3 (2)	15 (12)	20 (15)	77 (63)	24 (18)	139
Massachusetts	50 (4)	74 (36)	82 (26)	133 (80)	54 (35)	392
Rhode Island	6 (4)	5 (2)	4 (0)	7 (0)	14 (0)	36
Connecticut	0	0	0	1 (1)	1 (1)	2
New York	5 (1)	14 (1)	15 (0)	17 (0)	14 (1)	65
New Jersey	7	11 (2)	21 (0)	10 (0)	7 (0)	56
Maryland	0	2 (0)	0	1 (0)	0	3
Virginia	1	3	1 (0)	4 (0)	0	9
Northe Carolina	6 (2)	6 (5)	11 (1)	2 (0)	2 (0)	27
Total	256	202	224	399	247	1327

Unspecified seals (all states)	51	34	22	11	27	132

a. Some of the data reported in this table differ from that reported in previous years. We have reviewed the records and made an effort to standardize reporting. Records of live releases and rehabbed animals have been eliminated. Mortalities include animals found dead and animals that were euthanized, died during handling, or died in the transfer to, or upon arrival at, rehab facilities.
b. Unusual Mortality event (UME) declared for harbor seals in southern Maine to northern Massachusetts in 2011.

STATUS OF STOCK

Harbor seals are not listed as threatened or endangered under the Endangered Species Act, and the western North Atlantic stock is not considered strategic under the Marine Mammal Protection Act. The 2008-2012 average annual human-caused mortality and serious injury does not exceed PBR. The status of the western North Atlantic harbor seal stock, relative to OSP, in the U.S. Atlantic EEZ is unknown. Total fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate.

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GRAY SEAL (*Halichoerus grypus grypus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The gray seal is found on both sides of the North Atlantic, with three major populations: eastern Canada, northwestern Europe and the Baltic Sea (Katona *et al.* 1993). The western North Atlantic stock is equivalent to the eastern Canada population, and ranges from New Jersey to Labrador (Davies 1957; Mansfield 1966; Katona *et al.* 1993; Lesage and Hammill 2001; DiGiovanni, pers. comm., Riverhead Foundation for Marine Research and Preservation). This stock is separated by geography, differences in the breeding season, and mitochondrial DNA variation from the northeastern Atlantic stock (Bonner 1981; Boskovic *et al.* 1996; Lesage and Hammill 2001). There are three breeding concentrations in eastern Canada: Sable Island, Gulf of St. Lawrence, and along the coast of Nova Scotia (Laviguer and Hammill 1993). Tagging studies indicate that there is little intermixing between the two breeding groups (Zwanenberg and Bowen 1990) and, for management purposes, they are treated by the Canadian Department of Fisheries and Oceans (DFO) as separate stocks (Mohn and Bowen 1996). Outside the breeding period, there is overlap in the distribution of animals from the three colonies (Lavigueur and Hammill 1993; Harvey *et al.* 2008; Breed *et al.* 2006, 2009, Hammill, pers. comm. DFO, Mont-Joli, Quebec, Canada). In the mid- 1980s, small numbers of animals and pupping were observed on several isolated islands along the Maine coast and in Nantucket-Vineyard Sound, Massachusetts (Katona *et al.* 1993; Rough 1995: Gilbert *et al.* 2005). In the late 1990s, a year-round breeding population of approximately 400+ animals was documented on outer Cape Cod and Muskeget Island (D. Murley, pers. comm., Mass. Audubon Society, Wellfleet, MA). In December 2001, NMFS initiated aerial surveys to monitor gray seal pup production on Muskeget Island and adjacent sites in Nantucket Sound, and Green and Seal Islands off the coast of Maine (Wood *et al.* 2007). To assess the stock structure of gray seals in the northwest Atlantic, tissue samples were collected from Canadian and US populations for genetic analyses (Wood et al. 2011). Based on examination of nine highly variable microsatellite loci, all individuals were placed into one population. This provides additional confirmation that recolonization by Canadian gray seals is the source of the U.S. population.

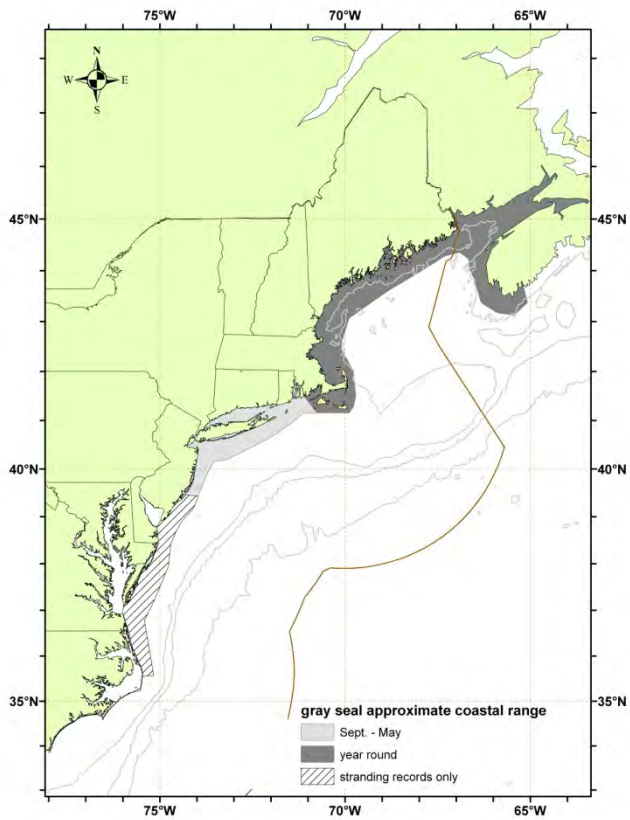

Figure 1. Approximate coastal range of gray seals. Isobaths are the 100-m, 1000-m, and 4000-m depth contours.

POPULATION SIZE

Current estimates of the total western Atlantic gray seal population are not available; although estimates of portions of the stock are available for select time periods. The size of the total Canadian population from 1969-2012 has been estimated using updated age-specific reproductive rate data, and accounting for higher pup mortality in the Gulf of St. Lawrence breeding colony due to years with poor ice condition (DFO, 2011d; Hammill *et al*. 2012). For Sable Island the 2012 pup production estimate is 67,000 (95% CI=56,000 to 85,000), the total population size estimate of 262,000 (95% CI 219,000-332,000). Model estimates for coastal Nova Scotia were 2,300 (95% CI

=1,100-3800) pups and a total population of 20,000 (95% CI= 17,000-23,000) in 2012. For the Gulf in 2012, pup production was estimated to be 7,000 (95% CI=2,900-15,200), and a total population of 49,000 (95% CI=27,000-102,000). The combined 2012 pup production is estimated to be 76,300 (95% CI=60,000-105,000), with a total population of 331,000 (95% CI=262,000-458,000). Difference between the total 2012 and 2010 (Thomas *et al*. 2011) estimates are due solely to differences in modeling approaches (DFO 2011d; Hammill *et al*. 2012). The new model estimates replace the 2010 pup production and total population estimates reported in Thomas *et al*. (2011). Average annual rates of total population increase were estimated to be 6% in the 1980s, 9% in the 1990s, and 6% in the 2000s. The authors note that these estimates should be treated with caution due to modeling and data concerns. In comparison to the pooled estimates, Bowen *et al*. (2003) reported that the Sable Island had been increasing by approximately 13% for nearly 40 years, but subsequently declined to 7% based on the 2004 pup production survey (Trzcinski *et al*. 2005; Bowen *et al*. 2007). The 2012 estimates suggest that the Sable Island population continued to increase at a rate of about 2.8% since 2010 (Hammill *et al*. 2012). Whereas, the coastal Nova Scotia and Gulf of St. Lawrence stocks do not appear to have shown much change in abundance since 2010 (DFO 2012, in review).

In U.S. waters, gray seals currently pup at five established colonies: Muskeget Island, Massachusetts, and Green Island, e, Seal Island, Matinicus Rock and Mount Desert Rock in Maine. Although white coated pups have stranded on eastern Long Island beaches, no pupping colonies have been detected in that region. Gray seals have been observed using the historic pupping site on Muskeget Island in Massachusetts since 1990. Pupping has taken place on Seal and Green Islands in Maine since at least the mid 1990s. Aerial survey data from these sites indicate that pup production is increasing. A minimum of 2,620 pups (Muskeget= 2,095, Green= 59, Seal= 466) were born in the U.S. in 2008 (Wood LaFond 2009). Table 2 summarizes single-day pup counts from the three U.S. pupping colonies from 2001/2002 to 2007/2008 pupping periods. The decrease in pup counts in some years is an artifact of survey timing and not indicative of true declines in those years. In recent years NMFS monitoring surveys have detected an occasional mother/pup (white coats) pair on both Monomoy Island and Nomans Land in Massachusetts. Some of the local breeders have been observed with brands and tags indicating they had been born on Sable Island, Canada (Rough 1995; L. Sette, pers. comm.). The increase in the number of gray seals observed in the U.S. is probably due to both natural increase and immigration.

Gray seals are also observed in New England outside of the pupping season. In April-May 1994 a maximum count of 2,010 was obtained for Muskeget Island and Monomoy combined (Rough 1995). Maine coast-wide surveys conducted during summer revealed 597 and 1,731 gray seals in 1993 and 2001, respectively (Gilbert *et al.* 2005). In March 1999 a maximum count of 5,611 was obtained in the region south of Maine (between Isles of Shoals, Maine and Woods Hole, Massachusetts) (Barlas 1999). In March 2011 a maximum count of 15,756 was obtained in southeastern Massachusetts coastal waters (NMFS unpubl. data). No gray seals were recorded at haul-out sites between Newport, Rhode Island and Montauk Pt., New York (Barlas 1999), currently several hundred gray seals have been recorded in surveys conducted off eastern Long Island (R. DiGiovanni, pers. comm).

Table 1. Summary of abundance estimates for the western North Atlantic gray seal: year, and area covered during each abundance survey, resulting total abundance estimate and 95% confidence interval.

Month/Year	**Area**	**N_{best}**	**CI**
2012[a]	Gulf of St Lawrence + Nova Scotia Eastern Shore + Sable Island	331,000	95% CI 263,000-458,000

[a]These are model based estimates derived from pup surveys.

Table 2. The number of pups observed on Muskeget, Seal, and Green Islands 2002-2008. Data are from aerial surveys[1]. These are single-day counts, not estimates of total pup production (Wood LaFond 2009).

Pupping Season	Muskeget Island	Seal Island	Green Island
2001-2	883	No data	34
2002-3	509	147	No data
2003-4	824	150	26
2004-5	992	365	33
2005-6	868	239	43
2006-7	1704	364	57
2007-8	2095	466	59

[1] Survey data for the 2008-9 through 2012-3 seasons have not been counted, including Matinicus Rock and Mount Desert Rock

Minimum Population Estimate

Based on modeling, the total Canadian gray seal population was estimated to be 331,000 (95% CI 263,000-458,000) (Hammill *et al.* 2011d). Present data are insufficient to calculate the minimum population estimate for U.S. waters.

Current Population Trend

Gray seal abundance is likely increasing in the U.S. Atlantic Exclusive Economic Zone (EEZ), but the rate of increase is unknown. The population in eastern Canada was greatly reduced by hunting and bounty programs, and in the 1950s the gray seal was considered rare (Lesage and Hammill 2001). The Sable Island, Nova Scotia, population was less affected and has been increasing for several decades. Pup production on Sable Island increased exponentially at a rate of 12.8% per year between the 1970s and 1997 (Stobo and Zwanenburg 1990; Mohn and Bowen 1996; Bowen *et al.* 2003; Trzcinski *et al.* 2005; Bowen *et al.* 2007; DFO 2011a), but has declined to about 4% per year between 2007 and 2010, and 2.8% from 2010 to 2012 (DFO 2011a, 2012). The non-Sable Island population increased from approximately 25,000 in the mid-1980s to a peak of 71,500 in 2010 (Thomas *et al.* 2011). Modeling estimates of pup production increased from approximately 6,000 in 1985 to 17,400 in 2010 (Thomas *et al.* 2011). Approximately 70% of the western North Atlantic population is from the Sable Island stock. In the early 1990s pupping was established on Hay Island, off the Cape Breton coast (Lesage and Hammill 2001; Hammill *et al.* 2007, 2010).

Surveys of winter breeding colonies in Maine and on Muskeget Island may provide some measure of gray seal population trends and expansion in distribution. Sightings in New England increased during the 1980s as the gray seal population and range expanded in eastern Canada. Five pups were born at Muskeget in 1988. The number of pups increased to 12 in 1992, 30 in 1993, and 59 in 1994 (Rough 1995). In January 2002, 883 pups were counted on Muskeget Island and surrounding shoals (Wood Lafond 2009). In recent years NMFS monitoring surveys have detected an occasional mother/pup (white coats) pair on both Monomoy Island and Nomans Land. These observations continue the increasing trend in pup production reported by Rough (1995). The change in gray seal counts from southeastern Massachusetts (i.e., Monomoy, Muskeget and adjacent tidal bars) from 5,611 in spring 1999 to 15,756 in spring 2011 represents an annual increase of 8.6%, however, it has not been determined what proportion of the increase represents growth or immigration. For example, a few gray seals branded as pups on Sable Island in the 1970s and 2000s (Stobo and Zwanenburg 1990; C. den Heyer, pers. comm. DFO, Halifax) and satellite-tagged adults have been sighted in the Cape Cod region. Further, a branded female and pup were photographed on Seal Island, Maine in early January 2014 (unpubl. NMFS data).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. Recent studies estimated the current annual rate of increase at 2.8% between 2010 and 2012 on Sable Island (DFO 2011d), continuing a decline in the rate of increase (Trzcinski *et al*. 2005; Bowen *et al*. 2007; Thomas *et al.* 2011). Overall, population growth in the three Canadian breeding herds appears to be leveling off (DFO 2011d). For purposes of this assessment, the maximum net productivity rate was assumed to be 0.12. This value is based on theoretical modeling showing that pinniped populations may not grow at rates much greater than 12% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is unknown. The maximum productivity rate is 0.12, the default value for pinnipeds. The recovery factor (F_R) for this stock is 1.0, the value for stocks of unknown status, but which are known to be increasing. PBR for the western North Atlantic gray seals in U.S. waters is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

For the period 2008-2012 , the total estimated human caused mortality and serious injury to gray seals was 4,533 per year. The average was derived from five components: 1) 1,086 (CV=0.11) (Table 3) from the 2008-2012 U.S. observed fishery; 2) 9 from average 2008-2012 non-fishery related, human interaction stranding mortalities (NMFS unpublished data); 3) 403 from average 2008-2012 kill in the Canadian hunt (DFO in 2011d)*;* 4) 90 from DFO scientific collections (DFO in 2011d.); and 5) 2,945 removals of nuisance animals in Canada (DFO 2011d). Analysis of bycatch rates from fisheries observer program records likely greatly under-represents sub-lethal fishey interactions. Photographic analysis of gray seals at haulout sites on Cape Cod, Massachusetts revealed 5-8% of seals

exhibited signs of entanglement (Sette *et al.* 2009).

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Detailed fishery information is given in Appendix III.

U.S.

Northeast Sink Gillnet

Annual estimates of gray seal bycatch in the Northeast sink gillnet fishery reflect seasonal distribution of the species and of fishing effort. Estimated annual mortalities (CV in parentheses) from this fishery were 618 (0.23) in 2008, 1,063(0.26) in 2009, 1,155(0.28) in 2010, 1,491 (0.22) in 2011, and 542 (0.19) in 2012 (Table 3; Orphanides 2013; Hatch and Orphanides 2014). There were 6, 8, 7, 9, and 1 unidentified seals observed during 2008-2012, respectively. Since 1997 unidentified seals have not been prorated to a species. This is consistent with the treatment of other unidentified mammals that do not get prorated to a specific species. Average annual estimated fishery-related mortality and serious injury to this stock attributable to this fishery during 2008-2012 was 974 gray seals (CV=0.12) (Table 3). The stratification design used is the same as that for harbor porpoise (Bravington and Bisack 1996).

Mid-Atlantic Gillnet

Gray seal interactions were first observed in this fishery in 2010, when nine gray seal and 2 unidentified seal mortalities were observed. In 2011, 1 unidentified seal and 2 gray seal mortalities were observed in this fishery. In 2012 one gray seal mortality was observed. Annual estimated fishery-related mortality and serious injury (CV in parentheses) to this stock attributable to this fishery was 267 (0.75) in 2010, 19 (0.60) in 2011, and 14 (0.98) in 2012 (Table 3; Orphanides 2013; Hatch and Orphanides 2014). Average annual estimated fishery-related mortality and serious injury to this stock attributable to this fishery during 2008-2012 was 60 gray seals (CV=0.67) (Table 3).

Northeast Mid-Water Trawl

One gray seal mortality was observed in 2012 in this fishery. An expanded bycatch estimate has not been generated. Until this bycatch estimate can be developed, the average annual fishery-related mortality and serious injury for 2008-2012 is calculated as 0.2 animals (1 animal /5 years).

Mid-Atlantic Mid-Water Trawl

One gray seal mortality was observed in 2010 in this fishery. An expanded bycatch estimate has not been generated. Until this bycatch estimate can be developed, the average annual fishery-related mortality and serious injury for 2008-2012 is calculated as 0.2 animals (1 animal /5 years).

Gulf of Maine Atlantic Herring Purse Seine Fishery

The Gulf of Maine Atlantic Herring Purse Seine Fishery is a Category III fishery. This fishery was not observed until 2003, and was not observed in 2006. No mortalities have been observed, but 15 gray seals were captured and released alive in 2004, 19 in 2005, 0 in 2007, 6 in 2008, 0 in 2009, 4 in 2010, 34 in 2011, and 33 in 2012. In addition, 5 seals of unknown species were captured and released alive in 2004, 2 in 2005, 1 in 2007, none in 2008-2010, 8 in 2011, and 0 in 2012.

Northeast Bottom Trawl

Vessels in the North Atlantic bottom trawl fishery, a Category III fishery under MMPA, were observed in order to meet fishery management, rather than marine mammal management needs. No mortalities were observed prior to 2005, when four mortalities were attributed to this fishery. No mortalities were observed in 2006. The estimated annual fishery-related mortality and serious injury attributable to this fishery was 0 between 2001 and 2004, and for 2006. Nine gray seal mortalities were attributed to this fishery in 2007, 4 in 2008, 5 in 2009, 9 in 2010, 19 in 2011,

and 8 in 2012. The average annual fishery-related mortality and serious injury for 2008-2012 is calculated as 33 (0.18) animals.

Mid-Atlantic Bottom Trawl

One gray seal mortality was observed in this fishery in 2009, 2 in 2011 and 1 in 2012 (Table 2). The average annual fishery-related mortality and serious injury for 2008-2012 is calculated as 19 (0.48) animals.

CANADA

Historically, an unknown number of gray seals have been taken in Newfoundland and Labrador, Gulf of St. Lawrence, and Bay of Fundy groundfish gillnets, Atlantic Canada and Greenland salmon gillnets, Atlantic Canada cod traps, and in Bay of Fundy herring weirs (Read 1994). In addition to incidental catches, some mortalities (e.g., seals trapped in herring weirs) were the result of direct shooting, and there were culls of about 1,700 animals annually during the 1970s and early 1980s on Sable Island (Anonymous 1986).

In 1996, observers recorded 3 gray seals (1 released alive) in Spanish deep-water trawl fishing on the southern edge of the Grand Banks (NAFO Areas 3) (Lens 1997). Seal bycatch occurred year-round, but interactions were highest during April-June. Many of the seals that died during fishing activities were unidentified. The proportion of sets with mortality (all seals) was 2.7 per 1,000 hauls (0.003).

Table 3. Summary of the incidental mortality of gray seal (*Halichoerus grypus grypus*) by commercial fishery including the years sampled, the type of data used, the annual observer coverage, the serious injuries and mortalities recorded by on-board observers, the estimated annual mortality, the estimated CV of the annual mortality and the mean annual combined mortality (CV in parentheses).

Fishery	Years	Data Type [a]	Observer Coverage [b]	Observed Serious Injury[e]	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Annual Combined Mortality
Northeast Sink Gillnet[c]	08-12	Obs. Data,Weighout, Trip Logbook	.05. 04, .17, .19, .15	0, 0, 0, 0, 0	31, 52, 107, 222, 91	0, 0, 0, 0, 0	618, 1063, 1155, 1491, 542	618, 1063, 1155, 1491, 542	.23, .26, .28, .22, .19	974(0.12)
Mid-Atlantic Gillnet	08-12	Obs. Data, Trip Logbook, Allocated Dealer Data	.03, .03, .04, .02, .02	0, 0, 0, 0, 0	0, 0, 9, 2, 1	0, 0, 0, 0, 0	0, 0, 267, 19, 14	0, 0, 267, 19, 14	0, 0, .75, .60, .98	60 (0.67)
Northeast Bottom Trawl	08-12	Obs. Data,Trip Logbook	.08, .09, .16, .26, 17	0, 0, 0, 0, 0	4, 5, 9, 19, 8	0, 0, 0, 0, 0	16, 22, 30, 58, 37	16, 22, 30, 58, 37	.52, .46, .34, .25, .49	33 (0.18)
Mid-Atlantic Bottom Trawl	08-12	Obs. Data,Trip Logbook	.03, .05, .06, .08, .05	0, 0, 0, 0, 0	0, 3, 0, 3, 1	0, 0, 0, 0, 0	0, 38, 0, 25, 30	0, 38, 0, 25, 30	0, .70, 0, .57, 1.1	19 (0.48) [d]
Northeast Mid-water Trawl - Including Pair Trawl	08-12	Obs. Data,Trip Logbook	.199, .42, .53, .41, .45	0, 0, 0, 0, 0	0, 0, 0, 0, 1	0, 0, 0, 0, 0	0, 0, 0, 0, na	0, 0, 0, 0, na	0, 0, 0, 0, na	0.2 (na)
Mid-Atlantic Mid-water Trawl - Including Pair Trawl	08-12	Obs. Data, Trip Logbook	.13, .13, .25, .41, .21	0, 0, 0, 0, 0	0, 0, 1, 0, 0	0, 0, 0, 0, 0	0, 0, na, 0, 0	0, 0, na, 0, 0	0, 0, na, 0, 0	0.2 (na)
TOTAL										1086 (0.11)

a. Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. The Northeast Fisheries Observer Program collects landings data (Weighout), and total landings are used as a measure of total effort for the sink gillnet fishery. Mandatory logbook (Logbook) data are used to determine the spatial distribution of fishing effort in the Northeast multispecies sink gillnet fishery.

b. The observer coverages for the Northeast sink gillnet fishery and the mid-Atlantic gillnet fisheries are ratios based on tons of fish landed. . North Atlantic bottom trawl mid-Atlantic bottom trawl, and mid-Atlantic mid-water trawl fishery coverages are ratios based on trips. Total observer coverage reported for bottom trawl gear and gillnet gear in the years 2010 -2012 includes traditional fisheries observers in addition to fishery monitors through the Northeast Fisheries Observer Program (NEFOP). c. Since 1998, takes from pingered and non-pingered nets within a marine mammal time/area closure that required pingers, and takes from pingered and non-pingered nets not within a marine mammal time/area closure were pooled. The pooled bycatch rate was weighted by the total number of samples taken from the stratum and used to estimate the mortality. In 2008- 2012, respectively, 4, 13, 17, 125 and 54 takes were observed in nets with pingers. In 2008 -2012, respectively, 72, 27, 39, 90, 97, and 10 takes were observed in nets without pingers.
d. Fishery related bycatch rates for years 2008-2012 were estimated using an annual stratified ratio-estimator. These estimates replace the 2008-2011 annual estimates reported in the 2013 stock assessment report that were generated using a different method.
e. Serious injuries were evaluated for the 2008-2011 period using new guidelines (Waring *et al.* 2014, 2015)

Other Mortality

Canada: In Canada, gray seals were hunted for several centuries by indigenous people and European settlers in the Gulf of St. Lawrence and along the Nova Scotia eastern shore, and were locally extirpated (Laviguer and Hammill 1993). Between 1999 and 2012 the annual kill of gray seals by hunters in Canada was: 1999 (98), 2000 (342), 2001 (76), 2002 (126), 2003 (6), 2004 (0), 2005 (1073), 2006 (1,857) 2007 (1747), 2008 (1,471), 2009 (263), 2010 (58), and 2011 (215). (DFO 2003; 2008; 2009; 2011b; 2011d). DFO reports less than 10 gray seals were taken in commercial hunts in 2012 (http://www.dfo-mpo.gc.ca/fm-gp/seal-phoque/faq-eng.htm; accessed 11 January 2014). The traditional hunt of a few hundred animals is expected to continue off the Magdalen Islands and in other areas, except Sable Island where commercial hunting is not permitted (DFO 2003). DFO established a total allowable catch (TAC) of 12,000 gray seals for 2007 and 2008: 2,000 in the Gulf and 10,000 on the Scotian Shelf. The TAC for 2009 and 2010 was 50,000 seals, and for 2011 and 2012 it was set at 60,000. Since 2007, a small commercial hunt has taken place on Hay Island in Nova Scotia (http://www.dfo-mpo.gc.ca/fm-gp/seal-phoque/faq-eng.htm). The Hay Island TAC for 2010 was 2,220 (DFO 2011c), and for 2011 and 2012 it was set at 1,900 (http://www.dfo-mpo.gc.ca/decisions/fm-2012-gp/atl-002-eng.htm, accessed 27 February 2013)). The hunting of gray seals will continue to be prohibited on Sable Island (DFO 2011b).

Canada also issues personal hunting licenses which allow the holder to take six gray seals annually (Lesage and Hammill 2001; DFO 2011b). Hunting is not permitted during the breeding season and some additional seasonal/spatial restrictions are in effect (Lesage and Hammill 2001). Further, between 2005 and 2012 the lethal removal of nuisance seals was: 2005 (3105), 2006 (3437), 2007 (3373), 2008 (3334), 2009 (3381), 2010 (2933), 2011 (2076), and 2012 (3000) (DFO 2011b).

For scientific collections, DFO took 87, 320, and 90 animals, respectively in 2007, 2011, and 2012 (DFO 2012,).

U.S.: Gray seals, like harbor seals, were hunted for bounty in New England waters until the late 1960s (Katona, *et al.* 1993; Lelli, *et al*. 2009). This hunt may have severely depleted this stock in U.S. waters (Rough 1995; Lelli, *et al*. 2009). Other sources of mortality include human interactions, storms, abandonment by the mother, disease, and predation. Mortalities caused by human interactions include boat strikes, fishing gear interactions, power plant entrainment, oil spill/exposure, harassment, and shooting. Seals entangled in netting have been reported at several major haul-out sites in the Gulf of Maine.

From 2008 to 2012 468 gray seal stranding mortalities were recorded, extending from Maine to North Carolina (Table 4; NMFS unpublished data). Most stranding mortalities were in Massachusetts, which is the center of gray seal abundance in U.S. waters. Seventy-one (15.2%) of the total stranding mortalities showed signs of human interaction (21 in 2008, 14 in 2009, 12 in 2010, 20 in 2011 and 4 in 2012), 27 of which had some indication of fishery interaction (7 in 2008, 9 in 2009, 4 in 2010, 5 in 2011 and 2 in 2012). Ten gray seals are recorded in the NE stranding database during the 2008 to 2012 period as having been shot – one in Maine in 2009 and one in Maine and two in Massachusetts in 2010, 6 in Massachusetts in 2011 and none in 2012.

Table 4. Gray seal (*Halichoerus grypus grypus*) stranding mortalities [a] along the U.S. Atlantic coast (2008-2012) with subtotals of animals recorded as pups in parentheses.

State	2008	2009	2010	2011	2012	Total
Maine	6 (1)	3	8 (4)	4 (2)	10(2)	31
New Hampshire	0	1 (1)	0	8 (1)	1 (1)	10

Massachusetts	53 (4)	52 (7)	43 (5)	89 (14)	38 (21)	274
Rhode Island	7	10 (2)	8 (3)	14 (2)	13 (5)	52
Connecticut	0	1(1)	0	2	0	3
New York	2 (2)	16 (7)	10 (7)	22 (6)	5 (3)	55
New Jersey	3	4	4 (1)	10	4	25
Delaware	1 (1)	0	0	0	0	1
Maryland	1	1	1	4 (2)	0	7
Virginia	1	2	1	1	0	5
North Carolina	1 (1)	1 (1)	1	2 (2)	0	5
Total	75 (9)	91 (19)	76 (20)	156 (29)	71 (32)	468
Unspecified seals (all states)	51	34	22	11	27	145

a. Mortalities include those which stranded dead, died at site, were euthanized, died during transport, or died soon after transfer to rehab.

STATUS OF STOCK

Gray seals are not listed as threatened or endangered under the Endangered Species Act, and the western North Atlantic stock is not considered strategic under the Marine Mammal Protection Act. The level of human-caused mortality and serious injury in the U.S. Atlantic EEZ is unknown, but believed to be very low relative to the total stock size. The status of the gray seal population relative to OSP in U.S. Atlantic EEZ waters is unknown, but the stock's abundance appears to be increasing in Canadian and U.S. waters. The total U.S. fishery-related mortality and serious injury for this stock is low relative to the stock size in Canadian and U.S. waters and can be considered insignificant and approaching zero mortality and serious injury rate.

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Northern Gulf of Mexico Oceanic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Thirty-six bottlenose dolphin stocks have been delimited in the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) (Waring *et al.* 2001). Northern Gulf of Mexico inshore habitats have been separated into 31 bay, sound and estuary stocks. Three northern Gulf of Mexico coastal stocks inhabit coastal waters from the shore to the 20-m isobath. The northern Gulf of Mexico Continental Shelf Stock inhabits waters from 20 to 200 m deep. The northern Gulf of Mexico Oceanic Stock inhabits the waters from the 200-m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ; Figure 1).

Both "coastal" and "offshore" ecotypes of common bottlenose dolphins (Mead and Potter 1995) occur in the Gulf of Mexico (Vollmer 2011; Vollmer and Rosel 2013), but the distribution of each is not well defined. The offshore and coastal ecotypes are genetically distinct based on both mitochondrial and nuclear markers (Hoelzel *et al.* 1998; Vollmer 2011). In the northwestern Atlantic Ocean, Torres *et al.* (2003) found a statistically significant break in the distribution of the ecotypes at 34 km from shore. The offshore ecotype was found exclusively seaward of 34 km and in waters deeper than 34 m. The continental shelf is much wider in the Gulf of Mexico and these results may not apply. Ongoing research is aimed at better defining stock boundaries in coastal, continental shelf and oceanic waters of the Gulf of Mexico. Although the boundaries are not certain, all 141 *Tursiops* samples collected during 1994-2008 in waters greater than 200 m were of the offshore ecotype (Vollmer 2011), and so the Oceanic Stock as currently defined is thought to be composed entirely of bottlenose dolphins of the offshore ecotype.

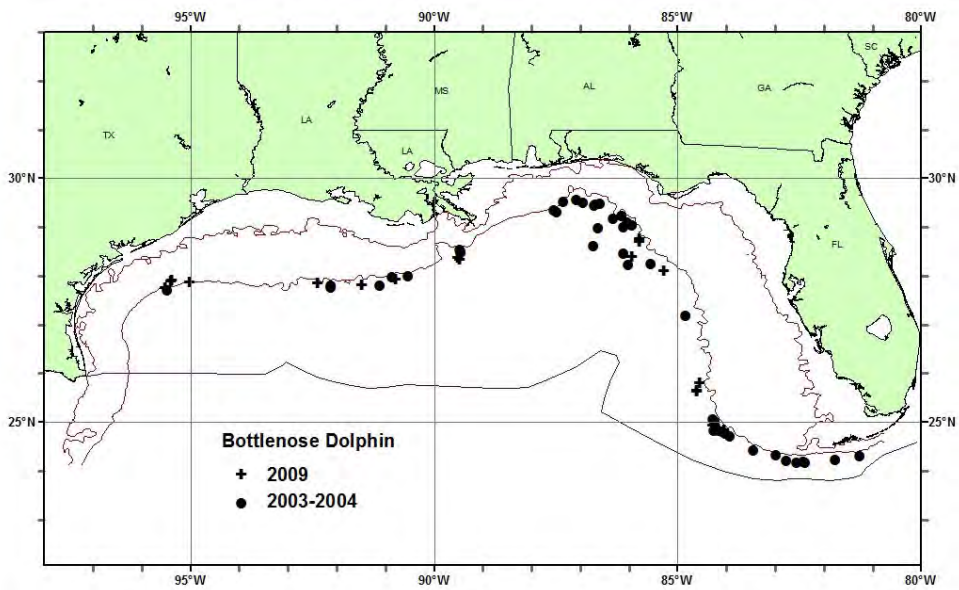

Figure 1. *Distribution of on-effort common bottlenose dolphin sightings from SEFSC shipboard surveys during summer 2003 and spring 2004, and during summer 2009. Solid lines indicate the 20 m and 200 m isobaths and the offshore extent of the U.S. EEZ.*

Because there are many confirmed records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Ortega Ortiz 2002), bottlenose dolphins almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), including waters belonging to Mexico and Cuba, where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico and 35% of the oceanic (i.e., >200 m) Gulf of Mexico.

The northern Gulf of Mexico Oceanic Stock of bottlenose dolphins is being considered separate from the Atlantic Ocean stocks of bottlenose dolphins for management purposes. One line of evidence to support this decision comes from Baron *et al.* (2008), who found that Gulf of Mexico bottlenose dolphin whistles (collected from oceanic waters) were significantly different from those in the western North Atlantic Ocean (collected from continental shelf and oceanic waters) in duration, number of inflection points and number of steps.

POPULATION SIZE

The best abundance estimate available for the northern Gulf of Mexico Oceanic Stock of bottlenose dolphins is 5,806 (CV=0.39; Table 1). This estimate is from a summer 2009 oceanic survey covering waters from the 200-m

isobath to the seaward extent of the U.S. EEZ.

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions.

Recent survey and abundance estimate

During summer 2009, a vessel-based line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico. Survey lines were stratified in relation to depth and the location of the Loop Current. The abundance estimate for bottlenose dolphins in oceanic waters during 2009 was 5,806 (CV=0.39; Table 1).

Table 1. Summary of recent abundance estimates for the northern Gulf of Mexico oceanic stock of bottlenose dolphins. Month, year and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Jun-Aug 2009	Oceanic waters	5,806	0.39

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for bottlenose dolphins is 5,806 (CV=0.39). The minimum population estimate for the northern Gulf of Mexico oceanic stock is 4,230 bottlenose dolphins.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long intervals between surveys. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007). Three point estimates of oceanic bottlenose dolphin abundance have been made based on data from surveys covering 1996-2009. The estimates vary by a maximum factor of more than two. Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of oceanic bottlenose dolphin abundance. The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum productivity rates are unknown for this stock. For purposes of this assessment, the maximum productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 4,230. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because the stock is of unknown status. PBR for the Gulf of Mexico oceanic bottlenose dolphin is 42.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The estimated annual average fishery-related mortality or serious injury to this stock during 2008-2012 was 6.5 bottlenose dolphins (CV=0.65; Table 2).

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fisheries Information

The commercial fisheries that could potentially interact with this stock in the Gulf of Mexico are the Category I Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery and the Atlantic Highly Migratory Species (high seas longline) fishery. The Category III Gulf of Mexico butterfish trawl fishery may also interact with this stock (Appendix III). There is very little effort within the Gulf of Mexico by the high seas longline fishery, and no takes of bottlenose dolphins within high seas waters of the Gulf of Mexico have been observed or reported thus far.

Pelagic swordfish, tunas and billfish are the targets of the pelagic longline fishery operating in the northern Gulf of Mexico. The estimated annual average serious injury and mortality of bottlenose dolphins attributable to the Gulf of Mexico pelagic longline fishery for the 5-year period from 2008 to 2012 was 6.5 animals (CV=0.65; Table 2). There were no reports of mortality or serious injury to bottlenose dolphins by this fishery in the northern Gulf of Mexico during 1999-2008 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009). However, during 2009, 1 serious injury of a bottlenose dolphin was observed during the second quarter (Garrison and Stokes 2010). During 2010, 1 serious injury was observed in the second quarter during experimental fishing to test the effectiveness of "weak" hooks as a potential bycatch mitigation tool. There was 100% observer coverage of all experimental sets, and the experimental fishing is not included in extrapolated bycatch estimates because it is not representative of the normal fishing effort (Garrison and Stokes 2012a). During 2011, 1 serious injury of a bottlenose dolphin was observed during the fourth quarter (Garrison and Stokes 2012b). Again during 2012, 1 serious injury of a bottlenose dolphin was observed during the fourth quarter (Garrison and Stokes 2013). From earlier years, 1 bottlenose dolphin was observed entangled and released alive in the northern Gulf of Mexico during 2007. All longline gear was removed and the animal was presumed to have no serious injuries. One bottlenose dolphin serious injury was observed in the pelagic longline fishery in 1998, and estimated serious injuries attributable to the pelagic longline fishery in the Gulf of Mexico region during quarter 1 of that year were 22 (CV=1.00; Yeung 1999).

A trawl fishery for butterfish was monitored by NMFS observers for a short period in the 1980's with no records of incidental take of marine mammals (Burn and Scott 1988; NMFS unpublished data), although an experimental set by NMFS resulted in the death of 2 bottlenose dolphins (Burn and Scott 1988). There are no other data available with regard to this fishery.

Table 2. Summary of the incidental mortality and serious injury of northern Gulf of Mexico oceanic bottlenose dolphins in the pelagic longline commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).

Fishery	Years	Vessels [a]	Data Type [b]	Observer Coverage [c]	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Est. CVs	Mean Annual Mortality
Pelagic Longline	08-12	53, 47, 46, 42, 47	Obs. Data Logbook	.26, .22, .28, .18, .11	0,1,0,1,1	0,0,0,0,0	0,3.2,0, 13.8,15.7	0,0,0,0,0	0,3.2,0, 13.8,15.7	NA,1.0, NA,1.0, 1.0	6.5 (0.65)

[a] Number of vessels in the fishery is based on vessels reporting effort to the pelagic longline logbook.
[b] Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC). Observer coverage in the GOM is dominated by very high coverage rates during April-June associated with efforts to improve estimates of Bluefin Tuna bycatch.
[c] Proportion of sets observed.

Other Mortality

A total of 1,703 bottlenose dolphins were found stranded in the northern Gulf of Mexico from 2008 through 2012 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 [for 2008-2011 data] and 15 April 2013 [for 2012 data]). Of these, 141 showed evidence of human interactions (e.g., gear entanglement, mutilation, gunshot wounds). The vast majority of stranded bottlenose dolphins are assumed to belong to one of the coastal stocks or to bay, sound and estuary stocks. Nevertheless, it is possible that some of the stranded bottlenose dolphins belonged to the continental shelf or oceanic stocks and that they were among those strandings with evidence of human interactions. (Strandings do occur for other cetacean species whose primary range in the Gulf of Mexico is outer continental shelf or oceanic waters.)

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010; and, as of 2013, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, 221 bottlenose dolphins were considered to be part of the UME; during 2011, 324 bottlenose dolphins, and during 2012, 151 bottlenose dolphins. The vast majority of stranded bottlenose dolphins are assumed to come from stocks that live nearest to land, namely the bay, sound and estuary stocks and the 3 coastal stocks. Nevertheless, it is possible that some of the stranded bottlenose dolphins considered part of the UME belonged to the continental shelf or oceanic stocks.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500 m deep, exploded on 20 April 2010. The rig sank, and over 87 days ~4.9 million barrels of oil were discharged from the wellhead until it was capped on 15 July 2010 (McNutt *et al.* 2012). During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, continental shelf, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. For continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed bottlenose dolphins, Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins and sperm whales swimming in oil in offshore waters. Some bottlenose dolphins were seen swimming in oil near the wellhead, where water depths would suggest these dolphins belonged to the Oceanic Stock. The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur

(Geraci 1990).

The use of explosives to remove oil rigs in portions of the continental shelf in the western Gulf of Mexico has the potential to cause serious injury or mortality to marine mammals. These activities have been closely monitored by NMFS observers since 1987 (Gitschlag and Herczeg 1994). There have been no reports of either serious injury or mortality to bottlenose dolphins in the oceanic Gulf of Mexico associated with these activities (NMFS unpublished data).

STATUS OF STOCK

Common bottlenose dolphins are not listed as threatened or endangered under the Endangered Species Act, and the northern Gulf of Mexico Oceanic Stock is not considered strategic under the MMPA. Total U.S. fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. The average annual human-related mortality and serious injury does not exceed PBR. The status of bottlenose dolphins, relative to OSP, in the northern Gulf of Mexico oceanic waters is unknown. There are insufficient data to determine population trends for this stock.

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PANTROPICAL SPOTTED DOLPHIN (*Stenella attenuata attenuata*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

There are two species of spotted dolphin in the Atlantic Ocean, the Atlantic spotted dolphin (*Stenella frontalis*) and the pantropical spotted dolphin (*S. attenuata*) (Perrin *et al.* 1987). The Atlantic spotted dolphin occurs in two forms which may be distinct sub-species (Perrin *et al.* 1987, 1994; Rice 1998): the large, heavily spotted form which inhabits the continental shelf and is usually found inside or near the 200m isobath; and the smaller, less spotted island and offshore form which occurs in the Atlantic Ocean but is not known to occur in the Gulf of Mexico (Fulling *et al.* 2003; Mullin and Fulling 2003; Mullin and Fulling 2004). Where they co-occur, the offshore form of the Atlantic spotted dolphin and the pantropical spotted dolphin can be difficult to differentiate at sea.

The pantropical spotted dolphin is distributed worldwide in tropical and some sub-tropical oceans (Perrin *et al.* 1987; Perrin and Hohn 1994). Sightings of this species occur in oceanic waters of the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) (Figure 1; Mullin and Fulling 2004; Maze-Foley and Mullin 2006). Pantropical spotted dolphins were seen in all seasons during GulfCet aerial surveys of the northern Gulf of Mexico between 1992 and 1998 (Hansen *et al.* 1996; Mullin and Hoggard 2000). Because there are many confirmed records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Jefferson and Schiro 1997, Ortega Ortiz 2002), pantropical spotted dolphins almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), which is also composed of waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico and 35% of the oceanic (i.e., >200 m) Gulf of Mexico.

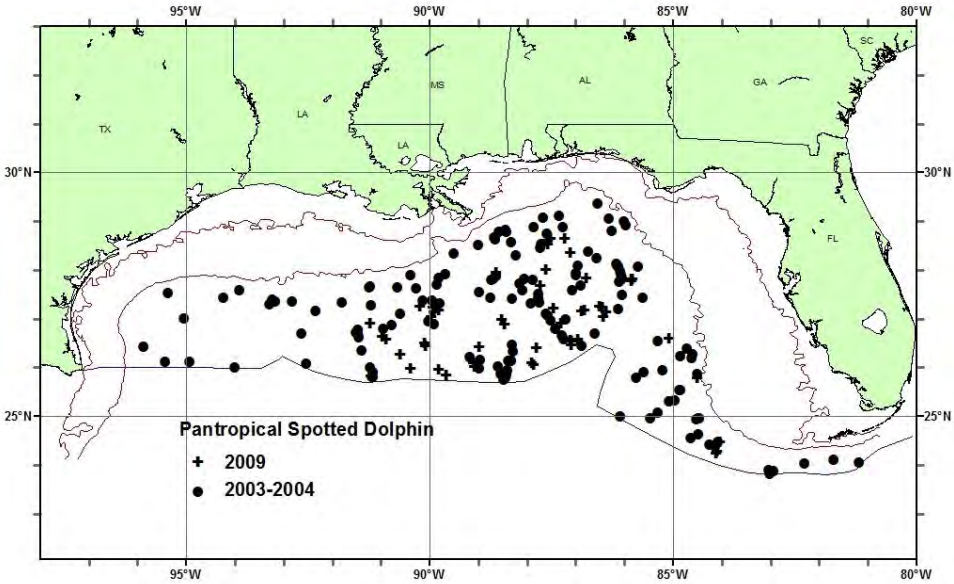

Figure 1. *Distribution of pantropical spotted dolphin sightings from SEFSC vessel surveys during summer 2003 and spring 2004, and during summer 2009. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 20 m and 200 m isobaths and the offshore extent of the U.S. EEZ.*

Some of the Pacific Ocean populations have been divided into different geographic stocks based on morphological characteristics (Perrin *et al.* 1987; Perrin and Hohn 1994). The Gulf of Mexico population is being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

The best abundance estimate available for northern Gulf of Mexico pantropical spotted dolphins is 50,880 (CV=0.27; Table 1). This estimate is from a summer 2009 oceanic survey covering waters from the 200m isobath to the seaward extent of the U.S. EEZ from Texas to Florida.

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions.

Recent survey and abundance estimate

During summer 2009, a vessel-based line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico. Survey lines were stratified in relation to depth and the location of the Loop Current. The abundance estimate for pantropical spotted dolphins in oceanic waters during 2009 was 50,880 (CV=0.27; Table 1).

Table 1. Summary of recent abundance estimates for northern Gulf of Mexico pantropical spotted dolphins. Month, year and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Jun-Aug 2009	Oceanic waters	50,880	0.27

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for pantropical spotted dolphins is 50,880 (CV=0.27). The minimum population estimate for the northern Gulf of Mexico is 40,699 pantropical spotted dolphins.

Current Population Trend

A trend analysis has not been conducted for this stock. Four point estimates of pantropical spotted dolphin abundance have been made based on data from surveys covering 1991-2009. The estimates vary by a maximum factor of nearly three. To determine whether changes in abundance have occurred over this period, an analysis of all the survey data needs to be conducted which incorporates covariates (e.g., survey conditions, season) that could potentially affect estimates. Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of pantropical spotted dolphin abundance. The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one half the maximum net productivity rate, and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 40,699. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because the stock is of unknown status. PBR for the northern Gulf of Mexico pantropical spotted dolphin stock is 407.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The estimated annual average fishery-related mortality or serious injury for this stock during 2008-2012 is 3.4 pantropical spotted dolphins (CV=0.65; Table 2).

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines

serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fisheries Information

The commercial fisheries that potentially could interact with this stock in the Gulf of Mexico are the Category I Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery and the Atlantic Highly Migratory Species (high seas longline) fishery (Appendix III). There is very little effort within the Gulf of Mexico by the high seas longline fishery, and no takes of pantropical spotted dolphins within high seas waters of the Gulf of Mexico have been observed or reported thus far. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico. The average annual serious injury and mortality in the Gulf of Mexico pelagic longline fishery for the 5-year period from 2008 to 2012 is 3.4 (CV=0.65; Table 2). There were no reports of mortality or serious injury to pantropical spotted dolphins by this fishery during 1998-2008 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009). However, during 2009, 4 pantropical spotted dolphins were observed to be seriously injured (3 during quarter 2 and 1 during quarter 4) and 1 pantropical spotted dolphin was released alive with no presumed serious injury after entanglement interactions with the pelagic longline fishery (Garrison and Stokes 2010). During 2010, 2 pantropical spotted dolphins were released alive with no presumed serious injuries after entanglement interactions with the pelagic longline fishery (Garrison and Stokes 2012a). One of the entanglements occurred during experimental fishing to test the effectiveness of "weak" hooks as a potential bycatch mitigation tool. There was 100% observer coverage of all experimental sets. During 2011 there were no reports of mortality or serious injury to pantropical spotted dolphins (Garrison and Stokes 2012b). During 2012, 1 mortality of a pantropical spotted dolphin occurred during an experimental set (during quarter 2; Garrison and Stokes 2013).

Table 2. Summary of the incidental mortality and serious injury of northern Gulf of Mexico pantropical spotted dolphins in the pelagic longline commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).

Fishery	Years	Vessels[a]	Data Type[b]	Observer Coverage[c]	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Est. CVs	Mean Annual Mortality
Pelagic Longline	08-12	53, 47, 46, 42, 47	Obs. Data Logbook	.26, .22, .28, .18, .11	0,4,0,0,0	0,0,0,0,1	0,16.0,0,0, 0	0,0,0,0,1.0	0,16.0,0,0, 1.0	NA, .69, NA, NA, NA	3.4 (0.65)

[a] Number of vessels in the fishery is based on vessels reporting effort to the pelagic longline logbook.
[b] Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC). Observer coverage in the GOM is dominated by very high coverage rates during April-June associated with efforts to improve estimates of Bluefin Tuna bycatch.
[c] Proportion of sets observed.

Other Mortality

Ten pantropical spotted dolphins were reported stranded in the Gulf of Mexico during 2008-2012 (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 30 September 2013). Evidence of human interaction was detected for 3 strandings (mortalities), which were the result of incidental capture in a research trawling net. No evidence of human interactions was detected for 2 stranded animals, and for the remaining 5 animals, it could not be determined if there was evidence of human interactions. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, nor will all of those that do wash ashore necessarily show signs of

entanglement or other fishery interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interactions.

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010; and, as of 2013, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, no animals from this stock were considered to be part of the UME, but the 5 strandings during 2011 and 2012 were included in the UME.

Table 2. Pantropical spotted dolphin (*Stenella attenuata*) strandings along the northern Gulf of Mexico coast, 2008-2012.

STATE	2008	2009	2010	2011	2012	TOTAL
Alabama	0	1	0	0	0	1
Florida	1	1	0	0	2*	4
Louisiana	0	0	0	3*,[a]	0	3
Mississippi	0	0	0	0	0	0
Texas	0	1	1	0	0	2
TOTAL	1	3	1	3	2	10

* These strandings are included in the Northern Gulf of Mexico UME.
[a] These 3 strandings were incidental takes during a research trawl.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and over 87 days ~4.9 million barrels of oil were discharged from the wellhead until it was capped on 15 July 2010 (McNutt *et al.* 2012). During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, continental shelf, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. For continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed pantropical spotted dolphins, Risso's dolphins, spinner dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters. The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990).

STATUS OF STOCK

Pantropical spotted dolphins are not listed as threatened or endangered under the Endangered Species Act, and the northern Gulf of Mexico stock is not considered strategic under the MMPA. Total fishery-related mortality and serious injury for this stock is likely less than 10% of PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. The status of pantropical spotted dolphins in the northern Gulf of Mexico, relative to OSP, is unknown. There are insufficient data to determine the population trends for this stock.

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RISSO'S DOLPHIN (*Grampus griseus*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Risso's dolphins are distributed worldwide in tropical to warm temperate waters (Leatherwood and Reeves 1983). Risso's dolphins in the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) occur throughout oceanic waters but are concentrated in continental slope waters (Figure 1; Baumgartner 1997; Maze-Foley and Mullin 2006). Risso's dolphins were seen in all seasons during GulfCet aerial surveys of the northern Gulf of Mexico between 1992 and 1998 (Hansen *et al.* 1996; Mullin and Hoggard 2000).

Although there are only a few records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Jefferson and Schiro 1997, Ortega Ortiz 2002), Risso's dolphins almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), including waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico and 35% of the oceanic (i.e., >200 m) Gulf of Mexico.

The Gulf of Mexico population is being considered a separate stock for management purposes, although there is currently little information to differentiate this stock from the Atlantic Ocean stock. In 2006, a Risso's dolphin that stranded on the Florida Gulf Coast was rehabilitated, tagged with a satellite-linked transmitter and released into the Gulf southwest of Tampa Bay. Over a 23-day period the Risso's dolphin moved from the Gulf release site into the Atlantic Ocean and north to just off of Delaware (Wells *et al.* 2009). During September 2007 – January 2008, tracking of an adult female Risso's dolphin that had been rehabilitated and released by Mote Marine Laboratory after stranding on the southwest coast of Florida documented movements throughout the northern Gulf of Mexico. The dolphin, released with its young calf, traveled as far as Bahia de Campeche, Mexico, and waters off Texas and Louisiana before returning to the shelf edge southwest of its stranding site off Florida (Wells *et al.* 2008a). As Wells *et al.* (2009) note, it is difficult to determine the effects of stranding and rehabilitation on post-release behavior, so it is unknown whether these movements were representative of Risso's dolphin ranging patterns in either the Gulf of Mexico or Atlantic Ocean. Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

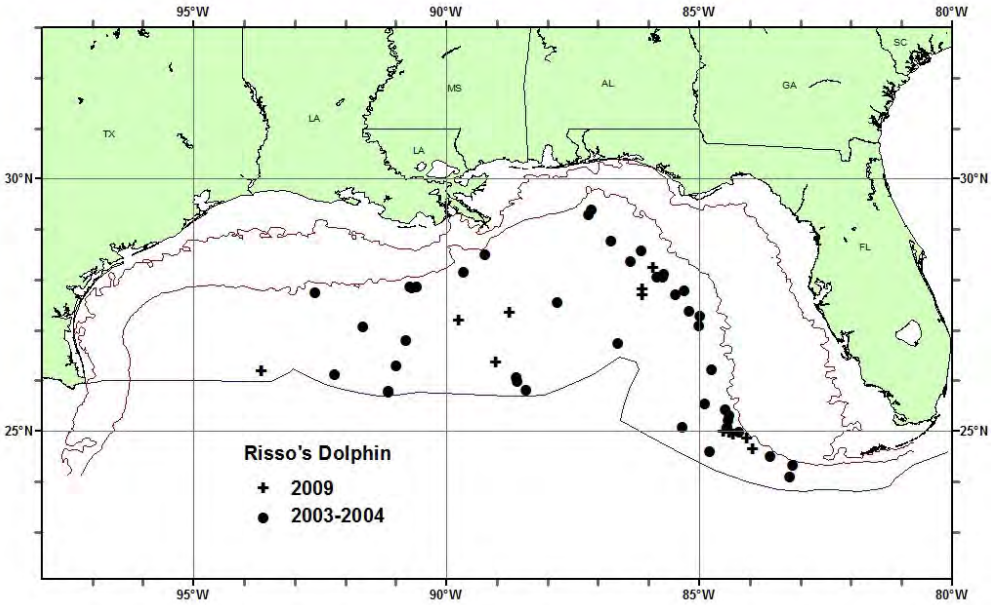

Figure 1. *Distribution of Risso's dolphin sightings from SEFSC vessel surveys during summer 2003 and spring 2004, and during summer 2009. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 20-m and 200-m isobaths and the offshore extent of the U.S. EEZ.*

POPULATION SIZE

The best abundance estimate available for northern Gulf of Mexico Risso's dolphins is 2,442 (CV=0.57; Table 1). This estimate is from a summer 2009 oceanic survey covering waters from the 200-m isobath to the seaward

extent of the U.S. EEZ.

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions.

Recent survey and abundance estimate

During summer 2009, a vessel-based line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico. Survey lines were stratified in relation to depth and the location of the Loop Current. The abundance estimate for Risso's dolphins in oceanic waters during 2009 was 2,442 (CV=0.57; Table 1).

Table 1. Summary of recent abundance estimates for northern Gulf of Mexico Risso's dolphins. Month, year and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Jun-Aug 2009	Oceanic waters	2,442	0.57

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for Risso's dolphins is 2,442 (CV=0.57). The minimum population estimate for the northern Gulf of Mexico is 1,563 Risso's dolphins.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long intervals between surveys. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007). Four point estimates of Risso's dolphin abundance have been made based on data from surveys covering 1991-2009. The estimates vary by a maximum factor of nearly two. Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of Risso's dolphin abundance. The 2 cases of satellite-linked tracking of Risso's dolphins in the Gulf of Mexico both showed movements out of the U.S. Gulf of Mexico EEZ (Wells *et al.* 2008a, 2009). The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one half the maximum net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 1,563. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because the stock is of unknown status. PBR for the northern Gulf of Mexico Risso's dolphin is 16.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The estimated annual average fishery-related mortality or serious injury for this stock during 2008-2012 is 7.9 Risso's dolphins (CV=0.76; Table 2).

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fisheries Information

The commercial fisheries that could potentially interact with this stock in the Gulf of Mexico are the Category I Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery and the Atlantic Highly Migratory Species (high seas longline) fishery (Appendix III). There is very little effort within the Gulf of Mexico by the high seas longline fishery, and no takes of Risso's dolphins within high seas waters of the Gulf of Mexico have been observed or reported thus far. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico. There were no reports of mortality or serious injury to Risso's dolphins in the northern Gulf of Mexico by this fishery during 1998-2007 or during 2009-2010 (Yeung 1999; 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison and Stokes 2010; 2012a). In 2008 and 2011-2012, 1 mortality and 4 serious injuries of Risso's dolphins were observed during interactions with the pelagic longline fishery. These interactions occurred during the first and second quarters of 2008, during the second quarter of 2011 and during the fourth quarter of 2012 (Table 2; Garrison *et al.* 2009; Garrison and Stokes 2010; Garrison and Stokes 2012a,b; 2013). For the 5-year period 2008-2012, the estimated annual combined serious injury and mortality attributable to the pelagic longline fishery in the northern Gulf of Mexico was 7.9 (CV=0.76). During 15 April – 15 June, in 2008-2012, observer coverage in the Gulf of Mexico was greatly enhanced to collect more robust information on the interactions between pelagic longline vessels and spawning bluefin tuna. Resulting observer coverage for this time and area is very high (approaching 55%). Therefore, the high observer coverage during 2008-2012 primarily reflects high coverage rates during the second quarter of each year. During 2011, 1 Risso's dolphin was observed entangled and released alive in the northern Gulf of Mexico. The animal was not hooked, but was entangled in mainline around its head and a flipper. All gear was removed and the animal immediately swam away and dove. During 2005, a Risso's dolphin was observed entangled and released alive in the northern Gulf of Mexico. The animal was not hooked, but was entangled with mainline and leader around its flukes. All gear was removed and the animal dove immediately. Both animals were presumed to have not been seriously injured (Fairfield Walsh and Garrison 2006; Garrison and Stokes 2012b). There is a high likelihood that releases of dolphins that have ingested gear or with multi-wrap entanglements of appendages near their insertions will lead to mortality (Wells *et al.* 2008b).

Table 2. Summary of the incidental mortality and serious injury of northern Gulf of Mexico Risso's dolphins in the pelagic longline commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).

Fishery	Years	Vessels [a]	Data Type [b]	Observer Coverage [c]	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Est. CVs	Mean Annual Mortality
Pelagic Longline	08-12	53, 47, 46, 42, 47	Obs. Data Logbook	.26, .22, .28, .18, .11	2,0,0,1,1	1,0,0,0,0	3.9,0,0, 1.5,29.8	4.4,0,0,0, 0	8.3,0,0, 1.5,29.8	.63,NA, NA,1.0, 1.0	7.9 (0.76)

[a] Number of vessels in the fishery is based on vessels reporting effort to the pelagic longline logbook.
[b] Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC). Observer coverage in the GOM is dominated by very high coverage rates during April-June associated with efforts to improve estimates of Bluefin Tuna bycatch.
[c] Proportion of sets observed.

Other Mortality

There were 6 reported strandings of Risso's dolphins in the Gulf of Mexico during 2008-2012 (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 30 September 2013). This includes one mass stranding of 2 animals in Florida during January 2009. No evidence of human interactions was detected for 2 of the stranded animals, and it could not be determined if there was evidence of human interactions for the remaining 4 stranded animals. Stranding data probably underestimate the extent of human-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in human interactions wash ashore, not all that wash ashore are discovered, reported or investigated, nor will all of those that do wash ashore necessarily show signs of entanglement or other human interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interactions.

Since 1990, there have been 13 bottlenose dolphin or cetacean die-offs or Unusual Mortality Events (UMEs) in the northern Gulf of Mexico, and 2 of these included a Risso's dolphin. Between August 1999 and May 2000, 152 bottlenose dolphins died coincident with *Karenia brevis* blooms and fish kills in the Florida Panhandle. Additional strandings included 3 Atlantic spotted dolphins, *Stenella frontalis*, 1 Risso's dolphin, 2 Blainville's beaked whales, *Mesoplodon densirostris*, and 4 unidentified dolphins. An UME was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010, and as of 2013, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010 and 2011, no animals from this stock were considered to be part of the UME, but during 2012, 1 stranded Risso's dolphin was included in the UME.

Table 3. Risso's dolphin (*Grampus griseus*) strandings along the northern Gulf of Mexico coast, 2008-2012.

STATE	2008	2009	2010	2011	2012	TOTAL
Alabama	0	0	0	0	0	0
Florida	0	2[a]	0	1	1[b]	4
Louisiana	0	0	0	0	0	0
Mississippi	0	0	1	0	0	1
Texas	0	1	0	0	0	1
TOTAL	0	3	1	1	1	6

[a] Includes Florida mass stranding of 2 animals in January 2009.
[b] This stranding is included in the Northern Gulf of Mexico UME.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500 m deep, exploded on 20 April 2010. The rig sank, and over 87 days ~4.9 million barrels of oil were discharged from the wellhead until it was capped on 15 July 2010 (McNutt *et al.* 2012). During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, continental shelf, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. For continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite-linked tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters. The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990).

STATUS OF STOCK

Risso's dolphins are not listed under the Endangered Species Act, and the northern Gulf of Mexico stock is not considered strategic under the MMPA. Total fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and therefore cannot be considered to be insignificant and approaching zero mortality and serious injury rate. The average annual human-related mortality and serious injury does not exceed PBR. The status of Risso's dolphins in the northern Gulf of Mexico, relative to OSP, is unknown. There are insufficient data to determine the population trends for this species.

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Gulf of Mexico Northern Coastal Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Common bottlenose dolphins inhabit coastal waters throughout the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) (Mullin *et al.* 1990). As a working hypothesis, it is assumed that the dolphins occupying habitats with dissimilar climatic, coastal and oceanographic characteristics might be restricted in their movements between habitats, and thus constitute separate stocks. Therefore, northern Gulf of Mexico coastal waters have been divided for management purposes into 3 stock areas: eastern, northern and western, with coastal waters defined as waters between the shore, barrier islands or presumed outer bay boundaries out to the 20-m isobath (Figure 1). The 20-m depth seaward boundary corresponds to survey strata (Scott 1990; Blaylock and Hoggard 1994; Fulling *et al.* 2003), and thus represents a management boundary rather than an ecological boundary. The Northern Coastal bottlenose dolphin stock area extends from 84°W longitude to the Mississippi River Delta. This region is characterized by a temperate climate, barrier islands, sand beaches, coastal marshes and marsh islands, and has a relatively high level of freshwater input. It is bordered on the east by an extensive area of coastal marsh and marsh islands typical of Florida's Apalachee Bay. Dolphins belonging to this stock are all expected to be of the coastal ecotype (Vollmer 2011).

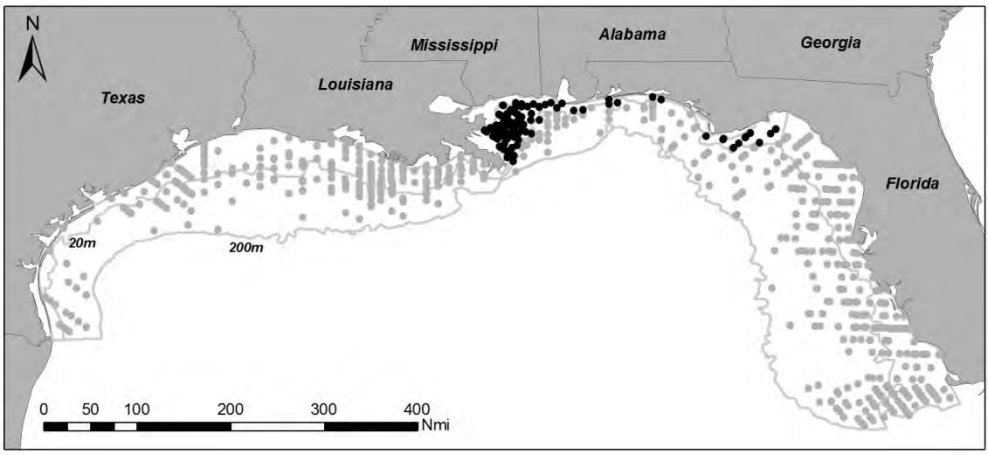

Figure 1. *Locations (circles) of common bottlenose dolphin groups sighted in coastal and continental shelf waters during aerial surveys conducted in spring, summer and fall of 2011 and in winter of 2012. Dark circles indicate groups within the boundaries of the Northern Coastal Stock. The 20-m and 200-m isobaths are shown.*

This stock's boundaries abut other bottlenose dolphin stocks, namely the Continental Shelf Stock and several bay, sound and estuary stocks, and while individuals from different stocks may occasionally overlap, it is not thought that significant mixing or interbreeding occurs between them. Fazioli *et al.* (2006) conducted photo-identification surveys of coastal waters off Tampa Bay, Sarasota Bay and Lemon Bay, Florida, over 14 months. They found coastal waters were inhabited by both 'inshore' and 'Gulf' dolphins but that the 2 types used coastal waters differently. Dolphins from the inshore communities were observed occasionally in Gulf near-shore waters adjacent to their inshore range, whereas 'Gulf' dolphins were found primarily in open Gulf of Mexico waters with some displaying seasonal variations in their use of the study area. The 'Gulf' dolphins did not show a preference for waters near passes as was seen for 'inshore' dolphins, but moved throughout the study area and made greater use of waters offshore of waters used by 'inshore' dolphins. During winter months abundance of 'Gulf' groups decreased while abundance for 'inshore' groups increased. These findings support an earlier report by Irvine *et al.* (1981) of increased use of pass and coastal waters by Sarasota Bay dolphins in winter. Seasonal movements of identified individuals and abundance indices suggest that part of the 'Gulf" dolphin community moves out of the study area during winter, but their destination is unknown. In a follow-up study, Sellas *et al.* (2005) examined genetic population subdivision in the study area of Fazioli *et al.* (2006), and found evidence of significant population structure among all areas on the basis of both mitochondrial DNA control region sequence data and 9 nuclear microsatellite loci. The Sellas *et al.* (2005) findings support the separate identification of bay, sound and

estuary stocks from those occurring in adjacent Gulf coastal waters, as suggested by Wells (1986).

Off Galveston, Texas, Beier (2001) reported an open population of individual dolphins in coastal waters, but several individual dolphins had been sighted previously by other researchers over a 10-year period. Some coastal animals may move relatively long distances alongshore. Two bottlenose dolphins previously seen in the South Padre Island area in Texas were seen in Matagorda Bay, 285 km north, in May 1992 and May 1993 (Lynn and Würsig 2002).

POPULATION SIZE

The best abundance estimate available for the northern Gulf of Mexico Northern Coastal Stock of bottlenose dolphins is 7,185 (CV=0.21; Table 1). This estimate is from an inverse-variance weighted average of seasonal abundance estimates from aerial surveys conducted during spring 2011, summer 2011, fall 2011 and winter 2012.

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions.

Recent surveys and abundance estimates

The Southeast Fisheries Science Center conducted aerial surveys of continental shelf waters (shoreline to 200 m depth) along the U.S. Gulf of Mexico coast from the Florida Keys to the Texas/Mexico border during spring (March-April) 2011, summer (July-August) 2011, fall (October-November) 2011 and winter (January-February) 2012. The surveys were conducted along tracklines oriented perpendicular to the shoreline and spaced 20-30 km apart. The total survey effort varied during each survey due to weather conditions, but ranged between 13,500 – 15,600 km. Each of these surveys was conducted using a two-team approach to develop estimates of visibility bias using the independent observer approach with Distance analysis (Laake and Borchers 2004). A model for the probability of detection on the trackline as a function of sighting conditions (sea state, glare, water color, etc.) was developed using data across all 4 surveys. This model was then applied to detection probability functions specific to each survey to account for the probability of detection as a function of distance from the trackline and additional environmental covariates. A bootstrap resampling approach was used to estimate the variance of the estimates. The survey data were post-stratified into spatial boundaries corresponding to the defined boundaries of bottlenose dolphin stocks within the surveyed area. The abundance estimates for the Northern Coastal Stock of bottlenose dolphins were based upon tracklines and sightings in waters from the shoreline to the 20-m isobath and between the Mississippi River Delta and 84°W longitude, including waters of northern Chandeleur Sound. The seasonal abundance estimates for this stock were: spring – 15,831 (CV=0.38), summer – 6,792 (CV=0.28), fall – 2,384 (CV=0.38) and winter – 2,384 (CV=0.31). Due to the uncertainty in stock movements and apparent seasonal variability in the abundance of the stock, a weighted average of these seasonal estimates was taken where the weighting was the inverse of the CV. This approach weights estimates with higher precision more heavily in the final weighted mean. The resulting weighted mean and best estimate of abundance for the Northern Coastal Stock of bottlenose dolphins was 7,185 (CV=0.21).

Previous abundance estimates for the Northern and Eastern Coastal Stocks were derived from aerial surveys conducted during 17 July to 8 August 2007. Survey effort covered waters from the shoreline to 200m depth and was stratified such that the majority of effort was expended in the 0-20m depth range of the coastal stocks. The survey team consisted of an observer stationed at each of two forward bubble windows and a third observer stationed at a belly window that monitored the trackline. Surveys were typically flown during favorable sighting conditions at Beaufort sea state less than or equal to 3 (surface winds <10 knots). Abundance estimates were derived using Distance analysis including environmental covariates that had a significant influence on sighting probability (Buckland *et al.* 2001), but these estimates were not corrected for *g(0)* and are thus negatively biased. The resulting abundance estimate for the Northern Coastal Stock was 2,473 (CV=0.25).

Table 1. Summary of recent abundance estimates for the Northern Coastal Stock of bottlenose dolphins. Month, year and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
July-Aug 2007	shoreline to 20 m, Northern Coastal Stock waters (Mississippi River Delta to 84°W longitude)	2,473	0.25

Spring, summer and fall 2011, winter 2012	shoreline to 20 m, Northern Coastal Stock waters (Mississippi River Delta to 84°W longitude)	7,185	0.21

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for the Northern Coastal Stock of bottlenose dolphins is 7,185 (CV=0.21). The minimum population estimate for the Northern Coastal Stock is 6,044 bottlenose dolphins.

Current Population Trend

There are insufficient data to determine population trends for this stock. The abundance estimates for summer 2007 and summer 2012 are 2,473 (CV=0.25) and 6,792 (CV=0.28), respectively.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate and a recovery factor (Wade and Angliss 1997). The minimum population size is 6,044. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because the stock is of unknown status. PBR for the northern Gulf of Mexico Northern Coastal Stock of bottlenose dolphins is 60.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury of the Northern Coastal Stock of bottlenose dolphins during 2008-2012 is unknown. Two mortalities were documented involving the Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) fishery; however, it is not possible to estimate the total number of interactions or mortalities associated with the hook and line fishery since there is no systematic observer program.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fisheries Information

The commercial fisheries which potentially could interact with the Northern Coastal Stock in the northern Gulf of Mexico are the Category II Southeastern U.S. Atlantic, Gulf of Mexico shrimp trawl, Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot, and Gulf of Mexico menhaden purse seine, and the Category III Gulf of Mexico blue crab trap/pot and Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) fisheries (Appendix III).

Hook and Line Fisheries

During 2008-2012, 2 mortalities involving hook and line gear entanglement or ingestion were documented for the Northern Coastal Stock. The mortalities occurred in 2012 and 2011. The mortalities were included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 [for 2008-2011 data] and 15 April 2013 [for 2012 data]) and are included in the stranding totals presented in Table 2.

Shrimp Trawl Fishery

During 2008-2012, no interactions between bottlenose dolphins of the Northern Coastal Stock and the shrimp trawl fishery were observed. A voluntary observer program for the shrimp trawl fishery began in 1992 and became mandatory in 2007. A total of 5 bottlenose dolphin mortalities were observed in the shrimp trawl fishery during 2003, 2007, 2008, 2010 and 2011, and 1 serious injury was observed during 2012. The 2003 mortality occurred off the coast of Alabama and could have belonged to the Northern Coastal Stock or a bay, sound and estuary stock (Mobile Bay, Bonsecour Bay Stock or Mississippi Sound, Lake Borgne, Bay Boudreau Stock). During 1992-2007 the observer program recorded an additional 6 unidentified dolphins caught in a lazy line or turtle excluder device, and 1 of these animals, a mortality in 2001, belonged to the Northern Coastal Stock. The observer report indicated the animal may have already been decomposed, but this could not be confirmed because there was no necropsy.

Blue and Stone Crab Trap/Pot Fisheries

There have been no reported mortalities or serious injuries involving trap/pot gear for the Northern Coastal Stock to date. However, mortalities and serious injuries have been reported for the Eastern Coastal Stock, Western Coastal Stock, and bay, sound and estuary stocks. Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab traps/pots.

Menhaden Purse Seine Fishery

During 2008-2012, no interactions between the Northern Coastal Stock and the menhaden purse seine fishery were documented. There is currently no observer program for the Gulf of Mexico menhaden purse seine fishery; however, recent interactions with bottlenose dolphins have been reported via two sources. First, during 2011, a pilot observer program operated from May through September, and observers documented 3 dolphins trapped within purse seine nets (within waters of the Western Coastal Stock and Mississippi Sound, Lake Borgne, Bay Boudreau Stock). All 3 were released alive without serious injury (Maze-Foley and Garrison in prep). Second, through the Marine Mammal Authorization Program (MMAP), there have been 13 self-reported incidental takes (all mortalities) of bottlenose dolphins in northern Gulf of Mexico coastal and estuarine waters by the menhaden purse seine fishery during 2000-2012. These takes likely affected the following stocks: Western Coastal Stock; Northern Coastal Stock; Mississippi Sound, Lake Borgne, Bay Boudreau Stock; and Mississippi River Delta Stock. Specific self-reported takes under the MMAP that might be attributed to the Northern Coastal Stock are as follows: one take of a single bottlenose dolphin was reported in Louisiana waters during 2001 that likely belonged to Mississippi River Delta Stock or Northern Coastal Stock; and during 2000, there was one reported take of a single bottlenose dolphin in Louisiana waters that likely belonged to Mississippi River Delta Stock or Northern Coastal Stock.

The menhaden purse seine fishery was observed to take 9 bottlenose dolphins (3 fatally) between 1992 and 1995 (NMFS unpublished data). During that period, there were 1,366 sets observed out of 26,097 total sets, which if extrapolated for all years suggests that as many as 172 bottlenose dolphins could have been taken in this fishery with up to 57 animals killed.

Without an ongoing observer program it is not possible to obtain statistically reliable information for this fishery on the number of sets annually, the incidental take and mortality rates, and the communities from which bottlenose dolphins are being taken.

Strandings

A total of 90 bottlenose dolphins were found stranded in Northern Coastal Stock waters of the Gulf of Mexico from 2008 through 2012 (Table 2; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 and 15 April 2013). Evidence of human interactions (e.g., gear entanglement, mutilation, gunshot wounds) was detected for 5 of these dolphins. Bottlenose dolphins are known to become entangled in, or ingest recreational and commercial fishing gear (Wells and Scott 1994; Gorzelany 1998; Wells *et al.* 1998; Wells *et al.* 2008), and some are struck by vessels (Wells and Scott 1997; Wells *et al.* 2008).

There are a number of difficulties associated with the interpretation of stranding data. It is possible that some or all of the stranded dolphins may have been from a nearby bay, sound and estuary stock; however, the proportion of stranded dolphins belonging to another stock cannot be determined because of the difficulty of determining from where the stranded carcass originated. Stranding data probably underestimate the extent of human-related mortality and serious injury because not all of the dolphins that die or are seriously injured due to human interactions wash ashore, nor will all of those that do wash ashore necessarily show signs of fishery-interaction or other human interactions. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interaction, and the condition of the carcass if badly decomposed can inhibit the

interpretation of cause of death.

Since 1990, there have been 13 bottlenose dolphin die-offs or Unusual Mortality Events (UMEs) in the northern Gulf of Mexico, and 7 of these have occurred within the boundaries of the Northern Coastal Stock and may have affected the stock. 1) From January through May 1990, a total of 367 bottlenose dolphins stranded in the northern Gulf of Mexico. Overall this represented a two-fold increase in the prior maximum recorded strandings for the same period, but in some locations (i.e., Alabama) strandings were 10 times the average number. The cause of the 1990 mortality event could not be determined (Hansen 1992). 2) In 1993-1994 an UME of bottlenose dolphins likely caused by morbillivirus started in the Florida Panhandle and spread west with most of the mortalities occurring in Texas (Lipscomb 1993; Lipscomb *et al.* 1994). From February through April 1994, 220 bottlenose dolphins were found dead on Texas beaches, of which 67 occurred in a single 10-day period. 3) In 1996 an UME was declared for bottlenose dolphins in Mississippi when 27 bottlenose dolphins stranded during November and December. The cause was not determined, but a *Karenia brevis* (red tide) bloom was suspected to be responsible. 4) Between August 1999 and May 2000, 152 bottlenose dolphins died coincident with *K. brevis* blooms and fish kills in the Florida Panhandle (additional strandings included 3 Atlantic spotted dolphins, *Stenella frontalis*, 1 Risso's dolphin, *Grampus griseus*, 2 Blainville's beaked whales, *Mesoplodon densirostris*, and 4 unidentified dolphins). 5) In March and April 2004, in another Florida Panhandle UME possibly related to *K. brevis* blooms, 105 bottlenose dolphins and 2 unidentified dolphins stranded dead (NMFS 2004). Although there was no indication of a *K. brevis* bloom at the time, high levels of brevetoxin were found in the stomach contents of the stranded dolphins (Flewelling *et al.* 2005). 6) A separate UME was declared in the Florida Panhandle after elevated numbers of dolphin strandings occurred in association with a *K. brevis* bloom in September 2005. Dolphin strandings remained elevated through the spring of 2006 and brevetoxin was again detected in the tissues of some of the stranded dolphins. Between September 2005 and April 2006 when the event was officially declared over, a total of 90 bottlenose dolphin strandings occurred (plus strandings of 3 unidentified dolphins). 7) An UME was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010; and, as of 2013, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, 14 animals from this stock were considered to be part of the UME, during 2011, 40 animals, and during 2012, 16 animals.

Table 2. Bottlenose dolphin strandings occurring in Northern Coastal Stock waters of the northern Gulf of Mexico from 2008 to 2012, as well as number of strandings for which evidence of human interaction (HI) was detected and number of strandings for which it could not be determined (CBD) if there was evidence of HI. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 13 September 2012 [for 2008-2011 data] and 15 April 2013 [for 2012 data]). Please note HI does not necessarily mean the interaction caused the animal's death.

Stock	Category	2008	2009	2010	2011	2012	Total
Northern Coastal Stock	Total Stranded	7	8	18[a]	40[b]	17[c]	90
	Human Interaction						
	---Yes	0	1	1	1[d]	2[e]	5
	---No	1	3	3	0	4	11
	---CBD	6	4	14	39	11	74

[a] This total includes 14 strandings that are part of the ongoing UME in the northern Gulf of Mexico.
[b] All of these strandings were part of the ongoing UME in the northern Gulf of Mexico.
[c] This total includes 16 strandings that are part of the ongoing UME in the northern Gulf of Mexico.
[d] This was an entanglement interaction (mortality) with recreational hook and line gear.
[e] Includes 1 entanglement interaction (mortality) with hook and line gear.

Other Mortality

The problem of dolphin depredation of fishing gear is increasing in the Gulf of Mexico. There have been 4 recent cases of fishermen illegally "taking" dolphins due to dolphin depredation of recreational and commercial fishing gear. One recent case of a shrimp fisherman illegally "taking" a dolphin in Mississippi Sound occurred during summer 2012. In December 2013 the fisherman was convicted under the MMPA for knowingly shooting a dolphin with a shotgun while shrimping. A commercial fisherman was indicted in November 2008 for throwing pipe bombs at dolphins off Panama City, Florida, and charged in March 2009 for "taking" dolphins with an explosive device. In 2006 a charter boat fishing captain was charged under the MMPA for shooting at a dolphin that was

swimming around his catch in the Gulf of Mexico, off Panama City, Florida. In 2007 a second charter fishing boat captain was fined under the MMPA for shooting at a bottlenose dolphin that was attempting to remove a fish from his line in the Gulf of Mexico, off Orange Beach, Alabama. Feeding or provisioning of wild bottlenose dolphins has been documented in Florida, particularly near Panama City Beach in the Panhandle (Samuels and Bejder 2004) and south of Sarasota Bay (Cunningham-Smith *et al.* 2006; Powell and Wells 2011), and also in Texas near Corpus Christi (Bryant 1994). Feeding wild dolphins is defined under the MMPA as a form of 'take' because it can alter their natural behavior and increase their risk of injury or death. Nevertheless, a high rate of provisioning was observed near Panama City Beach in 1998 (Samuels and Bejder 2004), and provisioning has been observed south of Sarasota Bay since 1990 (Cunningham-Smith *et al.* 2006; Powell and Wells 2011). There are emerging questions regarding potential linkages between provisioning and depredation of recreational fishing gear and associated entanglement and ingestion of gear, which is increasing through much of Florida. During 2006, an estimated 2% of the long-term resident dolphins of Sarasota Bay died from ingestion of recreational fishing gear (Powell and Wells 2011).

Swimming with wild bottlenose dolphins has also been documented in Florida in Key West (Samuels and Engleby 2007) and near Panama City Beach (Samuels and Bejder 2004). Near Panama City Beach, Samuels and Bejder (2004) concluded that dolphins were amenable to swimmers due to illegal provisioning. Swimming with wild dolphins may cause harassment, and harassment is illegal under the MMPA.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and over 87 days ~4.9 million barrels of oil were discharged from the wellhead until it was capped on 15 July 2010 (McNutt *et al.* 2012). During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Given the trajectory of the surface oil during the spill and the documented oiling of shoreline (Michel *et al.* 2013), it is likely the Northern Coastal Stock of bottlenose dolphins was exposed to oil during the event. A substantial number of beaches and wetlands along the Louisiana coast experienced heavy or moderate oiling (OSAT-2 2011; Michel *et al.* 2013). The heaviest oiling in Louisiana occurred west of the Mississippi River on the Mississippi Delta and in Barataria and Terrebonne Bays, and to the east of the river on the Chandeleur Islands. Some heavy to moderate oiling occurred on Alabama and Florida beaches, with the heaviest stretch occurring from Dauphin Island, Alabama, to Gulf Breeze, Florida. Light to trace oil was reported along the majority of Mississippi's mainland coast, from Gulf Breeze to Panama City, Florida, and outside of Atchafalaya and Vermilion Bays in western Louisiana. Heavy to light oiling occurred on Mississippi's barrier islands (Michel *et al.* 2013).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, continental shelf, coastal and estuarine marine mammals. The research is ongoing. For coastal and estuarine dolphins, the NOAA-led efforts include: active surveillance to detect stranded animals in remote locations; aerial surveys to document the distribution, abundance, species and exposure of marine mammals and sea turtles relative to oil from DWH spill; assessment of sublethal and chronic health impacts on coastal and estuarine bottlenose dolphins in Barataria Bay, Louisiana, and a reference site in Sarasota Bay, Florida; and assessment of injuries to dolphin stocks in Barataria Bay and Chandeleur Sound, Louisiana, Mississippi Sound, and as a reference site, St. Joseph Bay, Florida.

Dolphins were observed with tar balls attached to them and seen swimming through oil slicks close to shore and inland bays. The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression

and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990).

The nearshore habitat occupied by the 3 coastal stocks is adjacent to areas of high human population and in some areas, such as Tampa Bay, Florida, Galveston, Texas, and Mobile, Alabama, is highly industrialized. Concentrations of anthropogenic chemicals such PCBs and DDT and its metabolites vary from site to site, and can reach levels of concern for bottlenose dolphin health and reproduction in the southeastern U.S. (Schwacke *et al.* 2002). PCB concentrations in 3 stranded dolphins sampled from the Eastern Coastal Stock area ranged from 16-46µg/g wet weight. Two stranded dolphins from the Northern Coastal Stock area had the highest levels of DDT derivatives of any of the bottlenose dolphin liver samples analyzed in conjunction with a 1990 mortality investigation conducted by NMFS (Varanasi *et al.* 1992). The significance of these findings is unclear, but there is some evidence that increased exposure to anthropogenic compounds may reduce immune function in bottlenose dolphins (Lahvis *et al.* 1995), or impact reproduction through increased first-born calf mortality (Wells *et al.* 2005). Concentrations of chlorinated hydrocarbons and metals were relatively low in most of the bottlenose dolphins examined in conjunction with an anomalous mortality event in Texas bays in 1990; however, some had concentrations at levels of possible toxicological concern (Varanasi *et al.* 1992). Agricultural runoff following periods of high rainfall in 1992 was implicated in a high level of bottlenose dolphin mortalities in Matagorda Bay, which is adjacent to the Western Coastal Stock area (NMFS unpublished data).

The Mississippi River, which drains about two-thirds of the continental U.S., flows into the north-central Gulf of Mexico and deposits its nutrient load which is linked to the formation of one of the world's largest areas of seasonal hypoxia (Rabalais *et al.* 1999). This area is located in Louisiana coastal waters west of the Mississippi River delta. How it affects bottlenose dolphins is not known.

STATUS OF STOCK

The bottlenose dolphin is not listed as threatened or endangered under the Endangered Species Act. However, because an UME of unprecedented size and duration (began 1 February 2010 and is ongoing) has impacted the Northern Coastal Stock area, NMFS considers this to be a strategic stock under the MMPA. Total U.S. fishery-related mortality and serious injury for this stock is not known and there is insufficient information available to determine whether the total fishery-related mortality and serious injury is insignificant and approaching the zero mortality and serious injury rate. The status of this stock relative to OSP in the Gulf of Mexico EEZ is unknown. There are insufficient data to determine the population trends for this stock.

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Gulf of Mexico Eastern Coastal Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Common bottlenose dolphins inhabit coastal waters throughout the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) (Mullin *et al.* 1990). As a working hypothesis, it is assumed that the dolphins occupying habitats with dissimilar climatic, coastal and oceanographic characteristics might be restricted in their movements between habitats, and thus constitute separate stocks. Therefore, northern Gulf of Mexico coastal waters have been divided for management purposes into 3 stock areas: eastern, northern and western, with coastal waters defined as waters between the shore, barrier islands or presumed outer bay boundaries out to the 20-m isobath (Figure 1). The 20-m depth seaward boundary corresponds to survey strata (Scott 1990; Blaylock and Hoggard 1994; Fulling *et al.* 2003), and thus represents a management boundary rather than an ecological boundary. The Eastern Coastal bottlenose dolphin stock area extends from 84°W longitude to Key West, Florida. The region is temperate to subtropical in climate, is bordered by a mixture of coastal marshes, sand beaches, marsh and mangrove islands, and has an intermediate level of freshwater input. It is bordered on the north by an extensive area of coastal marsh and marsh islands typical of Florida's Apalachee Bay. Dolphins belonging to this stock are all expected to be of the coastal ecotype (Vollmer 2011).

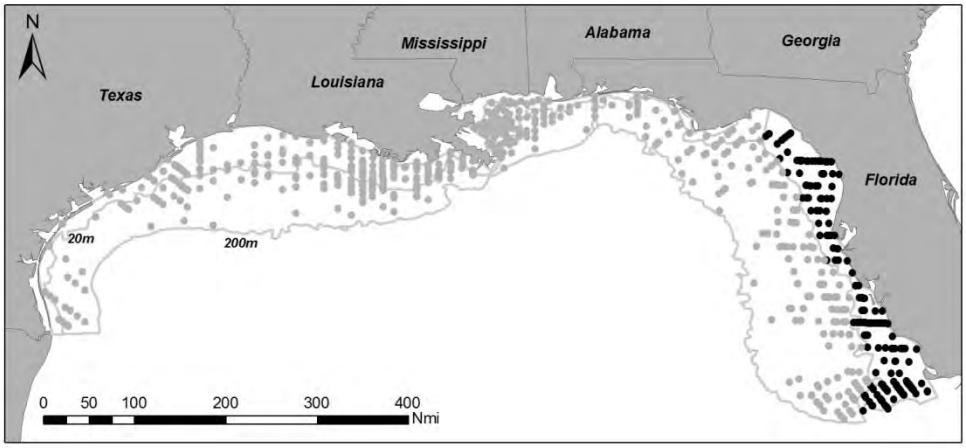

Figure 1. *Locations (circles) of common bottlenose dolphin groups sighted in coastal and continental shelf waters during aerial surveys conducted in spring, summer and fall of 2011 and in winter of 2012. Dark circles indicate groups within the boundaries of the Eastern Coastal Stock. The 20-m and 200-m isobaths are shown.*

This stock's boundaries abut other bottlenose dolphin stocks, namely the Continental Shelf Stock and several bay, sound and estuary stocks, and while individuals from different stocks may occasionally overlap, it is not thought that significant mixing or interbreeding occurs between them. Fazioli *et al.* (2006) conducted photo-identification surveys of coastal waters off Tampa Bay, Sarasota Bay and Lemon Bay, Florida, over 14 months. They found coastal waters were inhabited by both 'inshore' and 'Gulf' dolphins but that the 2 types used coastal waters differently. Dolphins from the inshore communities were observed occasionally in Gulf near-shore waters adjacent to their inshore range, whereas 'Gulf' dolphins were found primarily in open Gulf of Mexico waters with some displaying seasonal variations in their use of the study area. The 'Gulf' dolphins did not show a preference for waters near passes as was seen for 'inshore' dolphins, but moved throughout the study area and made greater use of waters offshore of waters used by 'inshore' dolphins. During winter months abundance of 'Gulf' groups decreased while abundance for 'inshore' groups increased. These findings support an earlier report by Irvine *et al.* (1981) of increased use of pass and coastal waters by Sarasota Bay dolphins in winter. Seasonal movements of identified individuals and abundance indices suggest that part of the 'Gulf" dolphin community moves out of the study area during winter, but their destination is unknown. In a follow-up study, Sellas *et al.* (2005) examined genetic population subdivision in the study area of Fazioli *et al.* (2006), and found evidence of significant population structure among all areas on the basis of both mitochondrial DNA control region sequence data and 9 nuclear microsatellite loci. The Sellas *et al.* (2005) findings support the separate identification of bay, sound and estuary stocks from those occurring in adjacent Gulf coastal waters, as suggested by Wells (1986).

Off Galveston, Texas, Beier (2001) reported an open population of individual dolphins in coastal waters, but several individual dolphins had been sighted previously by other researchers over a 10-year period. Some coastal animals may move relatively long distances alongshore. Two bottlenose dolphins previously seen in the South Padre Island area in Texas were seen in Matagorda Bay, 285km north, in May 1992 and May 1993 (Lynn and Würsig 2002).

POPULATION SIZE

The best abundance estimate available for the northern Gulf of Mexico Eastern Coastal Stock of bottlenose dolphins is 12,388 (CV=0.13; Table 1). This estimate is from an inverse-variance weighted average of seasonal abundance estimates from aerial surveys conducted during spring 2011, summer 2011, fall 2011 and winter 2012.

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions.

Recent surveys and abundance estimates

The Southeast Fisheries Science Center conducted aerial surveys of continental shelf waters (shoreline to 200 m depth) along the U.S. Gulf of Mexico coast from the Florida Keys to the Texas/Mexico border during spring (March-April) 2011, summer (July-August) 2011, fall (October-November) 2011 and winter (January-February) 2012. The surveys were conducted along tracklines oriented perpendicular to the shoreline and spaced 20-30 km apart. The total survey effort varied during each survey due to weather conditions, but ranged between 13,500 – 15,600 km. Each of these surveys was conducted using a two-team approach to develop estimates of visibility bias using the independent observer approach with Distance analysis (Laake and Borchers 2004). A model for the probability of detection on the trackline as a function of sighting conditions (sea state, glare, water color, etc.) was developed using data across all 4 surveys. This model was then applied to detection probability functions specific to each survey to account for the probability of detection as a function of distance from the trackline and additional environmental covariates. A bootstrap resampling approach was used to estimate the variance of the estimates. The survey data were post-stratified into spatial boundaries corresponding to the defined boundaries of bottlenose dolphin stocks within the surveyed area. The abundance estimates for the Eastern Coastal Stock of bottlenose dolphins were based upon tracklines and sightings in waters from the shoreline to the 20-m isobath and between 84°W longitude and the Florida Keys. The seasonal abundance estimates for this stock were: spring – 13,770 (CV=0.22), summer – 8,458 (CV=0.23), fall – 10,019 (CV=0.36) and winter – 16,669 (CV=0.25). Due to the uncertainty in stock movements and apparent seasonal variability in the abundance of the stock, a weighted average of these seasonal estimates was taken where the weighting was the inverse of the CV. This approach weights estimates with higher precision more heavily in the final weighted mean. The resulting weighted mean and best estimate of abundance for the Eastern Coastal Stock of bottlenose dolphins was 12,388 (CV=0.13).

Previous abundance estimates for the Northern and Eastern Coastal Stocks were derived from aerial surveys conducted during 17 July to 8 August 2007. Survey effort covered waters from the shoreline to 200 m depth and was stratified such that the majority of effort was expended in the 0-20m depth range of the coastal stocks. The survey team consisted of an observer stationed at each of two forward bubble windows and a third observer stationed at a belly window that monitored the trackline. Surveys were typically flown during favorable sighting conditions at Beaufort sea state less than or equal to 3 (surface winds <10 knots). Abundance estimates were derived using distance analysis including environmental covariates that had a significant influence on sighting probability (Buckland *et al.* 2001), but these estimates were not corrected for *g(0)* and are thus negatively biased. The resulting abundance estimate for the Eastern Coastal Stock was 7,702 animals (CV=0.19).

Table 1. Summary of recent abundance estimates for the Eastern Coastal Stock of bottlenose dolphins. Month, year and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
July-Aug 2007	shoreline to 20 m, Eastern Coastal Stock waters (84°W longitude to Florida Keys)	7,702	0.19
Spring, summer and fall 2011, winter 2012	shoreline to 20 m, Eastern Coastal Stock waters (84°W longitude to	12,388	0.13

	Florida Keys)		

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for the Eastern Coastal Stock of bottlenose dolphins is 12,388 (CV=0.13). The minimum population estimate for the northern Gulf of Mexico Eastern Coastal Stock is 11,110 bottlenose dolphins.

Current Population Trend

There are insufficient data to determine population trends for this stock. However the abundance estimates for summer 2007 (7,702; CV=0.19) and summer 2012 (8,458; CV=0.23) are similar.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate and a recovery factor (Wade and Angliss 1997). The minimum population size is 11,110. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because the stock is of unknown status. PBR for the northern Gulf of Mexico Eastern Coastal Stock of bottlenose dolphins is 111.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury of the Eastern Coastal Stock of bottlenose dolphins during 2008-2012 is unknown. During 2008-2012, 2 mortalities and 1 serious injury were documented involving the Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) fishery, and 1 mortality, 2 live releases without serious injury, and 1 live release in unknown condition were documented in trap/pot fisheries. In addition, a bottlenose dolphin observed at-sea entangled in crab-pot type line was considered seriously injured. It is not possible to estimate the total number of interactions or mortalities associated with hook and line or trap/pot fisheries since there are no systematic observer programs for those fisheries.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fisheries Information

The commercial fisheries which potentially could interact with the Eastern Coastal Stock in the northern Gulf of Mexico are the Category II Southeastern U.S. Atlantic, Gulf of Mexico shrimp trawl, Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot, and the Category III Southeastern U.S. Atlantic, Gulf of Mexico shark bottom longline/hook-and-line, FL spiny lobster trap/pot, Gulf of Mexico blue crab trap/pot, FL West Coast sardine purse seine and Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) fisheries (Appendix III). There have been no documented interactions between bottlenose dolphins of the Eastern Coastal Stock and the FL West Coast sardine purse seine fishery; however, it should be noted there is no observer coverage of the sardine purse seine fishery.

Hook and Line Fisheries

During 2008-2012, 2 mortalities and 1 serious injury involving hook and line gear entanglement or ingestion were documented. The mortalities occurred in 2009 and 2011. During 2010 an attempt was made to disentangle 1

live animal from hook and line gear and an anchor line, and this animal was considered seriously injured (Maze-Foley and Garrison in prep a). The mortality and live entanglement were included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 [for 2008-2011 data] and 15 April 2013 [for 2012 data]) and are included in the stranding totals presented in Table 2.

Blue and Stone Crab and Spiny Lobster Trap/Pot Fisheries

During 2008-2012, 4 entanglements associated with trap/pot fisheries were documented: 1 mortality, 2 live releases without serious injury, and 1 live release in unknown condition. In 2010, 2 dolphins belonging to the Eastern Coastal Stock were disentangled and released alive. One animal was entangled in probable stone crab trap gear and its condition upon release could not be determined (Maze-Foley and Garrison in prep a). The second animal was entangled in commercial stone crab trap gear and was released alive without serious injury (Maze-Foley and Garrison in prep a). Also during 2010, 1 mortality was documented in which an animal was entangled in unidentified commercial trap/pot gear. During 2008, another dolphin belonging to the Eastern Coastal Stock, reportedly half the size of an adult, was disentangled from a trap/pot line and released without serious injury (Maze-Foley and Garrison in prep a). The mortality and live entanglements were included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 and 15 April 2013) and are included in the stranding totals presented in Table 2. Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab traps/pots.

Shark Bottom Longline Fishery

During 2008-2012, no interactions between bottlenose dolphins and this fishery were observed. The shark bottom longline fishery has been observed since 1994, and 3 interactions with bottlenose dolphins have been recorded, 1 of which likely involved the Eastern Coastal Stock: in 1999, a hooked dolphin escaped at the vessel (Burgess and Morgan 2003). No interactions were observed during 2004-2012 (Hale and Carlson 2007; Hale *et al.* 2007; Richards 2007; Hale *et al.* 2009; 2010; 2011; 2012; Gulak *et al.* 2013). For the shark bottom longline fishery in the Gulf of Mexico, Richards (2007) estimated bottlenose dolphin mortalities of 58 (CV=0.99), 0 and 0 for 2003, 2004 and 2005, respectively.

Shrimp Trawl Fishery

During 2008-2012, no interactions between bottlenose dolphins of the Eastern Coastal Stock and the shrimp trawl fishery were observed. A voluntary observer program for the shrimp trawl fishery began in 1992 and became mandatory in 2007. A total of 5 bottlenose dolphin mortalities were observed during 2003, 2007, 2008, 2010 and 2011, and 1 serious injury was observed during 2012. These mortalities and serious injury likely belonged to the Western Coastal Stock, the Northern Coastal Stock, the Continental Shelf Stock and/or possibly bay, sound and estuary stocks. During 1992-2007 the observer program recorded an additional 6 unidentified dolphins caught in a lazy line or turtle excluder device, and 1 of these animals, a mortality in 2007, likely belonged to the Eastern Coastal Stock.

Strandings

A total of 61 bottlenose dolphins were found stranded in Eastern Coastal waters of the northern Gulf of Mexico from 2008 through 2012 (Table 2; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 and 15 April 2013). Evidence of human interactions (e.g., gear entanglement, mutilation, gunshot wounds) was detected for 8 of these dolphins, and included entanglement interactions with trap/pot and hook and line fishing gear (see Table 2). Bottlenose dolphins are known to become entangled in, or ingest recreational and commercial fishing gear (Wells and Scott 1994; Gorzelany 1998; Wells *et al.* 1998; Wells *et al.* 2008), and some are struck by vessels (Wells and Scott 1997; Wells *et al.* 2008).

There are a number of difficulties associated with the interpretation of stranding data. It is possible that some or all of the stranded dolphins may have been from a nearby bay, sound and estuary stock; however, the proportion of stranded dolphins belonging to another stock cannot be determined because of the difficulty of determining from where the stranded carcass originated. Stranding data probably underestimate the extent of human-related mortality and serious injury because not all of the dolphins that die or are seriously injured due to human interactions wash ashore, nor will all of those that do wash ashore necessarily show signs of fishery-interaction or other human interactions. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interaction, and the condition of the carcass if badly decomposed can inhibit the

interpretation of cause of death.

Since 1990, there have been 13 bottlenose dolphin die-offs or Unusual Mortality Events (UMEs) in the northern Gulf of Mexico, and 3 of these have occurred within the boundaries of the Eastern Coastal Stock and may have affected the stock. 1) From January through May 1990, a total of 367 bottlenose dolphins stranded in the northern Gulf of Mexico. Overall this represented a two-fold increase in the prior maximum recorded strandings for the same period, but in some locations (i.e., Alabama) strandings were 10 times the average number. The cause of the 1990 mortality event could not be determined (Hansen 1992). 2) An unusual mortality event was declared for Sarasota Bay, Florida, in 1991, but the cause was not determined. 3) In 2005, a particularly destructive red tide (*K. brevis*) bloom occurred off of central west Florida. Manatee, sea turtle, bird and fish mortalities were reported in the area in early 2005 and a manatee UME had been declared. Dolphin mortalities began to rise above the historical averages by late July 2005, continued to increase through October 2005, and were then declared to be part of a multi-species UME. The multi-species UME extended into 2006, and ended in November 2006. A total of 190 dolphins were involved, primarily bottlenose dolphins (plus strandings of 1 Atlantic spotted dolphin, *S. frontalis*, and 24 unidentified dolphins). The evidence suggests the effects of a red tide bloom contributed to the cause of this event.

An UME was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010; and, as of 2013, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010-2012, no animals from the Eastern Coastal Stock were considered to be part of this UME.

Table 2. Bottlenose dolphin strandings occurring in Eastern Coastal Stock waters of the northern Gulf of Mexico from 2008 to 2012, as well as number of strandings for which evidence of human interaction (HI) was detected and number of strandings for which it could not be determined (CBD) if there was evidence of HI. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 13 September 2012 [for 2008-2011 data] and 15 April 2013 [for 2012 data]). Please note human interaction does not necessarily mean the interaction caused the animal's death.

Stock	Category	2008	2009	2010	2011	2012	Total
Eastern Coastal Stock	Total Stranded	9	13	11	16	12	61
	Human Interaction						
	---Yes	2[a]	1[b]	4[c]	1[d]	0	8
	---No	1	5	1	1	1	9
	---CBD	6	7	6	14	11	44

[a] This total includes 1 animal disentangled and released alive without serious injury from crab trap/pot gear.
[b] This was an entanglement interaction with hook and line gear (mortality).
[c] This total includes 3 entanglement interactions with trap/pot gear (1 mortality and 2 animals released alive, 1 without serious injury and 1 that could not be determined if seriously injured or not) and 1 entanglement interaction with recreational hook and line gear (released alive seriously injured).
[d] This was an entanglement interaction with recreational hook and line gear (mortality).

Other Mortality

In addition to animals included in the stranding database, during 2008-2012, there was 1 at-sea observation in 2011 in the Eastern Coastal Stock area of a bottlenose dolphin entangled in crab-pot type line, and this dolphin was considered seriously injured (Maze-Foley and Garrison in prep a,b).

The problem of dolphin depredation of fishing gear is increasing in the Gulf of Mexico. To date, there are no records of depredation for this stock area however.

Feeding or provisioning of wild bottlenose dolphins has been documented in Florida, particularly near Panama City Beach in the Panhandle (Samuels and Bejder 2004) and south of Sarasota Bay (Cunningham-Smith *et al.* 2006; Powell and Wells 2011), and also in Texas near Corpus Christi (Bryant 1994). Feeding wild dolphins is defined under the MMPA as a form of 'take' because it can alter their natural behavior and increase their risk of injury or death. There are emerging questions regarding potential linkages between provisioning and depredation of recreational fishing gear and associated entanglement and ingestion of gear, which is increasing through much of Florida. During 2006, an estimated 2% of the long-term resident dolphins of Sarasota Bay, immediately inshore of the Eastern Coastal Stock, died from ingestion of recreational fishing gear (Powell and Wells 2011).

Swimming with wild bottlenose dolphins has also been documented in Florida, including Key West (Samuels and Engleby 2007) and Panama City Beach (Samuels and Bejder 2004), but to date, there are no records for this

stock area.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and over 87 days ~4.9 million barrels of oil were discharged from the wellhead until it was capped on 15 July 2010 (McNutt *et al.* 2012). During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011). Because the range of the Eastern Coastal Stock of bottlenose dolphins does not extend west of 84°W longitude, this stock is not thought to have experienced oil exposure due to the DWH event.

The nearshore habitat occupied by the 3 coastal stocks is adjacent to areas of high human population and in some areas, such as Tampa Bay, Florida, Galveston, Texas, and Mobile, Alabama, is highly industrialized. Concentrations of anthropogenic chemicals such PCBs and DDT and its metabolites vary from site to site, and can reach levels of concern for bottlenose dolphin health and reproduction in the southeastern U.S. (Schwacke *et al.* 2002). PCB concentrations in 3 stranded dolphins sampled from the Eastern Coastal Stock area ranged from 16-46µg/g wet weight. Two stranded dolphins from the Northern Coastal Stock area had the highest levels of DDT derivatives of any of the bottlenose dolphin liver samples analyzed in conjunction with a 1990 mortality investigation conducted by NMFS (Varanasi *et al.* 1992). The significance of these findings is unclear, but there is some evidence that increased exposure to anthropogenic compounds may reduce immune function in bottlenose dolphins (Lahvis *et al.* 1995), or impact reproduction through increased first-born calf mortality (Wells *et al.* 2005). Concentrations of chlorinated hydrocarbons and metals were relatively low in most of the bottlenose dolphins examined in conjunction with an anomalous mortality event in Texas bays in 1990; however, some had concentrations at levels of possible toxicological concern (Varanasi *et al.* 1992). Agricultural runoff following periods of high rainfall in 1992 was implicated in a high level of bottlenose dolphin mortalities in Matagorda Bay, which is adjacent to the Western Coastal Stock area (NMFS unpublished data).

STATUS OF STOCK

The bottlenose dolphin is not listed as threatened or endangered under the Endangered Species Act, and the Eastern Coastal Stock is not considered strategic under the MMPA. Total U.S. fishery-related mortality and serious injury for this stock is not known and there is insufficient information available to determine whether the total fishery-related mortality and serious injury is insignificant and approaching the zero mortality and serious injury rate. However, this is not a strategic stock because it is assumed that the average annual human-related mortality and serious injury does not exceed PBR. The status of this stock relative to OSP in the Gulf of Mexico EEZ is unknown. There are insufficient data to determine the population trends for this stock.

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Gulf of Mexico Western Coastal Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Common bottlenose dolphins inhabit coastal waters throughout the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) (Mullin *et al.* 1990). As a working hypothesis, it is assumed that the dolphins occupying habitats with dissimilar climatic, coastal and/or oceanographic characteristics might be restricted in their movements between habitats, and thus constitute separate stocks. Therefore, northern Gulf of Mexico coastal waters have been divided for management purposes into 3 stock areas: eastern, northern and western, with coastal waters defined as waters between the shore, barrier islands or presumed outer bay boundaries out to the 20-m isobath (Figure 1). The 20-m depth seaward boundary corresponds to survey strata (Scott 1990; Blaylock and Hoggard 1994; Fulling *et al.* 2003) and thus represents a management boundary rather than an ecological boundary. The Western Coastal bottlenose dolphin stock area extends from the Mississippi River Delta to the Texas-Mexico border. This region is characterized by an arid to temperate climate, sand beaches in southern Texas, extensive coastal marshes in northern Texas and Louisiana, and varying amounts of freshwater input. Dolphins belonging to this stock are all expected to be of the coastal ecotype (Vollmer 2011). The Western Coastal Stock is trans-boundary with Mexico; however, there is no information available for abundance estimation, nor for estimating fishery-related mortality in Mexican waters.

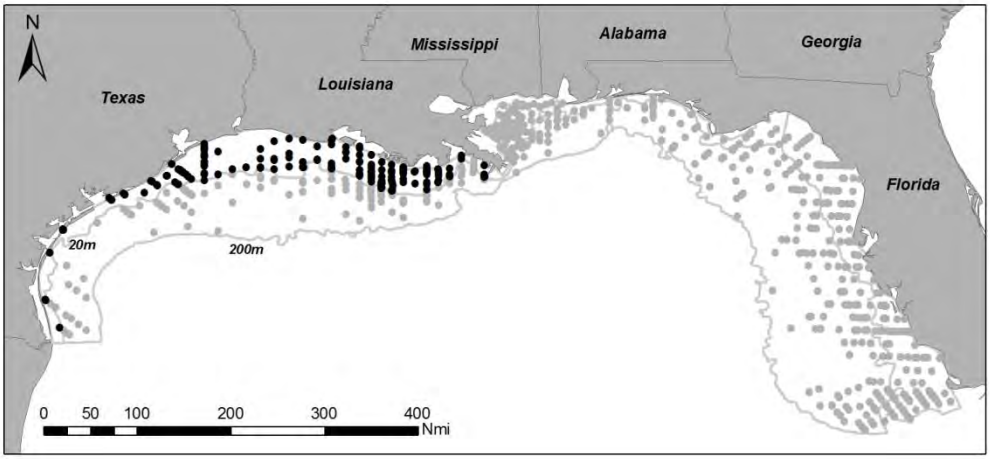

Figure 1. *Locations (circles) of common bottlenose dolphin groups sighted in coastal and continental shelf waters during aerial surveys conducted in spring, summer and fall of 2011 and in winter of 2012. Dark circles indicate groups within the boundaries of the Western Coastal Stock. The 20-m and 200-m isobaths are shown.*

This stock's boundaries abut other bottlenose dolphin stocks, namely the Continental Shelf stock and several bay, sound and estuary stocks, and while individuals from different stocks may occasionally overlap, it is not thought that significant mixing or interbreeding occurs between them. Fazioli *et al.* (2006) conducted photo-identification surveys of coastal waters off Tampa Bay, Sarasota Bay and Lemon Bay, Florida, over 14 months. They found coastal waters were inhabited by both 'inshore' and 'Gulf' dolphins but that the 2 types used coastal waters differently. Dolphins from the inshore communities were observed occasionally in Gulf near-shore waters adjacent to their inshore range, whereas 'Gulf' dolphins were found primarily in open Gulf of Mexico waters with some displaying seasonal variations in their use of the study area. The 'Gulf' dolphins did not show a preference for waters near passes as was seen for 'inshore' dolphins, but moved throughout the study area and made greater use of waters offshore of waters used by 'inshore' dolphins. During winter months abundance of 'Gulf' groups decreased while abundance for 'inshore' groups increased. These findings support an earlier report by Irvine *et al.* (1981) of increased use of pass and coastal waters by Sarasota Bay dolphins in winter. Seasonal movements of identified individuals and abundance indices suggest that part of the 'Gulf" dolphin community moves out of the study area during winter, but their destination is unknown. In a follow-up study, Sellas *et al.* (2005) examined genetic population subdivision in the study area of Fazioli *et al.* (2006), and found evidence of significant population structure among all areas on the basis of both mitochondrial DNA control region sequence data and 9 nuclear microsatellite loci. The Sellas *et al.* (2005) findings support the separate identification of bay, sound and estuary stocks from those occurring in adjacent Gulf coastal waters, as suggested by

Wells (1986).

Off Galveston, Texas, Beier (2001) reported an open population of individual dolphins in coastal waters, but several individual dolphins had been sighted previously by other researchers over a 10-year period. Some coastal animals may move relatively long distances alongshore. Two bottlenose dolphins previously seen in the South Padre Island area in Texas were seen in Matagorda Bay, 285km north, in May 1992 and May 1993 (Lynn and Würsig 2002).

POPULATION SIZE

The best abundance estimate available for the northern Gulf of Mexico Western Coastal Stock of bottlenose dolphins is 20,161 (CV=0.17; Table 1). This estimate is from an inverse-variance weighted average of seasonal abundance estimates from aerial surveys conducted during spring 2011, summer 2011, fall 2011 and winter 2012.

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions.

Recent surveys and abundance estimates

The Southeast Fisheries Science Center conducted aerial surveys of continental shelf waters (shoreline to 200 m depth) along the U.S. Gulf of Mexico coast from the Florida Keys to the Texas/Mexico border during spring (March-April) 2011, summer (July-August) 2011, fall (October-November) 2011 and winter (January-February) 2012. The surveys were conducted along tracklines oriented perpendicular to the shoreline and spaced 20-30 km apart. The total survey effort varied during each survey due to weather conditions, but ranged between 13,500 – 15,600 km. Each of these surveys was conducted using a two-team approach to develop estimates of visibility bias using the independent observer approach with Distance analysis (Laake and Borchers 2004). A model for the probability of detection on the trackline as a function of sighting conditions (sea state, glare, water color, etc.) was developed using data across all 4 surveys. This model was then applied to detection probability functions specific to each survey to account for the probability of detection as a function of distance from the trackline and additional environmental covariates. A bootstrap resampling approach was used to estimate the variance of the estimates. The survey data were post-stratified into spatial boundaries corresponding to the defined boundaries of bottlenose dolphin stocks within the surveyed area. The abundance estimates for the Western Coastal Stock of bottlenose dolphins were based upon tracklines and sightings in waters from the shoreline to the 20-m isobath and between the Texas-Mexico border and the Mississippi River Delta. The seasonal abundance estimates for this stock were: spring – 6,047 (CV=0.60), summer – 32,987 (CV=0.28), fall – 12,150 (CV=0.23) and winter – 24,139 (CV=0.33). Due to the uncertainty in stock movements and apparent seasonal variability in the abundance of the stock, a weighted average of these seasonal estimates was taken where the weighting was the inverse of the CV. This approach weights estimates with higher precision more heavily in the final weighted mean. The resulting weighted mean and best estimate of abundance for the Western Coastal Stock of bottlenose dolphins was 20,161 (CV=0.17).

Table 1. Summary of recent abundance estimates for the Western Coastal Stock of bottlenose dolphins. Month, year and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Spring, summer and fall 2011, winter 2012	shoreline to 20 m, Western Coastal Stock waters (Texas/Mexico border to Mississippi River Delta)	20,161	0.17

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for the Western Coastal Stock of bottlenose dolphins is 20,161 (CV=0.17). Therefore, the minimum population estimate for the northern Gulf of Mexico Western Coastal Stock is 17,491.

Current Population Trend

There are insufficient data to determine population trends for this stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate and a recovery factor (Wade and Angliss 1997). The minimum population size is 17,491. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because the stock is of unknown status. PBR for the northern Gulf of Mexico Western Coastal Stock of bottlenose dolphins is 175.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury of the Western Coastal Stock of bottlenose dolphins during 2008-2012 is unknown. During 2008-2012, 2 mortalities were documented involving the Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) fishery, and 1 mortality was observed in the Southeastern U.S. Atlantic, Gulf of Mexico shrimp trawl fishery. It is not possible to estimate the total number of interactions or mortalities associated with the hook and line fishery since there is no systematic observer program.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fisheries Information

The commercial fisheries which potentially could interact with the Western Coastal Stock in the northern Gulf of Mexico are the Category II Southeastern U.S. Atlantic, Gulf of Mexico shrimp trawl, Gulf of Mexico menhaden purse seine, Gulf of Mexico gillnet, and the Category III Gulf of Mexico blue crab trap/pot, and Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) fisheries (Appendix III).

Hook and Line Fisheries

During 2008-2012, 2 mortalities involving hook and line gear entanglement or ingestion were documented for the Western Coastal Stock. The mortalities occurred in 2012 and 2010. The mortalities were included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 [for 2008-2011 data] and 15 April 2013 [for 2012 data]) and are included in the stranding totals presented in Table 2.

Shrimp Trawl Fishery

During 2008-2012, 1 interaction (2010 mortality) between a bottlenose dolphin of the Western Coastal Stock and the shrimp trawl fishery was observed. In addition, 1 animal released alive without serious injury (in 2009) may have belonged to the Western Coastal Stock. A voluntary observer program for the shrimp trawl fishery began in 1992 and became mandatory in 2007. A total of 5 bottlenose dolphin mortalities were observed in the shrimp trawl fishery during 2003, 2007, 2008, 2010 and 2011, and 1 serious injury was observed during 2012. The 2007 and 2010 mortalities occurred off the Louisiana coast and both likely belonged to the Western Coastal Stock. During 2009, 1 bottlenose dolphin was released alive without serious injury after becoming entangled in the lazy line of a shrimp trawl. This animal could have belonged to the Continental Shelf Stock or the Western Coastal Stock.

Blue Crab Trap/Pot Fishery

During 2008-2012, 1 live release without serious injury (Maze-Foley and Garrison in prep a,b) was documented in association with crab trap/pot fisheries. In 2008, a dolphin likely belonging to the Western Coastal Stock was disentangled from crab trap gear in Texas by a concerned citizen and swam away with no reported injuries (NOAA

National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 and 15 April 2013). Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab traps/pots.

Menhaden Purse Seine Fishery

During 2008-2012, 2 live releases without serious injury were documented for the Western Coastal Stock and the menhaden purse seine fishery.

There is currently no observer program for the Gulf of Mexico menhaden purse seine fishery; however, recent interactions with bottlenose dolphins have been reported via two sources. First, during 2011, a pilot observer program operated from May through September, and observers documented 3 dolphins trapped within purse seine nets. All 3 were released alive without serious injury (Maze-Foley and Garrison in prep a). Two of the 3 dolphins were trapped within a single purse seine within waters of the Western Coastal Stock. The third animal was trapped in waters of the Mississippi Sound, Lake Borgne, Bay Boudreau Stock. Second, through the Marine Mammal Authorization Program (MMAP), there have been 13 self-reported incidental takes (all mortalities) of bottlenose dolphins in northern Gulf of Mexico coastal and estuarine waters by the menhaden purse seine fishery during 2000-2012. These takes likely affected the following stocks: Western Coastal Stock; Northern Coastal Stock; Mississippi Sound, Lake Borgne, Bay Boudreau Stock; and Mississippi River Delta Stock. Specific self-reported takes under the MMAP likely involving the Western Coastal Stock are as follows: two takes of single bottlenose dolphins were reported in Louisiana waters during 2005 (1 of the animals may have been dead prior to capture); and during 2000, one take of a single bottlenose dolphin was reported in Louisiana waters.

The menhaden purse seine fishery was observed to take 9 bottlenose dolphins (3 fatally) between 1992 and 1995 (NMFS unpublished data). During that period, there were 1,366 sets observed out of 26,097 total sets, which if extrapolated for all years suggests that as many as 172 bottlenose dolphins could have been taken in this fishery with up to 57 animals killed.

Without an ongoing observer program it is not possible to obtain statistically reliable information for this fishery on the number of sets annually, the incidental take and mortality rates, and the communities from which bottlenose dolphins are being taken.

Gillnet Fishery

No marine mammal mortalities associated with U.S. gillnet fisheries have been reported for the Western Coastal Stock, but stranding data suggest that gillnet and marine mammal interactions do occur, causing mortality and serious injury. During 2011 enforcement officers found a dead bottlenose dolphin entangled in a Mexican gillnet that had been illegally set in U.S. waters. This mortality, attributed to the Western Coastal Stock, was included in the stranding data in Table 2 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 and 15 April 2013).

Strandings

A total of 712 bottlenose dolphins were found stranded in Western Coastal Stock waters of the northern Gulf of Mexico from 2008 through 2012 (Table 2; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 and 15 April 2013). Evidence of human interactions was detected for 31 of these stranded dolphins. Human interactions were from numerous sources, including 14 animals that stranded with visible, external oil (in Louisiana) and 5 entanglement interactions with various types of fishing gear (see Table 2 for details). Bottlenose dolphins are known to become entangled in, or ingest recreational and commercial fishing gear (Wells and Scott 1994; Gorzelany 1998; Wells *et al.* 1998; Wells *et al.* 2008), and some are struck by vessels (Wells and Scott 1997; Wells *et al.* 2008).

There are a number of difficulties associated with the interpretation of stranding data. It is possible that some or all of the stranded dolphins may have been from a nearby bay, sound and estuary stock; however, the proportion of stranded dolphins belonging to another stock cannot be determined because of the difficulty of determining from where the stranded carcass originated. Stranding data probably underestimate the extent of human-related mortality and serious injury because not all of the dolphins that die or are seriously injured due to human interactions wash ashore, nor will all of those that do wash ashore necessarily show signs of fishery-interaction or other human interactions. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interaction, and the condition of the carcass if badly decomposed can inhibit the interpretation of cause of death.

Since 1990, there have been 13 bottlenose dolphin die-offs or Unusual Mortality Events (UMEs) in the northern Gulf of Mexico, and 7 of these have occurred within the boundaries of the Western Coastal Stock and may have

affected the stock. 1) From January through May 1990, a total of 367 bottlenose dolphins stranded in the northern Gulf of Mexico. Overall this represented a two-fold increase in the prior maximum recorded strandings for the same period, but in some locations (i.e., Alabama) strandings were 10 times the average number. The cause of the 1990 mortality event could not be determined (Hansen 1992). 2) In March and April 1992, 111 bottlenose dolphins stranded in Texas, about 9 times the average number. The cause of this event was not determined, but carbamates were a suspected cause. 3) In 1993-1994 an UME of bottlenose dolphins likely caused by morbillivirus started in the Florida Panhandle and spread west with most of the mortalities occurring in Texas (Lipscomb 1993; Lipscomb *et al.* 1994). From February through April 1994, 220 bottlenose dolphins were found dead on Texas beaches, of which 67 occurred in a single 10-day period. 4) During February and March of 2007 an event was declared for northeast Texas and western Louisiana involving 66 bottlenose dolphins. Decomposition prevented conclusive analyses on most carcasses. 5) During February and March of 2008 an additional event was declared in Texas involving 113 bottlenose dolphin strandings. Most of the animals recovered were in a decomposed state. The event has been closed, however, the investigation is ongoing. 6) An UME was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010; and, as of 2013, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, 46 animals from this stock were considered to be part of the UME, during 2011, 86 animals, and during 2012, 48 animals. 7) An UME occurred from November 2011 to March 2012 across 5 Texas counties including 123 bottlenose dolphin strandings. Ninety-six animals from this stock were considered to be part of the UME. The strandings were coincident with a harmful algal bloom of *K. brevis*, but researchers have not determined that was the cause of the event.

Table 2. Bottlenose dolphin strandings occurring in Western Coastal Stock waters of the northern Gulf of Mexico from 2008 to 2012, as well as number of strandings for which evidence of human interaction (HI) was detected and number of strandings for which it could not be determined (CBD) if there was evidence of HI. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 13 September 2012 [for 2008-2011 data] and 15 April 2013 [for 2012 data]). Please note HI does not necessarily mean the interaction caused the animal's death.

Stock	Category	2008	2009	2010	2011	2012	Total
Western Coastal Stock	Total Stranded	151[a]	100	136[b]	186[c]	139[d]	712
	Human Interaction						
	---Yes	1[e]	3	9[f]	11[g]	7[h]	31
	---No	29	5	15	11	9	69
	---CBD	121	92	112	164	123	612

[a] This total includes 95 animals that were part of an UME in Texas.
[b] This total includes 46 strandings that are part of the ongoing UME in the northern Gulf of Mexico.
[c] This total includes 86 strandings that are part of the ongoing UME in the northern Gulf of Mexico and 18 strandings that were part of the 2011-2012 Texas UME.
[d] This total includes 48 strandings that are part of the ongoing UME in the northern Gulf of Mexico and 78 strandings that were part of the 2011-2012 Texas UME.
[e] This animal was entangled in probable trap/pot gear and released alive without serious injury.
[f] This total includes 1 live animal visibly oiled and the following mortalities: 3 animals visibly oiled and 1 entanglement interaction with recreational hook and line gear.
[g] This total includes the following mortalities: 1 gunshot wound and unknown fishery interaction, 1 illegal gillnet take in foreign fishing gear, and 8 animals visibly oiled.
[h] This total includes the following mortalities: 2 animals visibly oiled and 1 entanglement interaction with hook and line gear.

Other Mortality

As part of its annual coastal dredging program, the Army Corps of Engineers conducts sea turtle relocation trawling during hopper dredging as a protective measure for marine turtles. Five incidents have been documented in the Gulf of Mexico involving bottlenose dolphins and relocation trawling activities. Four of the incidents were mortalities, and 1 occurred during each of the following years: 2003, 2005, 2006, and 2007. Based on the location of the interactions, it is likely 2 of these animals belonged to the Western Coastal Stock (2005, 2007) and 2 belonged to bay, sound and estuary stocks (2003, 2006). An additional incident occurred during 2006 in which the dolphin

became free during net retrieval and was observed swimming away normally. It is likely this animal belonged to a bay, sound and estuary stock. All of the mortalities were included in the stranding database and the 2 most recent are included in the appropriate stranding tables under "Yes" for Human Interaction.

The problem of dolphin depredation of fishing gear is increasing in the Gulf of Mexico. To date, there are no records of depredation for this stock area, however.

Feeding or provisioning of wild bottlenose dolphins has been documented in Florida, particularly near Panama City Beach in the Panhandle (Samuels and Bejder 2004) and south of Sarasota Bay (Cunningham-Smith *et al.* 2006; Powell and Wells 2011), and also in Texas near Corpus Christi (Bryant 1994). Feeding wild dolphins is defined under the MMPA as a form of 'take' because it can alter their natural behavior and increase their risk of injury or death. There are emerging questions regarding potential linkages between provisioning and depredation of recreational fishing gear and associated entanglement and ingestion of gear, which is increasing through much of Florida. During 2006, an estimated 2% of the long-term resident dolphins of Sarasota Bay died from ingestion of recreational fishing gear (Powell and Wells 2011).

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and over 87 days ~4.9 million barrels of oil were discharged from the wellhead until it was capped on 15 July 2010 (McNutt *et al.* 2012). During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Given the trajectory of the surface oil during the spill and the documented oiling of shoreline and marshes west of the Mississippi River (Michel *et al.* 2013), it is likely the Western Coastal Stock of bottlenose dolphins was exposed to oil during the event. A substantial number of beaches and wetlands along the Louisiana coast experienced heavy or moderate oiling (OSAT-2 2011; Michel *et al.* 2013). The heaviest oiling in Louisiana occurred west of the Mississippi River on the Mississippi Delta and in Barataria and Terrebonne Bays, and to the east of the river on the Chandeleur Islands. Some heavy to moderate oiling occurred on Alabama and Florida beaches, with the heaviest stretch occurring from Dauphin Island, Alabama, to Gulf Breeze, Florida. Light to trace oil was reported along the majority of Mississippi's mainland coast, from Gulf Breeze to Panama City, Florida, and outside of Atchafalaya and Vermilion Bays in western Louisiana. Heavy to light oiling occurred on Mississippi's barrier islands (Michel *et al.* 2013).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, continental shelf, coastal and estuarine marine mammals. The research is ongoing. For coastal and estuarine dolphins, the NOAA-led efforts include: active surveillance to detect stranded animals in remote locations; aerial surveys to document the distribution, abundance, species and exposure of marine mammals and sea turtles relative to oil from DWH spill; assessment of sublethal and chronic health impacts on coastal and estuarine bottlenose dolphins in Barataria Bay, Louisiana, and a reference site in Sarasota Bay, Florida; and assessment of injuries to dolphin stocks in Barataria Bay and Chandeleur Sound, Louisiana, Mississippi Sound, and as a reference site, St. Joseph Bay, Florida.

Dolphins were observed with tar balls attached to them and seen swimming through oil slicks close to shore and inland bays. The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990).

The nearshore habitat occupied by the 3 coastal stocks is adjacent to areas of high human population and in

some areas, such as Tampa Bay, Florida, Galveston, Texas, and Mobile, Alabama, is highly industrialized. Concentrations of anthropogenic chemicals such PCBs and DDT and its metabolites vary from site to site, and can reach levels of concern for bottlenose dolphin health and reproduction in the southeastern U.S. (Schwacke *et al.* 2002). PCB concentrations in 3 stranded dolphins sampled from the Eastern Coastal Stock area ranged from 16-46µg/g wet weight. Two stranded dolphins from the Northern Coastal Stock area had the highest levels of DDT derivatives of any of the bottlenose dolphin liver samples analyzed in conjunction with a 1990 mortality investigation conducted by NMFS (Varanasi *et al.* 1992). The significance of these findings is unclear, but there is some evidence that increased exposure to anthropogenic compounds may reduce immune function in bottlenose dolphins (Lahvis *et al.* 1995), or impact reproduction through increased first-born calf mortality (Wells *et al.* 2005). Concentrations of chlorinated hydrocarbons and metals were relatively low in most of the bottlenose dolphins examined in conjunction with an anomalous mortality event in Texas bays in 1990; however, some had concentrations at levels of possible toxicological concern (Varanasi *et al.* 1992). Agricultural runoff following periods of high rainfall in 1992 was implicated in a high level of bottlenose dolphin mortalities in Matagorda Bay, which is adjacent to the Western Coastal Stock area (NMFS unpublished data).

The Mississippi River, which drains about two-thirds of the continental U.S., flows into the north-central Gulf of Mexico and deposits its nutrient load which is linked to the formation of one of the world's largest areas of seasonal hypoxia (Rabalais *et al.* 1999). This area is located in Louisiana coastal waters west of the Mississippi River delta. How it affects bottlenose dolphins is not known.

STATUS OF STOCK

The bottlenose dolphin is not listed as threatened or endangered under the Endangered Species Act. However, because an UME of unprecedented size and duration (began 1 February 2010 and is ongoing) has impacted the Western Coastal Stock area, NMFS considers this to be a strategic stock under the MMPA. Total U.S. fishery-related mortality and serious injury for this stock is not known and there is insufficient information available to determine whether the total fishery-related mortality and serious injury is insignificant and approaching the zero mortality and serious injury rate. The status of this stock relative to OSP in the Gulf of Mexico EEZ is unknown. There are insufficient data to determine the population trends for this stock.

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Northern Gulf of Mexico Continental Shelf Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) Continental Shelf Stock of common bottlenose dolphins inhabits waters from 20 to 200 m deep in the northern Gulf from the U.S.-Mexican border to the Florida Keys (Figure 1). Genetically distinct "coastal" and "offshore" ecotypes of bottlenose dolphins (Hoelzel *et al.* 1998; Vollmer 2011) occur in the Gulf of Mexico, and the Continental Shelf Stock, while predominantly of the coastal ecotype, may also include dolphins of the offshore ecotype (Vollmer 2011). The Continental Shelf Stock range may extend into Mexican and Cuban territorial waters; for example, a stranded dolphin from the Florida Panhandle was rehabilitated and released over the shelf off western Florida and traveled into the Atlantic Ocean (Wells *et al.* 1999). However, there are no available estimates of either abundance or mortality from Mexico or Cuba to incorporate in this assessment.

This stock's boundaries abut other bottlenose dolphin stocks, namely the Oceanic Stock and the three coastal stocks. While individuals from different stocks may occasionally overlap, the degree of overlap is unknown and it is not thought that significant mixing or interbreeding occurs between them. Genetic studies have shown significant differentiation between inshore stocks and the adjacent coastal stock (Sellas *et al.* 2005) and among dolphins living in coastal and shelf waters (Vollmer 2011). These results suggest that if there is spatial overlap there may be mechanisms reducing interbreeding between the stocks. Overall, stock structure of bottlenose dolphins in the northern Gulf of Mexico is complex and has not been fully examined. Continued studies are necessary to examine the current stock boundaries delineated in coastal, shelf and oceanic waters. As research is completed, it may be necessary to revise stocks of bottlenose dolphins in the northern Gulf of Mexico.

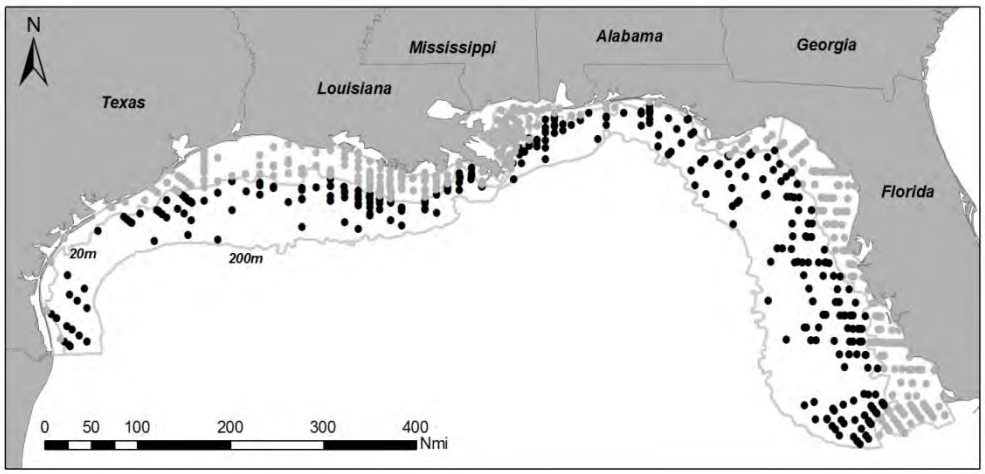

Figure 1. *Locations (circles) of common bottlenose dolphin groups sighted in coastal and continental shelf waters during aerial surveys conducted in spring, summer and fall of 2011 and in winter of 2012. Dark circles indicate groups within the boundaries of the Continental Shelf Stock. The 20-m and 200-m isobaths are shown.*

POPULATION SIZE

The best abundance estimate available for the northern Gulf of Mexico Continental Shelf Stock of bottlenose dolphins is 51,192 (CV=0.10; Table 1). This estimate is from an inverse-variance weighted average of seasonal abundance estimates from aerial surveys conducted during spring 2011, summer 2011, fall 2011 and winter 2012.

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions.

Recent survey and abundance estimate

The Southeast Fisheries Science Center conducted aerial surveys of continental shelf waters (shoreline to 200 m

depth) along the U.S. Gulf of Mexico coast from the Florida Keys to the Texas/Mexico border during spring (March-April) 2011, summer (July-August) 2011, fall (October-November) 2011 and winter (January-February) 2012. The surveys were conducted along tracklines oriented perpendicular to the shoreline and spaced 20-30 km apart. The total survey effort varied during each survey due to weather conditions, but ranged between 13,500 – 15,600 km. Each of these surveys was conducted using a two-team approach to develop estimates of visibility bias using the independent observer approach with Distance analysis (Laake and Borchers 2004). A model for the probability of detection on the trackline as a function of sighting conditions (seas state, glare, water color, etc.) was developed using data across all four surveys. This model was then applied to detection probability functions specific to each survey to account for the probability of detection as a function of distance from the trackline and additional environmental covariates. A bootstrap resampling approach was used to estimate the variance of the estimates. The survey data were post-stratified into spatial boundaries corresponding to the defined boundaries of bottlenose dolphin stocks within the surveyed area. The abundance estimates for the Continental Shelf Stock of bottlenose dolphins were based upon tracklines and sightings in waters from the 20-m to the 200-m isobaths and between the Texas-Mexico border and the Florida Keys. The seasonal abundance estimates for this stock were: spring – 45,171 (CV=0.22), summer – 64,583 (CV=0.16), fall – 34,181 (CV=0.20) and winter – 58,561 (CV=0.25). Due to the uncertainty in stock movements and apparent seasonal variability in the abundance of the stock, a weighted average of these seasonal estimates was taken where the weighting was the inverse of the CV. This approach weights estimates with higher precision more heavily in the final weighted mean. The resulting weighted mean and best estimate of abundance for the Western Coastal Stock of bottlenose dolphins was 51,192 (CV=0.10).

Table 1. Summary of recent abundance estimates for the northern Gulf of Mexico Continental Shelf Stock of bottlenose dolphins. Month, year and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Season/Year	Area	N_{best}	CV
Spring, summer and fall 2011, winter 2012	Continental Shelf waters, 20-200 m	51,192	0.10

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for bottlenose dolphins is 51,192 (CV=0.10). The minimum population estimate for the northern Gulf of Mexico is 46,926.

Current Population Trend

There are insufficient data to determine the population trends for this species because of methodological differences in the surveys over time.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one half the maximum net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 46,926. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because the stock is of unknown status. PBR for the Gulf of Mexico Continental Shelf Stock of bottlenose dolphins is 469.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury within the Continental Shelf Stock during 2008-2012 is unknown. During 2008-2012, 1 mortality and 1 serious injury were observed in the Southeastern U.S. Atlantic, Gulf of Mexico, Caribbean snapper-grouper and other reef fish fishery, and 2 mortalities and 1 serious injury were observed in the Southeastern U.S. Atlantic, Gulf of Mexico shrimp trawl fishery. One mortality occurred

during 2010 incidental to oil rig platform removal operations when an animal became entangled in line and drowned. In addition, in 2010, 1 serious injury was observed that likely involved the Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) fishery.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fisheries Information

The commercial fisheries which potentially could interact with this stock in the Gulf of Mexico are: the Category II Southeastern U.S. Atlantic, Gulf of Mexico shrimp trawl fishery; and the Category III Southeastern U.S. Atlantic, Gulf of Mexico shark bottom longline/hook-and-line fishery; Southeastern U.S. Atlantic, Gulf of Mexico, Caribbean snapper-grouper and other reef fish fishery; Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) fishery; and the Gulf of Mexico butterfish trawl fishery (Appendix III). The level of past or current, direct, human-caused mortality of bottlenose dolphins in the northern Gulf of Mexico is unknown; however, interactions between bottlenose dolphins and fisheries have been observed in the northern Gulf of Mexico.

Reef Fish Fishery

During 2008-2012, 1 mortality and 1 serious injury were observed in the snapper-grouper and other reef fish fishery. During 2012 a mortality occurred when a dolphin was entangled in the mainline of bottom longline gear. During 2010 a serious injury occurred in which a bottlenose dolphin was hooked in the rostrum and line was wrapped around the rostrum (Maze-Foley and Garrison in prep a). Both animals were likely from the Continental Shelf Stock, and both incidents occurred off Florida's west coast.

Shrimp and Butterfish Trawl Fisheries

During 2008-2012, 2 mortalities and 1 serious injury were observed in the shrimp trawl fishery that can be ascribed to this stock. A voluntary observer program for the shrimp trawl fishery began in 1992 and became mandatory in 2007. A total of 5 bottlenose dolphin mortalities were observed in the shrimp trawl fishery during 2003, 2007, 2008, 2010 and 2011, and 1 bottlenose dolphin was observed to be seriously injured during 2012. The 2008 and 2011 mortalities as well as the 2012 serious injury likely belonged to the Continental Shelf Stock. During 2009, 1 bottlenose dolphin was released alive presumably with no serious injury after becoming entangled in the lazy line of a shrimp trawl. This animal could have belonged to the Continental Shelf Stock or the Western Coastal Stock. During 1992-2007 the observer program recorded an additional 6 unidentified dolphins caught in a lazy line or turtle excluder device, and it is likely that 3-4 of the animals belonged to the Continental Shelf Stock or the Atlantic spotted dolphin (*Stenella frontalis*) stock. For 2 of these cases, the observer report indicated the animal may have already been decomposed, but this could not be confirmed because there was no necropsy in either case. In addition, in 2008 a dolphin carcass was caught on the tickler chain of a shrimp trawl; however, the animal's carcass was severely decomposed and may have been captured in this state. It is likely the unidentified carcass belonged to the bottlenose dolphin Continental Shelf Stock or the Atlantic spotted dolphin stock.

A trawl fishery for butterfish was monitored by NMFS observers for a short period in the 1980's with no records of incidental take of marine mammals (Burn and Scott 1988; NMFS unpublished data), although an experimental set by NMFS resulted in the death of 2 bottlenose dolphins (Burn and Scott 1988). There are no other data available.

Shark Bottom Longline Fishery

The shark bottom longline fishery has been observed since 1994. No interactions between bottlenose dolphins and this fishery were observed during 2004-2012 (Hale and Carlson 2007; Hale *et al.* 2007; Richards 2007; Hale *et al.* 2009; 2010; 2011; 2012; Gulak *et al.* 2013). The shark bottom longline fishery has been observed since 1994, and 3 interactions with bottlenose dolphins have been recorded, 2 of which likely involved the Continental Shelf Stock: 1 mortality (2003) and 1 hooked animal that escaped at the vessel (2002; Burgess and Morgan 2003). For the shark bottom longline fishery in the Gulf of Mexico, Richards (2007) estimated bottlenose dolphin mortalities of 58 (CV=0.99), 0 and 0 for 2003, 2004 and 2005, respectively.

Other Mortality

During 2008-2012, there was 1 at-sea observation in 2010 in the Continental Shelf Stock area of a bottlenose dolphin entangled in monofilament line and hooks, and this dolphin was considered seriously injured (Maze-Foley and Garrison in prep a,b).

The use of explosives to remove oil rigs in portions of the continental shelf in the western Gulf of Mexico has the potential to cause serious injury or mortality to marine mammals. These activities have been closely monitored by NMFS observers since 1987 (Gitschlag and Herczeg 1994). There had been no reports of either serious injury or mortality to bottlenose dolphins until 2010 (NMFS unpublished data). One mortality occurred during 2010 when a bottlenose dolphin became entangled in a diver's guide line during platform removal operations. A diver discovered the dolphin at a depth of 25.9m and reported it to be motionless and unresponsive with both tail flukes caught in poly guide line, which was being used to transfer equipment to the sea floor. No explosives were involved in this incident.

A total of 1,703 bottlenose dolphins were found stranded in the northern Gulf of Mexico from 2008 through 2012 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 [for 2008-2011 data] and 15 April 2013 [for 2012 data]). Of these, 141 showed evidence of human interactions (e.g., gear entanglement, mutilation, gunshot wounds). Bottlenose dolphins are known to become entangled in, or ingest recreational and commercial fishing gear (Wells and Scott 1994; Wells *et al.* 1998; Gorzelany 1998), and some are struck by vessels (Wells and Scott 1997). The vast majority of stranded bottlenose dolphins are assumed to come from stocks that live nearest to land, namely the bay, sound and estuary stocks and the three coastal stocks. Nevertheless, it is possible that some of the stranded bottlenose dolphins belonged to the Continental Shelf or Oceanic Stocks and that they were among those strandings with evidence of human interactions. (Strandings do occur for other cetacean species whose primary range in the Gulf of Mexico is outer continental shelf or oceanic waters.)

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010; and, as of 2013, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, 221 bottlenose dolphins were considered to be part of the UME; during 2011, 320 bottlenose dolphins, and during 2012, 151 bottlenose dolphins. The vast majority of stranded bottlenose dolphins are assumed to belong to one of the coastal stocks or to bay, sound and estuary stocks. Nevertheless, it is possible that some of the stranded bottlenose dolphins considered part of the UME belonged to the Continental Shelf Stock.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and over 87 days ~4.9 million barrels of oil were discharged from the wellhead until it was capped on 15 July 2010 (McNutt *et al.* 2012). During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, continental shelf, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. For continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters. Given the location of the well head and the trajectory of the surface oil during the spill, it is likely the Continental Shelf Stock of bottlenose dolphins was exposed to oil during the event. The effects of oil exposure on marine mammals depend on a number of factors

including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990).

STATUS OF STOCK

Bottlenose dolphins are not listed as threatened or endangered under the Endangered Species Act, and the northern Gulf of Mexico Continental Shelf Stock is not considered strategic under the MMPA. Total U.S. fishery-related mortality and serious injury for this stock is not known, but is likely to be less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. The status of bottlenose dolphins, relative to OSP, in the northern Gulf of Mexico continental shelf waters is unknown. There are insufficient data to determine population trends for this stock.

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Northern Gulf of Mexico Bay, Sound, and Estuary Stocks

NOTE – NMFS is in the process of writing individual stock assessment reports for each of the 31 bay, sound and estuary stocks of common bottlenose dolphins that are included in this report. Until this effort is completed and this report is replaced by 31 individual reports, basic information for all individual bay, sound and estuary stocks will remain in this report: "Northern Gulf of Mexico Bay, Sound and Estuary Stocks". Twenty-seven stocks are assessed in this report.

STOCK DEFINITION AND GEOGRAPHIC RANGE

Common bottlenose dolphins are distributed throughout the bays, sound and estuaries of the Gulf of Mexico (Mullin 1988). The identification of biologically-meaningful "stocks" of bottlenose dolphins in these waters is complicated by the high degree of behavioral variability exhibited by this species (Shane *et al.* 1986; Wells and Scott 1999; Wells 2003), and by the lack of requisite information for much of the region.

Distinct stocks are delineated in each of 31 areas of contiguous, enclosed or semi-enclosed bodies of water adjacent to the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico; Table 1). The genesis of the delineation of these stocks was work initiated in the 1970s in Sarasota Bay, Florida (Irvine *et al.* 1981), and in bays in Texas (Shane 1977; Gruber 1981). These studies documented year-round residency of individual bottlenose dolphins in estuarine waters. As a result, the expectation of year-round resident populations was extended to bay, sound and estuary waters across the northern Gulf of Mexico when the first stock assessment reports were established in 1995. Since these early studies, long-term (year-round, multi-year) residency has been reported from nearly every site where photographic identification (photo-ID) or tagging studies have been conducted in the Gulf of Mexico. In Texas, some of the dolphins in the Matagorda-Espiritu Santo Bay area (Gruber 1981; Lynn and Würsig 2002), Aransas Pass (Shane 1977; Weller 1998), San Luis Pass (Maze and Würsig 1999; Irwin and Würsig 2004), and Galveston Bay (Bräger 1993; Bräger *et al.* 1994; Fertl 1994) have been reported as long-term residents. In Louisiana, Miller (2003) concluded the bottlenose dolphin population in the Barataria Basin was relatively closed. Hubard *et al.* (2004) reported sightings of dolphins tagged 12-15 years previously in Mississippi Sound. In Florida, long-term residency has been reported from Choctawhatchee Bay (1989-1993; F. Townsend, unpublished data), Tampa Bay (Wells 1986; Wells *et al.* 1996b; Urian *et al.* 2009), Sarasota Bay (Irvine and Wells 1972; Irvine *et al.* 1981; Wells 1986; Wells *et al.* 1987; Scott *et al.* 1990; Wells 1991; 2003), Lemon Bay (Wells *et al.* 1996a), Charlotte Harbor/Pine Island Sound (Shane 1990; Wells *et al.* 1996a; Wells *et al.* 1997; Shane 2004; Bassos-Hull *et al.* 2013) and southwest Florida (Lemon Bay, Gasparilla Sound, Charlotte Harbor and Pine Island Sound; Bassos-Hull *et al.* 2013). In Sarasota Bay, which has the longest research history, at least 5 concurrent generations of identifiable residents have been identified, including some of those first identified in 1970. Maximum immigration and emigration rates of about 2-3% have been estimated (Wells and Scott 1990).

Genetic data also support the concept of relatively discrete bay, sound and estuary stocks. Analyses of mitochondrial DNA haplotype distributions indicate the existence of clinal variations along the Gulf of Mexico coastline (Duffield and Wells 2002). Differences in reproductive seasonality from site to site also suggest genetic-based distinctions between communities (Urian *et al.* 1996). Mitochondrial DNA analyses suggest finer-scale structural levels as well. For example, Matagorda Bay, Texas, dolphins appear to be a localized population, and differences in haplotype frequencies distinguish between adjacent communities in Tampa Bay, Sarasota Bay and Charlotte Harbor/Pine Island Sound, along the central west coast of Florida (Duffield and Wells 1991; 2002). Examination of protein electrophoretic data resulted in similar conclusions for the Florida dolphins (Duffield and Wells 1986). Additionally, Sellas *et al.* (2005) examined population subdivision among dolphins sampled in Sarasota Bay, Tampa Bay, Charlotte Harbor, Matagorda Bay, and the coastal Gulf of Mexico (1 – 12 km offshore) from just outside Tampa Bay to the south end of Lemon Bay, and found evidence of significant population structure among all areas on the basis of both mitochondrial DNA control region sequence data and 9 nuclear microsatellite loci. The Sellas *et al.* (2005) findings support the separate identification of bay, sound and estuary populations from those occurring in adjacent Gulf coastal waters.

In many cases, residents emphasize use of the bay, sound or estuary waters, with limited movements through passes to the Gulf of Mexico (Shane 1977; 1990; Gruber 1981; Irvine *et al.* 1981; Maze and Würsig 1999; Lynn and Würsig 2002; Fazioli *et al.* 2006). These habitat use patterns are reflected in the ecology of the dolphins in some areas; for example, residents of Sarasota Bay, Florida, lacked squid in their diet, unlike non-resident dolphins stranded on nearby Gulf beaches (Barros and Wells 1998). However, in some areas year-round residents may co-

occur with non-resident dolphins. For example, about 14-17% of group sightings involving resident Sarasota Bay dolphins include at least 1 non-resident as well (Wells *et al.* 1987; Fazioli *et al.* 2006). Mixing of inshore residents and non-residents has been seen at San Luis Pass, Texas (Maze and Würsig 1999), the Cedar Keys, Florida (Quintana-Rizzo and Wells 2001), and Pine Island Sound, Florida (Shane 2004). Non-residents exhibit a variety of patterns, ranging from apparent nomadism recorded as transience to a given area, to apparent seasonal or non-seasonal migrations. Passes, especially the mouths of the larger estuaries, serve as mixing areas. For example, dolphins from several different areas were documented at the mouth of Tampa Bay, Florida (Wells 1986), and most of the dolphins identified in the mouths of Galveston Bay and Aransas Pass, Texas, were considered transients (Henningsen 1991; Bräger 1993; Weller 1998).

Seasonal movements of dolphins into and out of some of the bays, sounds and estuaries have also been documented. In Sarasota Bay, Florida, and San Luis Pass, Texas, residents are documented moving into Gulf coastal waters in fall/winter, and return inshore in spring/summer (Irvine *et al.* 1981; Maze and Würsig 1999). Fall/winter increases in abundance have been noted for Tampa Bay (Scott *et al.* 1989) and are thought to occur in Matagorda Bay (Gruber 1981; Lynn and Würsig 2002) and Aransas Pass (Shane 1977; Weller 1998). Spring/summer increases in abundance occur in Mississippi Sound (Hubard *et al.* 2004) and are thought to occur in Galveston Bay (Henningsen 1991; Bräger 1993; Fertl 1994).

Spring and fall increases in abundance have been reported for St. Joseph Bay, Florida. Mark-recapture abundance estimates were highest in spring and fall and lowest in summer and winter (Table 1; Balmer *et al.* 2008). Individuals with low site-fidelity indices were sighted more often in spring and fall, whereas individuals sighted during summer and winter displayed higher site-fidelity indices. In conjunction with health assessments, 23 dolphins were radio tagged during April 2005 and July 2006. Dolphins tagged in spring 2005 displayed variable utilization areas and variable site fidelity patterns. In contrast, during summer 2006 the majority of radio tagged individuals displayed similar utilization areas and moderate to high site-fidelity patterns. The results of the studies suggest that during summer and winter St. Joseph Bay hosts dolphins that spend most of their time within this region, and these may represent a resident community. In spring and fall, St. Joseph Bay is visited by dolphins that range outside of this area (Balmer *et al.* 2008).

The current bay, sound and estuary stocks are delineated as described in Table 1. There are some estuarine areas that are not currently part of any stock's range. Many of these are areas that dolphins cannot readily access. For example, the marshlands between Galveston Bay and Sabine Lake and between Sabine Lake and Calcasieu Lake are fronted by long, sandy beaches that prohibit dolphins from entering the marshes. The region between the Calcasieu Lake and Vermilion Bay/Atchafalaya Bay stocks has some access, but these marshes are predominantly freshwater rather than saltwater marshes, making them unsuitable for long-term survival of a viable population of bottlenose dolphins. In other regions, there is insufficient estuarine habitat to harbor a demographically independent population, for instance between the Matagorda Bay and West Bay Stocks in Texas, and/or sufficient isolation of the estuarine habitat from coastal waters. The regions between the south end of the Estero Bay Stock area to just south of Naples and between Little Sarasota Bay and Lemon Bay are highly developed and contain little appropriate habitat. South of Naples to San Marco Island and Gullivan Bay is also not currently covered in a stock boundary. This region may reasonably contain bottlenose dolphins, but the relationship of any dolphins in this region to other BSE stocks is unknown. They may be members of the Gullivan to Chokoloskee Bay stock as there is passage behind San Marco Island that would allow dolphins to move north. Finally, the regions between Apalachee Bay and Cedar Key/Waccasassa Bay, between Crystal Bay and St. Joseph Sound and between Chokoloskee Bay and Whitewater Bay are comprised of a thin strip of marshland with no barriers to adjacent coastal waters. Further work is necessary to determine whether year-round resident dolphins use these thin marshes or whether dolphins in these areas are members of the coastal stock that use the fringing marshland as well. Finally, the region between the eastern border of the Barataria Bay Stock and the Mississippi Delta Stock to the east may harbor dolphins, but the area is small and work is necessary to determine whether any dolphins utilizing this habitat come from an adjacent bay, sound and estuary stock.

As more information becomes available, combination or division of these stocks, or alterations to stock boundaries, may be warranted. For example, unpublished research suggests B36, Caloosahatchee River, can be considered a part of Pine Island Sound. Recent research based on photo-ID data collected by Bassos-Hull *et al.* (2013) recommended combining B21, Lemon Bay, with B22-23, Gasparilla Sound, Charlotte Harbor, Pine Island Sound. Therefore, these stocks have been combined (see Table 1). However, it should be noted this change was made in the absence of genetic data and could be revised again in the future when genetic data are available. Additionally, a number of geographically and socially distinct subgroupings of dolphins in regions such as Tampa Bay, Charlotte Harbor, Pine Island Sound, Aransas Pass and Matagorda Bay have been identified, but the importance of these distinctions to stock designations remains undetermined (Shane 1977; Gruber 1981; Wells *et al.*

1996a; 1996b; 1997; Lynn and Würsig 2002; Urian 2002). For Tampa Bay, Urian *et al.* (2009) described 5 discrete communities (including the adjacent Sarasota Bay community) that differed in their social interactions and ranging patterns. Structure was found despite a lack of physiographic barriers to movement within this large, open embayment. Urian *et al.* (2009) further suggested that fine-scale structure may be a common element among bottlenose dolphins in the southeast U.S. and recommended that management should account for fine-scale structure that exists within current stock designations.

Table 1. Most recent common bottlenose dolphin abundance (N_{BEST}), coefficient of variation (CV) and minimum population estimate (N_{MIN}) in northern Gulf of Mexico bays, sounds and estuaries. Because they are based on data collected more than 8 years ago, most estimates are considered unknown or undetermined for management purposes. Blocks refer to aerial survey blocks illustrated in Figure 1. PBR – Potential Biological Removal; UNK – unknown; UND – undetermined.

Blocks	Gulf of Mexico Estuary	N_{BEST}	CV	N_{MIN}	PBR	Year	Reference
B51	Laguna Madre	80	1.57	UNK	UND	1992	A
B52	Nueces Bay, Corpus Christi Bay	58	0.61	UNK	UND	1992	A
B50	Copano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espiritu Santo Bay	55	0.82	UNK	UND	1992	A
B54	Matagorda Bay, Tres Palacios Bay, Lavaca Bay	61	0.45	UNK	UND	1992	A
B55	West Bay	32	0.15	UNK	UND	2000	E
B56	Galveston Bay, East Bay, Trinity Bay	152	0.43	UNK	UND	1992	A
B57	Sabine Lake	0[a]	-		UND	1992	A
B58	Calcasieu Lake	0[a]	-		UND	1992	A
B59	Vermilion Bay, West Cote Blanche Bay, Atchafalaya Bay	0[a]	-		UND	1992	A
B60	Terrebonne Bay, Timbalier Bay	100	0.53	UNK	UND	1993	A
B61	Barataria Bay	138	0.08	UNK	UND	2001	D
B30	Mississippi River Delta	332	0.93	170	1.7	2011-12	J
B02-05, 29, 31	Mississippi Sound, Lake Borgne, Bay Boudreau	901	0.63	551	5.6	2012	J
B06	Mobile Bay, Bonsecour Bay	122	0.34	UNK	UND	1993	A
B07	Perdido Bay	0[a]	-		UND	1993	A
B08	Pensacola Bay, East Bay	33	0.80	UNK	UND	1993	A
B09	Choctawhatchee Bay	179	0.04	173	1.7	2007	H
B10	St. Andrew Bay	124	0.57	UNK	UND	1993	A
B11	St. Joseph Bay	146	0.18	126	1.3	2005-07	F
B12-13	St. Vincent Sound, Apalachicola Bay, St. George Sound	439	0.14	390	3.9	2007-08	G
B14-15	Apalachee Bay	491	0.39	UNK	UND	1993	A
B16	Waccasassa Bay, Withlacoochee Bay, Crystal Bay	100	0.85	UNK	UND	1994	A
B17	St. Joseph Sound, Clearwater Harbor	37	1.06	UNK	UND	1994	A
B32-34	Tampa Bay	559	0.24	UNK	UND	1994	A
B20, 35	Sarasota Bay, Little Sarasota Bay	160	na[c]	160	1.6	2007	B
B21-23	Pine Island Sound, Charlotte Harbor, Gasparilla Sound, Lemon Bay	826	0.09	766	7.7	2006	I
B36	Caloosahatchee River	0[a,b]	-		UND	1985	C
B24	Estero Bay	104	0.67	UNK	UND	1994	A
B25	Chokoloskee Bay, Ten Thousand Islands, Gullivan Bay	208	0.46	UNK	UND	1994	A
B27	Whitewater Bay	242	0.37	UNK	UND	1994	A
B28	Florida Keys (Bahia Honda to Key West)	29	1.00	UNK	UND	1994	A

References: A – Blaylock and Hoggard 1994; B – Wells 2009; C – Scott *et al.* 1989; D – Miller 2003; E – Irwin and Würsig 2004; F – Balmer *et al.* 2008; G – Tyson *et al.* 2011; H – Conn *et al.* 2011; I - Bassos-Hull *et al.* 2013; J - NMFS unpublished data
Notes:
[a] During earlier surveys (Scott *et al.* 1989), the range of seasonal abundances was as follows: B57, 0-2 (CV=0.38); B58, 0-6 (0.34); B59, 0-0; B30, 0-182 (0.14); B07, 0-0; B21, 0-15 (0.43); and B36, 0-0.
[b] Block not surveyed during surveys reported in Blaylock and Hoggard (1994).
[c] No CV because N_{BEST} was a direct count of known individuals.

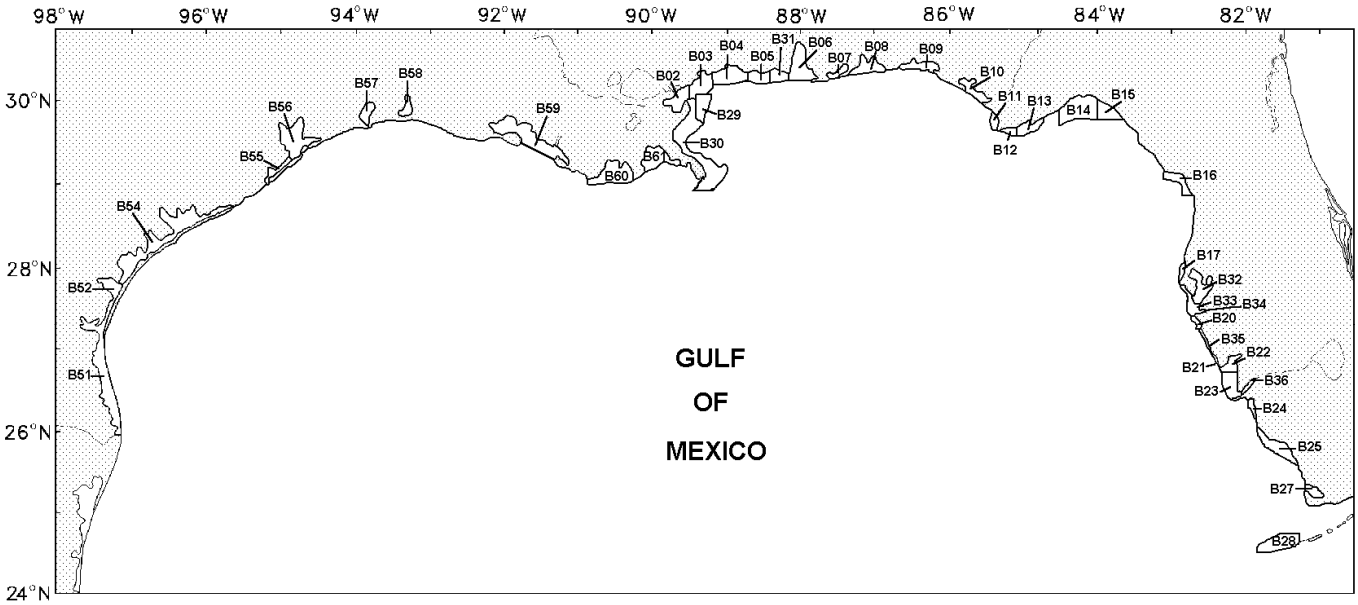

Figure 1. *Northern Gulf of Mexico bays and sounds. Each of the alpha-numerically designated blocks corresponds to one of the NMFS Southeast Fisheries Science Center logistical aerial survey areas listed in Table 1. The bottlenose dolphins inhabiting each bay and sound are considered to comprise a unique stock for purposes of this assessment.*

POPULATION SIZE

Population size estimates for most of the stocks are greater than 8 years old and therefore the current population size for all but 7 of these stocks is considered unknown (Wade and Angliss 1997). However, recent mark-recapture population size estimates are available for Gasparilla Sound, Charlotte Harbor, Pine Island Sound, Lemon Bay; Choctawhatchee Bay; St. Joseph Bay; and St. Vincent Sound, Apalachicola Bay, St. George Sound. A direct count is available for Sarasota Bay. Recent aerial survey line-transect population size estimates are available for Mississippi River Delta and Mississippi Sound, Lake Borgne, Bay Boudreau (Table 1). Population size estimates for the remaining stocks (Table 1) were generated from preliminary analyses of line-transect data collected during aerial surveys conducted in September-October 1992 in Texas and Louisiana; in September-October 1993 in Louisiana, Mississippi, Alabama and the Florida Panhandle (Blaylock and Hoggard 1994); and in September-November 1994 along the west coast of Florida (NMFS unpublished data). Standard line-transect perpendicular sighting distance analytical methods (Buckland *et al.* 1993) and the computer program DISTANCE (Laake *et al.* 1993) were used.

Minimum Population Estimate

The population size for all but 7 stocks is currently unknown and the minimum population estimates are given for those 7 stocks in Table 1. In most cases, the minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The minimum population estimate was calculated for each block from the estimated population size and its associated coefficient of variation. Where the population size resulted from a direct count of known individuals, the minimum population size was identical to the

estimated population size.

Current Population Trend

The data are insufficient to determine population trends for most of the Gulf of Mexico bay, sound and estuary bottlenose dolphin stocks.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for these stocks. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is undetermined for all but 7 stocks because the population size estimate is more than 8 years old. PBR is the product of minimum population size, one-half the maximum productivity rate and a recovery factor (Wade and Angliss 1997). The recovery factor, which accounts for endangered, depleted, and threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because these stocks are of unknown status. PBR for those stocks with population size estimates less than 8 years old is given in Table 1.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for these stocks during 2008-2012 is unknown. During 2008-2012, mortalities and/or serious injuries were documented involving the Gulf of Mexico menhaden purse seine fishery, the Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) fishery, and the Gulf of Mexico blue crab and/or Gulf of Mexico stone crab trap/pot fisheries. In addition, mortalities and serious injuries were documented in research-related gillnet gear, and 1 stabbing was documented. It is not possible to estimate the total number of mortalities or serious injuries associated with menhaden purse seine, hook and line, or crab trap/pot fisheries since there are no systematic observer programs for those fisheries.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

The commercial fisheries which potentially could interact with these stocks in the Gulf of Mexico are the Category II Southeastern U.S. Atlantic, Gulf of Mexico shrimp trawl, Gulf of Mexico menhaden purse seine, Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot, Gulf of Mexico gillnet, and the Category III Gulf of Mexico blue crab trap/pot and Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) fisheries (Appendix III).

Hook and Line Fisheries

During 2008-2012 there were 16 mortalities for which hook and line gear entanglement or ingestion were documented, and attempts were made to disentangle 7 animals from hook and line gear. During 2008 there were 2 mortalities. During 2009 there were 2 mortalities, and 2 live animals were disentangled from hook and line gear and were considered not seriously injured (Maze-Foley and Garrison in prep a). During 2010 there were 3 mortalities, and 1 live animal was disentangled and released, considered seriously injured (Maze-Foley and Garrison in prep a). During 2011, there were 2 mortalities, and 2 live animals were disentangled from hook and line gear. One of the live animals was considered seriously injured, and 1 was not seriously injured (Maze-Foley and Garrison in prep a). Finally, during 2012 there were 7 mortalities, and 2 live animals were disentangled from hook and line gear that were considered not seriously injured (Maze-Foley and Garrison in prep b). The interactions likely involved animals from the following bay, sound and estuary stocks: Tampa Bay; Sarasota Bay, Little Sarasota Bay; Pine Island Sound, Charlotte Harbor, Gasparilla Sound, Lemon Bay; Caloosahatchee River; Chokoloskee Bay, Ten Thousand Islands, Gullivan Bay; Galveston Bay, East Bay, Trinity Bay; Copano Bay, Aransas Bay, San Antonio Bay, Redfish

Bay, Espiritu Santo Bay; Neuces Bay, Corpus Christi Bay; and Laguna Madre. All mortalities and live entanglements were included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 [for 2008-2011 data] and 15 April 2013 [for 2012 data]) and are included in the stranding totals presented in Table 1.

Shrimp Trawl Fishery

During 2008-2012 there were no documented interactions for the shrimp trawl fishery within bay, sound and estuary waters; however, it should be noted that observer coverage of the shrimp trawl fishery does not extend into bay, sound and estuary waters. In earlier years, takes with this fishery have been observed in nearshore coastal waters. A voluntary observer program for the shrimp trawl fishery began in 1992 and became mandatory in 2007. Five bottlenose dolphin mortalities were observed in the shrimp trawl fishery during 2003, 2007, 2008, 2010 and 2011, and 1 serious injury was observed during 2012. The 2003 mortality occurred off the coast of Alabama and could have belonged to the Northern Coastal Stock or a bay, sound and estuary stock (Mobile Bay, Bonsecour Bay Stock or Mississippi Sound, Lake Borgne, Bay Boudreau Stock).

One mortality (2009) and 1 live release without serious injury (2012) occurred in Alabama bays during non-commercial shrimp trawling (see "Other Mortality" below for details).

Blue and Stone Crab Trap/Pot Fisheries

During 2008-2012 there were 5 documented interactions with crab trap/pot fisheries and BSE stocks. During 2011, 1 mortality occurred and 1 live animal was disentangled and released (it could not be determined if the animal was seriously injured [Maze-Foley and Garrison in prep a]). The BSE stocks involved were likely Waccasassa Bay, Withlacoochee Bay, Crystal Bay and Galveston Bay, East Bay, Trinity Bay. In 2010, a calf likely belonging to the Copano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espiritu Santo Bay Stock was disentangled by stranding network personnel from a crab trap line wrapped around its peduncle. The animal swam away with no obvious injuries, but was considered seriously injured because it is unknown whether it was reunited with its mother (Maze-Foley and Garrison in prep a). Also during 2010, a mortality was documented entangled in trap/pot gear. This animal likely belonged to the Mobile Bay, Bonsecour Bay Stock. In 2008 there was a report of a live dolphin in the Caloosahatchee River in Florida entangled in probable trap/pot line without a buoy attached. This animal, likely a member of the Caloosahatchee River Stock, was considered seriously injured (Maze-Foley and Garrison in prep a; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 and 15 April 2013). In 2002 there was a calf stranded near Clearwater, Florida, with blue crab trap line wrapped around its rostrum, through its mouth and looped around its tail (NMFS unpublished data). This animal was likely a member of the St. Joseph Sound, Clearwater Harbor Stock. Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab traps/pots.

Menhaden Purse Seine Fishery

During 2008-2012, there were 2 mortalities and 1 animal released alive without serious injury documented within bay, sound and estuary waters involving the menhaden purse seine fishery. All 3 interactions occurred within the waters of the Mississippi Sound, Lake Borgne, Bay Boudreau Stock (also reported in that SAR).

There is currently no observer program for the Gulf of Mexico menhaden purse seine fishery; however, recent incidental takes have been reported via two sources. First, during 2011, a pilot observer program operated from May through September, and observers documented 3 dolphins trapped within purse seine nets. All 3 were released alive without serious injury (Maze-Foley and Garrison in prep a). Two of the 3 dolphins were trapped within a single purse seine within waters of the Western Coastal Stock. The third animal was trapped in waters of the Mississippi Sound, Lake Borgne, Bay Boudreau Stock. Second, through the Marine Mammal Authorization Program (MMAP), there have been 13 self-reported incidental takes (all mortalities) of bottlenose dolphins in northern Gulf of Mexico coastal and estuarine waters by the menhaden purse seine fishery during 2000-2012. These takes likely affected the following stocks: Western Coastal Stock; Northern Coastal Stock; Mississippi Sound, Lake Borgne, Bay Boudreau Stock; and Mississippi River Delta Stock. Specific self-reported takes under the MMAP likely involving bay, sound and estuary stocks are as follows: two dolphins were reported taken in a single purse seine during 2012 in Mississippi Sound (Mississippi Sound, Lake Borgne, Bay Boudreau Stock); one take of a single bottlenose dolphin was reported in Louisiana waters during 2004 that likely belonged to the Mississippi River Delta Stock; one take of a single unidentified dolphin reported during 2002 likely belonged to the Mississippi Sound, Lake Borgne, Bay Boudreau Stock; one take of a single bottlenose dolphin was reported in Louisiana waters during 2001 that likely belonged to Mississippi River Delta Stock or Northern Coastal Stock; during 2000, one take of a single bottlenose dolphin was reported in Louisiana waters that likely belonged to Mississippi River Delta Stock or Northern Coastal

Stock; and also in 2000, 3 bottlenose dolphins were reported taken in a single purse seine in Mississippi waters that likely belonged to Mississippi Sound, Lake Borgne, Bay Boudreau Stock.

The menhaden purse seine fishery was observed to take 9 bottlenose dolphins (3 fatally) between 1992 and 1995 (NMFS unpublished data). During that period, there were 1,366 sets observed out of 26,097 total sets, which if extrapolated for all years suggests that as many as 172 bottlenose dolphins could have been taken in this fishery with up to 57 animals killed.

Without an ongoing observer program, it is not possible to obtain statistically reliable information for this fishery on the number of sets annually, the incidental take and mortality rates, and the stocks from which bottlenose dolphins are being taken.

Gillnet Fishery

No marine mammal mortalities associated with gillnet fisheries have been reported in recent years, but stranding data suggest that gillnet and marine mammal interactions do occur, causing mortality and serious injury. During 2008-2012, 9 dolphins were entangled in research-related gillnets in Texas. Historically, four research-related gillnet mortalities occurred between 2003 and 2007 in Texas (1 each in 2003, 2004, and 2007) and Louisiana (1 in 2006) (see "Other Mortality" below for details on recent and historical research-related entanglements). In 1995, a Florida state constitutional amendment banned gillnets and large nets from bays, sounds, estuaries and other inshore waters.

Strandings

A total of 442 bottlenose dolphins were found stranded within bays, sounds and estuaries of the northern Gulf of Mexico from 2008 through 2012 (Table 2; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 [for 2008-2011 data] and 15 April 2013 [for 2012 data]). Evidence of human interactions was detected for 69 of these dolphins. Human interactions were from numerous sources, including 23 entanglements with hook and line gear, 5 entanglements with crab trap/pot gear, 5 incidental takes in research gillnet gear, 1 stabbing, 1 entanglement in a non-commercial shrimp trawl, 2 strandings with visible, external oil, and 1 entrapment between oil booms (see Table 1). Strandings with evidence of fishery related interactions are reported above in the respective gear sections. Bottlenose dolphins are known to become entangled in, or ingest recreational and commercial fishing gear (Wells and Scott 1994; Gorzelany 1998; Wells *et al.* 1998; Wells *et al.* 2008), and some are struck by vessels (Wells and Scott 1997; Wells *et al.* 2008).

There are a number of difficulties associated with the interpretation of stranding data. Except in rare cases, such as Sarasota Bay, Florida, where residency can be determined, it is possible that some or all of the stranded dolphins may have been from a nearby coastal stock. However, the proportion of stranded dolphins belonging to another stock cannot be determined because of the difficulty of determining from where the stranded carcasses originated. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the dolphins which die or are seriously injured in fishery interactions wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other fishery-interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interaction, and the condition of the carcass if badly decomposed can inhibit the interpretation of cause of death.

Since 1990, there have been 13 bottlenose dolphin die-offs or Unusual Mortality Events (UMEs) in the northern Gulf of Mexico. 1) From January through May 1990, a total of 367 bottlenose dolphins stranded in the northern Gulf of Mexico. Overall this represented a two-fold increase in the prior maximum recorded number of strandings for the same period, but in some locations (i.e., Alabama) strandings were 10 times the average number. The cause of the 1990 mortality event could not be determined (Hansen 1992). 2) An unusual mortality event was declared for Sarasota Bay, Florida, in 1991, but the cause was not determined. 3) In March and April 1992, 111 bottlenose dolphins stranded in Texas - about 9 times the average number. The cause of this event was not determined, but carbamates were a suspected cause. 4) In 1993-1994 an UME of bottlenose dolphins likely caused by morbillivirus started in the Florida Panhandle and spread west with most of the mortalities occurring in Texas (Lipscomb 1993; Lipscomb *et al.* 1994). From February through April 1994, 220 bottlenose dolphins were found dead on Texas beaches, of which 67 occurred in a single 10-day period. 5) In 1996 an UME was declared for bottlenose dolphins in Mississippi when 27 bottlenose dolphins stranded during November and December. The cause was not determined, but a *Karenia brevis* (red tide) bloom was suspected to be responsible. 6) Between August 1999 and May 2000, 152 bottlenose dolphins died coincident with *K. brevis* blooms and fish kills in the Florida Panhandle (additional strandings included 3 Atlantic spotted dolphins, *Stenella frontalis*, 1 Risso's dolphin, *Grampus griseus*, 2 Blainville's beaked whales, *Mesoplodon densirostris*, and 4 unidentified dolphins. 7) In March and April 2004, in another Florida Panhandle UME possibly related to *K. brevis* blooms, 105 bottlenose dolphins and 2 unidentified

dolphins stranded dead (NMFS 2004). Although there was no indication of a *K. brevis* bloom at the time, high levels of brevetoxin were found in the stomach contents of the stranded dolphins (Flewelling *et al.* 2005). 8) In 2005, a particularly destructive red tide (*K. brevis*) bloom occurred off of central west Florida. Manatee, sea turtle, bird and fish mortalities were reported in the area in early 2005 and a manatee UME had been declared. Dolphin mortalities began to rise above the historical averages by late July 2005, continued to increase through October 2005, and were then declared to be part of a multi-species UME. The multi-species UME extended into 2006, and ended in November 2006. A total of 190 dolphins were involved, primarily bottlenose dolphins (plus strandings of 1 Atlantic spotted dolphin, *S. frontalis*, and 24 unidentified dolphins). The evidence suggests the effects of a red tide bloom contributed to the cause of this event. 9) A separate UME was declared in the Florida Panhandle after elevated numbers of dolphin strandings occurred in association with a *K. brevis* bloom in September 2005. Dolphin strandings remained elevated through the spring of 2006 and brevetoxin was again detected in the tissues of some of the stranded dolphins. Between September 2005 and April 2006 when the event was officially declared over, a total of 90 bottlenose dolphin strandings occurred (plus strandings of 3 unidentified dolphins). 10) During February and March of 2007 an event was declared for northeast Texas and western Louisiana involving 66 bottlenose dolphins. Decomposition prevented conclusive analyses on most carcasses. 11) During February and March of 2008 an additional event was declared in Texas involving 113 bottlenose dolphin strandings. Most of the animals recovered were in a decomposed state. The investigation is closed and a direct cause could not be identified. However, there were numerous, co-occurring harmful algal bloom toxins detected during the time period of this UME which may have contributed to the mortalities (Fire *et al.* 2011). 12) An UME was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010; and, as of 2013, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, 43 animals from bay, sound and estuary stocks were considered to be part of the UME; during 2011, 46 animals; and during 2012, 27 animals (these totals do not include strandings from Mississippi Sound, Lake Borgne, Bay Boudreau Stock and Barataria Bay Estuarine System Stock). 13) An UME occurred from November 2011 to March 2012 across 5 Texas counties and included 123 bottlenose dolphin strandings. The strandings were coincident with a harmful algal bloom of *K. brevis*, but researchers have not determined that was the cause of the event.

Table 2. Common bottlenose dolphin strandings occurring in bays, sounds and estuaries in the northern Gulf of Mexico from 2008 to 2012, as well as number of strandings for which evidence of human interaction was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interaction. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 13 September 2012 [for 2008-2011 data] and 15 April 2013 [for 2012 data]). Please note human interaction does not necessarily mean the interaction caused the animal's death. Please also note that this table does not include strandings from Barataria Bay Estuarine System, MS Sound, Choctawhatchee Bay or St. Joseph Bay.

Stock	**Category**	**2008**	**2009**	**2010**	**2011**	**2012**	**Total**
Bay, Sound and Estuary	Total Stranded	54[a]	72[b]	91[c]	106[d]	119[e]	442
	Human Interaction						
	---Yes	5[f]	18[g]	12[h]	13[i]	21[j]	69
	---No	13	6	8	4	4	35
	---CBD	36	48	71	89	94	338

[a] This total includes 4 animals that were part of an UME in Texas.
[b] This total includes a mass stranding of 6 animals in Louisiana in June 2009.
[c] This total includes 43 animals that are part of the ongoing UME in the northern Gulf of Mexico.
[d] This total includes 46 animals that are part of the ongoing UME in the northern Gulf of Mexico, and 7 animals that were part of the 2011-2012 UME in Texas.
[e] This total includes 27 animals that are part of the ongoing UME in the northern Gulf of Mexico, and 23 animals that were part of the 2011-2012 UME in Texas.
[f] Includes 2 entanglement interactions (mortalities) with hook and line fishing gear, and 1 entanglement interaction with probable trap/pot gear (released alive seriously injured).
[g] Includes 4 entanglement interactions with recreational hook and line gear (2 mortalities and 2 animals released alive without serious injuries), and 1 incidental take (mortality) in a research trawl.
[h] Includes 4 entanglement interactions with hook and line gear (3 mortalities and 1 animal released alive presumably seriously injured); 2 entanglement interactions with unidentified trap/pot gear (1 mortality, 1 animal release alive; 1 live release without serious injury following entrapment between oil booms; and 1 animal visibly oiled (mortality).

[i] Includes 4 entanglement interactions with hook and line gear (2 mortalities, 1 animal released alive seriously injured, 1 released alive without serious injury); 2 entanglement interactions with research gillnet gear (1 mortality, 1 released alive without serious injury); 2 entanglement interactions with trap/pot gear (1 mortality, 1 released alive that could not be determined if seriously injured or not); and 1 animal visibly oiled (mortality).
[j] Includes 9 entanglement interactions with hook and line gear (7 mortalities, 2 animals released alive without serious injuries); 3 entanglement interactions with research gillnet gear (1 released alive seriously injured, 2 released alive without serious injury); 1 entanglement in a non-commercial shrimp trawl net (released alive without serious injury); and 1 stabbing (serious injury).

Other Mortality

In addition to animals included in the stranding database, during 2008-2012, there were 17 at-sea observations in BSE stock areas of bottlenose dolphins entangled in fishing gear or unidentified gear (hook and line, crab trap/pot and unidentified gear/line/rope). During 2008, there were 2 observations (1 seriously injured, 1 not seriously injured); during 2009, 5 observations (3 seriously injured, 1 not seriously injured, 1 CBD); during 2010, 2 observations (1 seriously injured, 1 CBD); during 2011, 3 observations (2 seriously injured, 1 CBD); and during 2012, 5 observations (2 seriously injured, 3 CBD) (Maze-Foley and Garrison in prep a,b).

During 2012 in Alabama (Perdido Bay Stock), a dolphin was disentangled from a shrimp trawling net being used in a local ecotour. The animal was considered not seriously injured (Maze-Foley and Garrison in prep b). During 2009 in Mobile Bay, Alabama, near the entrance to the Gulf of Mexico, a bottlenose dolphin mortality resulted from an entanglement in the lazy line of a trawl net during an educational trawling cruise operated by a marine science education and research laboratory. This animal likely belonged to the Mobile Bay, Bonsecour Bay Stock. Both of these animals were included in the stranding database.

During 2008-2012, 9 dolphins were entangled in research-related gillnets in Texas. During 2012, 4 live animals were entangled and released from research-related gillnets in Texas. One of these animals was seriously injured (in Copano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espiritu Santo Bay Stock area), and the other 3 were not seriously injured (1 in Neuces Bay, Corpus Christi Bay Stock area, 1 in Copano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espiritu Santo Bay Stock area, 1 in Laguna Madre Stock area [Maze-Foley and Garrison in prep b]). Three of the 4 entanglements were included in the stranding database. During 2011, 1 research-related gillnet mortality occurred, and 1 live animal was entangled and released without serious injury (Maze-Foley and Garrison in prep a). Both of these interactions occurred in the Copano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espiritu Santo Bay Stock area, and both were included in the stranding database. During 2010, 2 animals were entangled and released from research-related gillnets in Texas. One of these animals was not seriously injured and for the other, it could not be determined if the animal was seriously injured (Maze-Foley and Garrison in prep a). Both of these interactions occurred in the Copano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espiritu Santo Bay Stock area (not included in stranding database). During 2008, 1 live animal was entangled and released without serious injuries from a research-related gillnet in the Matagorda Bay, Tres Palacios Bay, Lavaca Bay Stock area (not included in stranding database). Historically, 4 mortalities resulted from gillnet entanglements in research gear off Texas and Louisiana during 2003, 2004, 2006 and 2007. Three of the mortalities were a result of fisheries sampling and research in Texas, and 1 mortality (2006) occurred during a gulf sturgeon research project in Louisiana. These 4 animals likely belonged to the following bay, sound and estuary stocks: Copano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espiritu Santo Bay Stock (2003, 2004 mortalities); Mississippi River Delta Stock (2006 mortality); and Matagorda Bay, Tres Palacios Bay, Lavaca Bay Stock (2007 mortality). The mortalities were included in the stranding database.

The problem of dolphin depredation of fishing gear is increasing in Gulf of Mexico coastal and estuary waters. There have been 4 recent cases of fishermen illegally “taking” dolphins due to dolphin depredation of recreational and commercial fishing gear. One recent case of a shrimp fisherman illegally "taking" a dolphin in Mississippi Sound occurred during summer 2012. In December 2013 the fisherman was convicted under the MMPA for knowingly shooting a dolphin with a shotgun while shrimping. A commercial fisherman was indicted in November 2008 for throwing pipe bombs at dolphins off Panama City, Florida, and charged in March 2009 for “taking” dolphins with an explosive device. In 2006 a charter boat fishing captain was charged under the MMPA for shooting at a dolphin that was swimming around his catch in the Gulf of Mexico, off Panama City, Florida. In 2007 a second charter fishing boat captain was fined under the MMPA for shooting at a bottlenose dolphin that was attempting to remove a fish from his line in the Gulf of Mexico, off Orange Beach, Alabama.

During 2012 a dolphin was observed swimming in Perdido Bay with a screwdriver protruding from its melon and was found dead the next day. This stabbing was included in the stranding database.

Illegal feeding or provisioning of wild bottlenose dolphins has been documented in Florida, particularly near

Panama City Beach in the Panhandle (Samuels and Bejder 2004) and in and near Sarasota Bay (Cunningham-Smith *et al.* 2006; Powell and Wells 2011), and also in Texas near Corpus Christi (Bryant 1994). Feeding wild dolphins is defined under the MMPA as a form of 'take' because it can alter their natural behavior and increase their risk of injury or death. Nevertheless, a high rate of provisioning was observed near Panama City Beach in 1998 (Samuels and Bejder 2004), and provisioning has been observed south of Sarasota Bay since 1990 (Cunningham-Smith *et al.* 2006; Powell and Wells 2011). There are emerging questions regarding potential linkages between provisioning and depredation of recreational fishing gear and associated entanglement and ingestion of gear, which is increasing through much of Florida. During 2006, at least 2% of the long-term resident dolphins of Sarasota Bay died from ingestion of recreational fishing gear (Powell and Wells 2011).

Swimming with wild bottlenose dolphins has also been documented in Florida in Key West (Samuels and Engleby 2007) and near Panama City Beach (Samuels and Bejder 2004). Near Panama City Beach, Samuels and Bejder (2004) concluded that dolphins were amenable to swimmers due to illegal provisioning. Swimming with wild dolphins may cause harassment, and harassment is illegal under the MMPA.

As noted previously, bottlenose dolphins are known to be struck by vessels (Wells and Scott 1997). During 2008-2012, 15 stranded bottlenose dolphins (of 473 total strandings) showed signs of a boat collision (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 and 15 April 2013). It is possible some of the instances were post-mortem collisions. In addition to vessel collisions, the presence of vessels may also impact bottlenose dolphin behavior in bays, sounds and estuaries. Nowacek *et al.* (2001) reported that boats pass within 100m of each bottlenose dolphin in Sarasota Bay once every 6 minutes on average, leading to changes in dive patterns and group cohesion. Buckstaff (2004) noted changes in communication patterns of Sarasota Bay dolphins when boats approached. Miller *et al.* (2008) investigated the immediate responses of bottlenose dolphins to "high-speed personal watercraft" (i.e., boats) in Mississippi Sound. They found an immediate impact on dolphin behavior demonstrated by an increase in traveling behavior and dive duration, and a decrease in feeding behavior for non-traveling groups. The findings suggested dolphins attempted to avoid high-speed personal watercraft. It is unclear whether repeated short-term effects will result in long-term consequences like reduced health and viability of dolphins. Further studies are needed to determine the impacts throughout the Gulf of Mexico.

As part of its annual coastal dredging program, the Army Corps of Engineers conducts sea turtle relocation trawling during hopper dredging as a protective measure for marine turtles. No interactions have been documented during the most recent 5 years, 2008-2012, but in earlier years, 5 incidents were documented in the Gulf of Mexico involving bottlenose dolphins and relocation trawling activities. Four of the incidents were mortalities, and 1 occurred during each of the following years: 2003, 2005, 2006 and 2007. It is likely that 2 of these animals belonged to the Western Coastal Stock (2005, 2007) and 2 animals belonged to bay, sound and estuary stocks (2003, 2006). An additional incident occurred during 2006 in which the dolphin became free during net retrieval and was observed swimming away normally. It is likely this animal belonged to a bay, sound and estuary stock. .

Two dolphin research-related mortalities have occurred during health-assessment projects in past years. During November 2002 in Sarasota Bay, Florida, a 35-year-old male died in a health assessment research project. The histopathology report stated that drowning was the cause of death. However, the necropsy revealed that the animal was in poor condition as follows: anemic, thin (ribs evident, blubber thin and grossly lacking lipid), no food in the stomach and little evidence of recent feeding in the digestive tract, vertebral fractures with muscle atrophy, with additional conditions present. This has been the only such loss during capture/release research conducted over a 43-year period on Florida's central west coast. Another research-related mortality occurred during July 2006 in St. Joseph Bay, in the Florida Panhandle, during a NMFS health assessment research project to investigate a series of UMEs in the region. The animal became entangled deep in the capture net and was found dead during extrication of other animals from the net. The cause of death was determined to be asphyxiation.

Some of the bay, sound and estuary communities were the focus of a live-capture fishery for bottlenose dolphins which supplied dolphins to the U.S. Navy and to oceanaria for research and public display for more than 2 decades ending in 1989 (NMFS unpublished data). During the period 1972-1989, 490 bottlenose dolphins, an average of 29 dolphins annually, were removed from a few locations in the Gulf of Mexico, including the Florida Keys, Charlotte Harbor, Tampa Bay and elsewhere. Mississippi Sound sustained the highest level of removals with 202 dolphins taken from this stock during this period, representing 41% of the total and an annual average of 12 dolphins (compared to a previous PBR of 13). The annual average number of removals never exceeded previous PBR levels, but it may be biologically significant that 73% of the dolphins removed during 1982-1988 were females. The impact of these removals on the stocks is unknown.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and over 87 days ~4.9 million barrels of oil were discharged from the wellhead until it was capped on 15 July 2010 (McNutt *et al.* 2012). During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

A substantial number of beaches and wetlands along the Louisiana coast experienced heavy or moderate oiling (OSAT-2 2011; Michel *et al.* 2013). The heaviest oiling in Louisiana occurred west of the Mississippi River on the Mississippi Delta and in Barataria and Terrebonne Bays, and to the east of the river on the Chandeleur Islands. Some heavy to moderate oiling occurred on Alabama and Florida beaches, with the heaviest stretch occurring from Dauphin Island, Alabama, to Gulf Breeze, Florida. Light to trace oil was reported along the majority of Mississippi's mainland coast, from Gulf Breeze to Panama City, Florida, and outside of Atchafalaya and Vermilion Bays in western Louisiana. Heavy to light oiling occurred on Mississippi's barrier islands (Michel *et al.* 2013). Thus, it is likely that some bay, sound and estuary stocks were exposed to oil. Dolphins were observed with tar balls attached to them and seen swimming through oil slicks close to shore and inland bays. The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal’s ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, continental shelf, coastal and estuarine marine mammals. The research is ongoing. For coastal and estuarine dolphins, the NOAA-led efforts include: active surveillance to detect stranded animals in remote locations; aerial surveys to document the distribution, abundance, species and exposure of marine mammals and sea turtles relative to oil from DWH spill; assessment of sublethal and chronic health impacts on coastal and estuarine bottlenose dolphins in Barataria Bay, Louisiana, and a reference site in Sarasota Bay, Florida; and assessment of injuries to dolphin stocks in Barataria Bay and Chandeleur Sound, Louisiana, Mississippi Sound, and as a reference site, St. Joseph Bay, Florida.

The nearshore habitat occupied by many of these stocks is adjacent to areas of high human population, and in some bays, such as Mobile Bay in Alabama and Galveston Bay in Texas, is highly industrialized. The area surrounding Galveston Bay, for example, has a coastal population of over 3 million people. More than 50% of all chemical products manufactured in the U.S. are produced there, and 17% of the oil produced in the Gulf of Mexico is refined there (Henningsen and Würsig 1991). Many of the enclosed bays in Texas are surrounded by agricultural lands which receive periodic pesticide applications.

Concentrations of chlorinated hydrocarbons and metals were examined in conjunction with an anomalous mortality event of bottlenose dolphins in Texas bays in 1990 and found to be relatively low in most; however, some had concentrations at levels of possible toxicological concern (Varanasi *et al.* 1992). No studies to date have determined the amount, if any, of indirect human-induced mortality resulting from pollution or habitat degradation.

Analyses of organochlorine concentrations in the tissues of bottlenose dolphins in Sarasota Bay, Florida, have found that the concentrations in male dolphins exceeded toxic threshold values that may result in adverse effects on health or reproductive rates (Schwacke *et al.* 2002). Studies of contaminant concentrations relative to life history parameters showed higher levels of mortality in first-born offspring, and higher contaminant concentrations in these calves and in primiparous females (Wells *et al.* 2005). While there are no direct measurements of adverse effects of pollutants on estuary dolphins, the exposure to environmental pollutants and subsequent effects on population health is an area of concern and active research.

STATUS OF STOCKS

The status of these stocks relative to OSP is unknown and this species is not listed as threatened or endangered under the Endangered Species Act. The occurrence of 13 Unusual Mortality Events among bottlenose dolphins along the northern Gulf of Mexico coast since 1990 (NMFS unpublished data) is cause for concern; however, the effects of the mortality events on stock abundance have not yet been determined, in large part because it has not been possible to assign mortalities to specific stocks due to a lack of empirical information on stock identification.

The relatively high number of bottlenose dolphin deaths that occurred during the mortality events since 1990 suggests that some of these stocks may be stressed. Human-caused mortality and serious injury for each of these stocks is not known. Considering the evidence from stranding data (Table 2) and the low PBRs for stocks with recent abundance estimates, the total fishery-related mortality and serious injury likely exceeds 10% of the total known PBR or previous PBR, and therefore, it is probably not insignificant and not approaching the zero mortality and serious injury rate. NMFS considers each of these stocks to be strategic because most of the stock sizes are currently unknown, but likely small and relatively few mortalities and serious injuries would exceed PBR, and because stock areas in Louisiana, Mississippi, Alabama and the western Florida panhandle have been impacted by an UME of unprecedented size and duration (began 1 February 2010 and is ongoing).

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*)
Barataria Bay Estuarine System Stock

NOTE – NMFS is in the process of writing individual stock assessment reports for each of the 31 bay, sound and estuary stocks of common bottlenose dolphins in the Gulf of Mexico. Until this effort is completed and 31 individual reports are available, some of the basic information presented in this report will also be included in the report: "Northern Gulf of Mexico Bay, Sound and Estuary Stocks".

STOCK DEFINITION AND GEOGRAPHIC RANGE

Common bottlenose dolphins are distributed throughout the bays, sounds and estuaries of the Gulf of Mexico (Mullin 1988). Long-term (year-round, multi-year) residency by at least some individuals has been reported from nearly every site where photographic identification (photo-ID) or tagging studies have been conducted in the Gulf of Mexico (e.g., Irvine and Wells 1972; Shane 1977; Gruber 1981; Irvine *et al.* 1981; Wells 1986; Wells *et al.* 1987; Scott *et al.* 1990; Shane 1990; Wells 1991; Bräger 1993; Bräger *et al.* 1994; Fertl 1994; Wells *et al.* 1996a,b; Wells *et al.* 1997; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Wells 2003; Hubard *et al.* 2004; Irwin and Würsig 2004; Shane 2004; Balmer *et al.* 2008; Urian *et al.* 2009; Bassos-Hull *et al.* 2013). In many cases, residents predominantly use the bay, sound or estuary waters, with limited movements through passes to the Gulf of Mexico (Shane 1977; Shane 1990; Gruber 1981; Irvine *et al.* 1981; Shane 1990; Maze and Würsig 1999; Lynn and Würsig 2002; Fazioli *et al.* 2006; Bassos-Hull *et al.* 2013). Early studies indicating year-round residency to bays in both the eastern and western Gulf of Mexico led to the delineation of 33 bay, sound and estuary stocks, including Barataria Bay, with the first stock assessment reports published in 1995.

More recently, genetic data also support the concept of relatively discrete bay, sound and estuary stocks (Duffield and Wells 2002; Sellas *et al.* 2005). Sellas *et al.* (2005) examined population subdivision among dolphins sampled in Sarasota Bay, Tampa Bay, Charlotte Harbor, Matagorda Bay, Texas, and the coastal Gulf of Mexico (1-12 km offshore) from just outside Tampa Bay to the south end of Lemon Bay, and found evidence of significant population differentiation among all areas on the basis of both mitochondrial DNA control region sequence data and 9 nuclear microsatellite loci. The Sellas *et al.* (2005) findings support the identification of bay, sound and estuary populations distinct from those occurring in adjacent Gulf coastal waters. Differences in reproductive seasonality from site to site also suggest genetic-based distinctions among areas (Urian

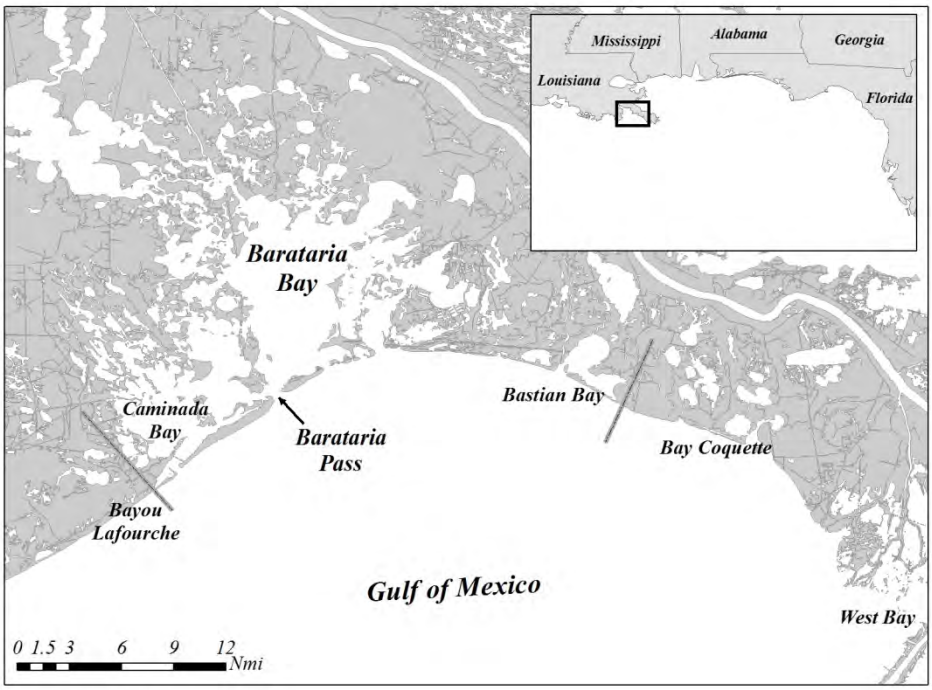

Figure 1. *Geographic extent of the Barataria Bay Estuarine System (BBES) Stock, located on the coast of Louisiana. The borders are denoted by solid lines.*

et al. 1996). Photo-ID and genetic data from several inshore areas of the southeastern United States also support the existence of resident estuarine animals and a differentiation between animals biopsied along the Atlantic coast and those biopsied within estuarine systems at the same latitude (Caldwell 2001; Gubbins 2002; Zolman 2002; Mazzoil *et al.* 2005; Litz 2007; Rosel *et al*. 2009; NMFS unpublished).

Barataria Bay is a shallow (mean depth=2 m) estuarine system located in central Louisiana. It is bounded in the west by Bayou Lafourche, in the east by the Mississippi River delta and in the south by the Grand Terre barrier islands. Barataria Bay is approximately 110 km in length and 50 km in width at its widest point where it opens into the Gulf of Mexico (Connor and Day 1987). This estuarine system is connected to the Gulf of Mexico by a series of passes: Caminada Pass, Barataria Pass, Pass Abel and Quatre Bayou Pass. The margins of Barataria Bay include marshes, canals, small embayments and channels. Bay waters are turbid, and salinity varies widely from south to north with the more saline, tidally influenced portions in the south and freshwater lakes in the north (U.S. EPA 1999; Moretzsohn *et al*. 2010). Miller and Baltz (2009) reported salinity varied seasonally and averaged 22.77 psu (practical salinity unit) in lower Barataria and Caminada Bays (data collected during dolphin sightings). Barataria Bay, together with the Timbalier-Terrebonne Bay system (referred to as the Barataria-Terrebonne National Estuary Program), has been selected as an estuary of national significance by the Environmental Protection Agency National Estuary Program (see http://www.btnep.org/BTNEP/home.aspx). The marshes and swamp forests which characterize Barataria Bay supply breeding and nursery grounds for an assortment of commercial and recreational species of consequence, such as finfish, shellfish, alligators, songbirds, geese and ducks, as well as for migratory birds (U.S. EPA 1999; Moretzsohn *et al*. 2010). The Barataria basin also produces a significant part of U.S. petroleum resources and is an important commercial harbor. High industrial and commercial use of the area and human alteration have resulted in environmental degradation and habitat loss. The most serious environmental issues facing the estuarine system include loss of coastal wetlands, eutrophication, barrier island erosion, saltwater intrusion and introduction of toxic substances (Connor and Day 1987; Barras *et al*. 2003).

The Barataria Bay Estuarine System (BBES) Stock area includes Caminada Bay, Barataria Bay and Bastian Bay (Figure 1). During June 1999 – May 2002, Miller (2003) conducted 44 boat-based, photo-ID surveys in lower Barataria and Caminada Bays. Dolphins were present year-round, and 133 individual dolphins were identified. One individual was sighted 6 times, but most individuals, 58%, were sighted only once. Using a fine-scale microhabitat approach, Miller and Baltz (2009) described foraging habitat of bottlenose dolphins in Barataria Bay. Significant differences in temperature, group size, season and turbidity differentiated foraging sites from non-foraging sites. Foraging was more often observed in waters 200-500 m from shore in 4-6 m depth and at salinity values of approximately 20 psu. Additional study is needed to further describe the population of bottlenose dolphins inhabiting the BBES. The current stock boundary does not include any coastal waters outside of the barrier islands. Further research is needed to determine the degree to which dolphins of this stock utilize nearshore coastal waters outside Barataria Bay. This stock boundary is subject to change upon further study of dolphin residency patterns in estuarine waters of Louisiana. Information on the use of coastal waters will be important when considering exposure to coastal fisheries as estuarine animals that make use of nearshore coastal waters would be at risk of entanglement in fishing gear while moving along the coast. Ongoing NOAA photo-ID surveys initiated in 2010, as well as data from tracking of 25 bottlenose dolphins tagged with satellite-linked transmitters in and around Barataria Bay in August 2011 will address some of these issues as the data become available.

Dolphins residing in the estuaries southeast of this stock between BBES and the Mississippi River mouth (Bay Coquette and West Bay) are not currently covered in any stock assessment report. There are insufficient data to determine whether animals in this region exhibit affiliation to the BBES stock or should be delineated as their own stock. Further research is needed to establish affinities of dolphins in this region. It should be noted that in this region during 2008-2012, 1 bottlenose dolphin was reported stranded. It could not be determined if there was evidence of human interactions for this stranding. This stranding was considered to be part of the ongoing Unusual Mortality Event (see Other Mortality).

POPULATION SIZE

The total number of bottlenose dolphins residing within the BBES Stock is unknown. Miller (2003) conducted boat-based, photo-ID surveys in lower Barataria and Caminada Bays from June 1999 to May 2002. Miller (2003) identified 133 individual dolphins, and using closed-population unequal catchability models in program CAPTURE, produced an abundance estimate of 138-238 (128-297, 95% CI). Miller's (2003) estimate covered only a portion of the area of the BBES stock and did not include a correction for the unmarked portion of the population. Therefore, her estimate is considered negatively biased. Also, these data are considered expired due to being more than 8 years old.

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate for the BBES Stock of bottlenose dolphins.

Current Population Trend

There are insufficient data to determine the population trends for this stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the BBES stock of bottlenose dolphins is unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is of unknown status. PBR for this stock of bottlenose dolphins is undetermined.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury of the BBES bottlenose dolphin stock during 2008-2012 is unknown. During 2008-2012, 1 mortality was documented involving the Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) fishery, and 1 mortality was documented in the Gulf of Mexico blue crab trap/pot fishery. In addition, 2 bottlenose dolphins observed at-sea entangled in fishing gear (monofilament line) were considered seriously injured. It is not possible to estimate the total number of mortalities or serious injuries associated with hook and line or blue crab trap/pot fisheries since there are no systematic observer programs for those fisheries.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

The commercial fisheries which potentially could interact with this stock are the Category II Southeastern U.S. Atlantic, Gulf of Mexico shrimp trawl, Gulf of Mexico menhaden purse seine and the Category III Gulf of Mexico blue crab trap/pot and Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) fisheries (Appendix III). Brown shrimp, white shrimp, blue crab and menhaden fisheries are all important commercial fisheries in the Barataria Bay region. There have been no documented interactions between BBES bottlenose dolphins and the shrimp trawl fishery. However, observer coverage of the shrimp trawl fishery does not extend into bay, sound and estuary waters. The menhaden purse seine fishery is an important fishery in Gulf of Mexico coastal waters just outside the barrier islands of Barataria Bay. It has the potential to interact with dolphins of the BBES Stock that use nearshore coastal waters. There is no systematic observer coverage of crab trap/pot fisheries; therefore, it is not possible to quantify total mortality.

Hook and Line Fisheries

During 2008-2012 there was 1 mortality for which hook and line gear entanglement or ingestion was documented. In addition, 1 animal was released alive without serious injury (Maze-Foley and Garrison in prep a,b). The mortality and live release both occurred during 2011 and were included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 [for 2008-2011 data] and 15 April 2013 [for 2012 data]) and are included in the totals presented in Table 1.

Blue Crab Trap/Pot Fishery

During 2008-2012 there was 1 documented mortality of a bottlenose dolphin in commercial blue crab trap/pot gear. The mortality occurred during 2011 and was included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 and 15 April 2013) and in the totals presented in Table 1. There is no systematic observer coverage of crab trap/pot fisheries, so it is not possible to quantify total mortality.

Other Mortality

From 2008 to 2012, 75 bottlenose dolphins were reported stranded within the BBES (Table 1; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 [for 2008-2011 data] and 15 April 2013 [for 2012 data]). Evidence of human interactions was detected for 12 stranded dolphins, 8 of which stranded visibly oiled. In addition, there was 1 entanglement with commercial blue crab pot gear, 2 entanglements with recreational hook and line gear, and 1 gunshot wound (see Table 1). Stranding data probably underestimate the extent of human-caused mortality and serious injury because not all of the marine mammals that die or are seriously injured in human interactions are discovered, reported or investigated, nor will all of those that are found necessarily show signs of entanglement or other human interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interactions.

In addition to animals included in the stranding database, during 2008-2012, there were 2 at-sea observations in Barataria Bay of dolphins entangled in fishing gear (monofilament line). The observations occurred during 2011 and 2012, and both dolphins were considered seriously injured (Maze-Foley and Garrison in prep a,b).

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010; and, as of 2013, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, 23 stranded dolphins from this stock were considered to be part of the UME; during 2011, 33 dolphins, and during 2012, 15 dolphins. One earlier mortality event that occurred from January through May 1990 and included 367 bottlenose dolphin strandings in the northern Gulf of Mexico may have affected the BBES Stock as well. Strandings were reported in the Barataria Bay area during the time of the 1990 mortality event, but there is little information available on the impact of the event on the BBES Stock. The cause of the 1990 mortality event could not be determined (Hansen 1992).

The problem of dolphin depredation of fishing gear is increasing in Gulf of Mexico coastal and estuary waters and illegal feeding or provisioning of wild bottlenose dolphins has been documented in Florida and Texas (Bryant 1994; Samuels and Bejder 2004; Cunningham-Smith *et al.* 2006; Powell and Wells 2011). There are emerging questions regarding potential linkages between provisioning and depredation of recreational fishing gear and associated entanglement and ingestion of gear. To date there are no records of depredation or provisioning for this stock area however.

Table 1. Bottlenose dolphin strandings occurring in the Barataria Bay Estuarine System Stock area from 2008 to 2012, as well as number of strandings for which evidence of human interaction (HI) was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interaction. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 13 September 2012 [for 2008-2011 data] and 15 April 2013 [for 2012 data]). Please note human interaction does not necessarily mean the interaction caused the animal's death.

Stock	Category	2008	2009	2010	2011	2012	Total
Barataria Bay Estuarine System Stock	Total Stranded	4	0	23[a]	33[a]	15[a]	75
	Human Interaction						
	---Yes	0	0	1[b]	10[c]	1[d]	12
	---No	2	0	1	3	2	8
	---CBD	2	0	21	20	12	55

[a] All strandings were part of the ongoing UME event in the northern Gulf of Mexico.
[b] This mortality stranded visibly oiled.
[c] Six HIs were animals stranded visibly oiled (mortalities); 1HI was an entanglement in commercial blue crab pot gear (mortality); and 2 HIs were entanglement interactions with the recreational hook and line fishery (1 mortality and 1 animal disentangled and released alive without serious injury).
[d] This mortality had a gunshot wound and was visibly oiled.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and over 87 days ~4.9 million barrels of oil were discharged from the wellhead until it was capped on 15 July 2010 (McNutt *et al.* 2012). During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al*. 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

A substantial number of beaches and wetlands along the Louisiana coast experienced heavy or moderate oiling (OSAT-2 2011; Michel *et al.* 2013). The heaviest oiling in Louisiana occurred west of the Mississippi River on the Mississippi Delta and in Barataria and Terrebonne Bays, and to the east of the river on the Chandeleur Islands. Some heavy to moderate oiling occurred on Alabama and Florida beaches, with the heaviest stretch occurring from Dauphin Island, Alabama, to Gulf Breeze, Florida. Light to trace oil was reported along the majority of Mississippi's mainland coast, from Gulf Breeze to Panama City, Florida, and outside of Atchafalaya and Vermilion Bays in western Louisiana. Heavy to light oiling occurred on Mississippi's barrier islands (Michel *et al.* 2013).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, continental shelf, coastal and estuarine marine mammals. The research is ongoing. For coastal and estuarine dolphins, the NOAA-led efforts include: active surveillance to detect stranded animals in remote locations; aerial surveys to document the distribution, abundance, species and exposure of marine mammals and sea turtles relative to oil from DWH spill; assessment of sublethal and chronic health impacts on coastal and estuarine bottlenose dolphins in Barataria Bay, Louisiana, and a reference site in Sarasota Bay, Florida; and assessment of injuries to dolphin stocks in Barataria Bay and Chandeleur Sound, Louisiana, Mississippi Sound, and as a reference site, St. Joseph Bay, Florida.

During August 2011, a live capture and release bottlenose dolphin health assessment was conducted in Barataria Bay and a reference site (Sarasota Bay). Preliminary findings from the NRDA health assessment indicate the health of many of the dolphins is compromised (Schwacke *et al.* 2014). Barataria Bay dolphins were 5 times more likely to have moderate-severe lung disease and many showed evidence of compromised adrenal function. Based on the observed disease conditions, 17% of the dolphins sampled in Barataria Bay were given a poor prognosis, indicating that they would likely not survive. The disease conditions in Barataria Bay dolphins were greater in prevalence and severity as compared to the reference site, as well as compared to disease previously reported in other wild populations (Schwacke *et al.* 2014).

The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal’s ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990).

Besides oil exposure, another habitat concern for BBES Stock dolphins is the degredation and loss of wetland habitat within the Barataria Bay Estuarine System. Wetland loss can be attributed to both natural processes and human activities (Committee on the Future of Coastal Louisiana 2002; Louisiana Coastal Wetlands Conservation and Restoration Task Force 2012). Natural erosional processes include herbivory, subsidence, sea-level rise, storms, winds and tides, and human activities include levee construction, channelization (navigational channels and oil and gas canals) and development. Critical problems contributing to wetland loss are considered to be the loss of freshwater and sediment input from the Mississippi River due to levee construction, and barrier island erosion. These problems result in land loss, changes in vegetation and increased salinity in lower Barataria Bay. As wetlands disappear, productivity and biodiversity of the Barataria Bay Estuarine System decrease (Committee on the Future of Coastal Louisiana 2002; Louisiana Coastal Wetlands Conservation and Restoration Task Force 2012).

STATUS OF STOCK

Common bottlenose dolphins are not listed as threatened or endangered under the Endangered Species Act. However, because an UME of unprecedented size and duration (began 1 February 2010 and is ongoing) has impacted the northern Gulf of Mexico, including Barataria Bay, and because the health assessment findings of Schwacke *et al.* (2014) indicate compromised health of dolphins sampled within Barataria Bay, NMFS considers this stock to be strategic under the MMPA. The total human-caused mortality and serious injury for this stock is unknown and there is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. The status of the BBES stock relative to OSP is unknown. There are insufficient data to determine population trends for this stock.

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*)
Mississippi Sound, Lake Borgne, Bay Boudreau Stock

NOTE – NMFS is in the process of writing individual stock assessment reports for each of the 31 bay, sound and estuary stocks of common bottlenose dolphins in the Gulf of Mexico. Until this effort is completed and 31 individual reports are available, some of the basic information presented in this report will also be included in the report: "Northern Gulf of Mexico Bay, Sound and Estuary Stocks".

STOCK DEFINITION AND GEOGRAPHIC RANGE

Common bottlenose dolphins are distributed throughout the bays, sounds and estuaries of the northern Gulf of Mexico (Mullin 1988). Long-term (year-round, multi-year) residency by at least some individuals has been reported from nearly every site where photographic identification (photo-ID) or tagging studies have been conducted in the Gulf of Mexico (e.g., Irvine and Wells 1972; Shane 1977; Gruber 1981; Irvine *et al.* 1981; Wells 1986; Wells *et al.* 1987; Scott *et al.* 1990; Shane 1990; Wells 1991; Bräger 1993; Bräger *et al.* 1994; Fertl 1994; Wells *et al.* 1996a,b; Wells *et al.* 1997; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Wells 2003; Hubard *et al.* 2004; Irwin and Würsig 2004; Shane 2004; Balmer *et al.* 2008; Urian *et al.* 2009; Bassos-Hull *et al.* 2013). In many cases, residents predominantly use the bay, sound or estuary waters, with limited movements through passes to the Gulf of Mexico (Shane 1977; Shane 1990; Gruber 1981; Irvine *et al.* 1981; Shane 1990; Maze and Würsig 1999; Lynn and Würsig 2002; Fazioli *et al.* 2006; Bassos-Hull *et al.* 2013). Early studies indicating year-round residency to bays in both the eastern and western Gulf of Mexico led to the delineation of 33 bay, sound and estuary stocks, including Mississippi Sound, Lake Borgne, Bay Boudreau, with the first stock assessment reports published in 1995.

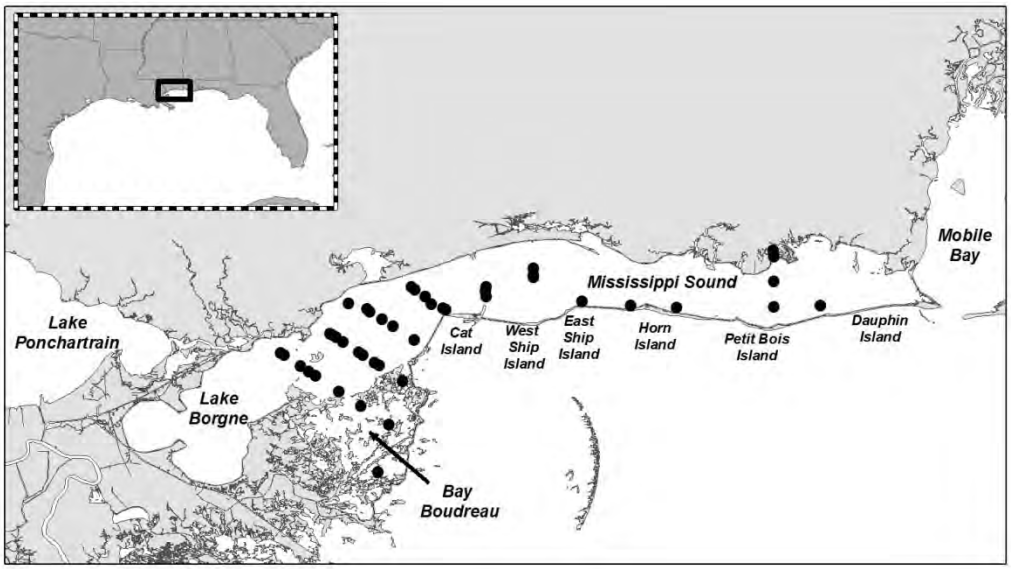

Figure 1. *Geographic extent of the Mississippi Sound, Lake Borgne, Bay Boudreau Stock, located on the coasts of Alabama, Mississippi and Louisiana. Dark circles indicate sightings of common bottlenose dolphins during aerial surveys conducted in spring, summer and fall of 2011 and in winter of 2012.*

More recently, genetic data also support the concept of relatively discrete, demographically independent bay, sound and estuary stocks (Duffield and Wells 2002; Sellas *et al.* 2005). Sellas *et al.* (2005) examined population subdivision among Sarasota Bay, Tampa Bay, and Charlotte Harbor, Florida; Matagorda Bay, Texas; and the coastal Gulf of Mexico (1-12 km offshore) from just outside Tampa Bay to the south end of Lemon Bay, and found evidence of significant population structure among all areas on the basis of both mitochondrial DNA control region sequence data and 9 nuclear microsatellite loci. The Sellas *et al.* (2005) findings support the identification of bay, sound and estuary populations distinct from those occurring in adjacent Gulf coastal waters. Differences in reproductive seasonality from site to site also suggest genetic-based distinctions among areas (Urian *et al.* 1996). Photo-ID and genetic data from several inshore areas of the southeastern United States also support the existence of resident estuarine animals and a differentiation between animals biopsied along the Atlantic coast and those biopsied

within estuarine systems at the same latitude (Caldwell 2001; Gubbins 2002; Zolman 2002; Mazzoil *et al.* 2005; Litz 2007; Rosel *et al*. 2009; NMFS unpublished).

The Mississippi Sound, Lake Borgne, Bay Boudreau Stock area (Figure 1) is complex with an estimated surface area of 3,711 km^2 (Scott *et al*. 1989). Mississippi Sound itself has a surface area of about 2,100 km^2 (Eleuterius 1978a,b) and is bounded by Mobile Bay in the east, Lake Borgne in the west, and the opening to Bay Boudreau in the southwest. It is bordered to the north by the mainlands of Louisiana, Mississippi and Alabama and to the south by six barrier islands: Cat, West Ship, East Ship, Horn, Petit Bois and Dauphin Islands (Eleuterius 1978b), and in the extreme west, Louisiana marshes. Mississippi Sound is an open embayment with large passes between the barrier islands allowing broad access to the Gulf of Mexico, including two dredged shipping channels. Average depth at mean low water is 2.98 m, and tides are diurnal with an average range of 0.57 m (Eleuterius 1978b). Sea surface temperature ranges seasonally from 9˚C to 32˚C and salinity from 0 to 33 ppt from winter to summer, respectively (Christmas 1973). The bottom type is soft substrate consisting of mud and/or sand (Moncreiff 2007). Lake Borgne and Bay Boudreau are part of the Pontchartrain Basin and are remnants of the Saint Bernard lobe of Mississippi River Delta that existed until about 2000 years ago when the Mississippi River changed course (Roberts 1997; Penland *et al.* 2013). Lake Borgne has an average depth of 3 m and an average salinity of 7 ppt (USEPA 1999). Bay Boudreau is a large shallow complex in the Saint Bernard marshes and consists of marshes, bayou, shallow bays and points (Penland *et al*. 2013).

The Mississippi Sound, Lake Borgne, Bay Boudreau Stock area ("MS Sound Region") configuration is in part a result of the management of the live-capture fishery for bottlenose dolphins (Scott 1990). Mississippi Sound was once the site of the largest live-capture fishery of bottlenose dolphins in North America (Reeves and Leatherwood 1984). Between 1973 and 1988, of the 533 bottlenose dolphins removed from Southeastern U.S. waters, 202 were removed from Mississippi Sound and adjacent waters (Scott 1990). In 1989, the Alliance of Marine Mammal Parks and Aquariums declared a self-imposed moratorium on the capture of bottlenose dolphins in the Gulf of Mexico (Corkeron 2009).

Passage of the Marine Mammal Protection Act in 1972 and the concomitant need to manage the live-capture fishery for bottlenose dolphins was the impetus for much of the earliest bottlenose dolphin research in the MS Sound Region. This work focused on estimating the abundance of bottlenose dolphins (see below) and, to a lesser extent, on stock structure research primarily to provide live-capture quota recommendations (Scott 1990). To gather baseline biological data and study dolphin ranging patterns, 57 bottlenose dolphins were captured from Mississippi Sound, freeze-branded and released from 1982-1983 (Solangi and Dukes 1983; Lohoefener *et al.* 1990*a*). Re-sighting efforts for these dolphins conducted from 1982-1985 by Lohoefener *et al.* (1990a) suggested at least some individual dolphins exhibited fidelity for specific areas within Mississippi Sound.

The first dedicated photo-ID effort in the area undertaken by Hubard *et al.* (2004) during 1995-1996 established a working photo-ID catalog for Mississippi Sound. Photo-ID data suggested that some individual dolphins, seen multiple times, displayed spatial and temporal patterns of site fidelity, and some dolphins showed preferences to different habitats, particularly barrier islands, channels or mainland coasts (Hubard *et al.* 2004). Some individuals were seen in the same seasons both years, while others were seen in multiple seasons with a gap during winter months (Hubard *et al.* 2004). During photo-ID/line transect surveys in 1995 and 1996, several animals photographed in 1991 (Mullin and Hoggard 1992a,b) were re-sighted (Hubard *et al.* 2004). Also, two dolphins freeze branded during the live capture performed by Solangi and Dukes (1983) were re-sighted by Hubard *et al.* (2004).

Mackey (2010) also examined site fidelity as well as residency patterns of bottlenose dolphins in a portion of Mississippi Sound using photo-ID data. During 2004-2007, Mackey (2010) primarily followed dolphins near and on both the Gulf and sound sides the barrier islands and along the Gulfport Shipping Channel and identified three different residency patterns. Of the 687 dolphins identified in those surveys, 71 (10%) were classified as year-round residents, 109 (16%) as seasonal residents, and 498 (73.5%) as transients. These patterns may not be representative of the MS Sound Region. Dolphins sighted near the barrier islands adjacent to or within the range of the Northern Coastal Stock of bottlenose dolphins may have a higher probability of being transient. Outside of the ship channel, a small proportion of the dolphins sighted by Mackey (2010) were from the interior two-thirds of Mississippi Sound (adjacent to the mainland) where dolphins may have quite different residency patterns. Mackey (2010) also identified two animals that were freeze-branded during the live captures 20 years earlier (Solangi and Dukes 1983). Both Mackey (2010) and Hubard *et al.* (2004) noted low re-sighting rates of dolphins with a high percentage of dolphins seen only on one occasion. Both studies also suggested dolphins move out of the Sound into deeper Gulf of Mexico waters during winter months (Hubard *et al*. 2004; Mackey 2010). Definitive conclusions on bottlenose dolphin site fidelity and residency patterns in the MS Sound Region are difficult to make based on available research. Establishing residency patterns in the MS Sound Region using photo-ID studies that cover large study areas (e.g., Hubard *et al*. 2004) will be difficult because of the large number of dolphins that inhabit the area and its

open geography. Nevertheless, studies to date indicate that, similar to other Gulf of Mexico areas, some individuals are long-term inhabitants of the MS Sound Region. The current stock boundary does not include any coastal waters outside of the barrier islands. Further research is needed to determine the degree to which dolphins of this stock utilize nearshore coastal waters outside the MS Sound Region. The stock boundaries are subject to change upon further study of dolphin residency patterns in estuarine waters of Alabama, Mississippi and Louisiana. Information on the use of coastal waters will be important when considering exposure to coastal fisheries as estuarine animals that make use of nearshore coastal waters would be at risk of entanglement in fishing gear while moving along the coast. Ongoing NOAA photo-ID surveys initiated in 2010, as well as data from tracking of 19 bottlenose dolphins tagged with satellite-linked transmitters in and around Mississippi Sound in July 2013, will address some of these issues as the data become available.

POPULATION SIZE

The best available abundance estimate for the Mississippi Sound, Lake Borgne, Bay Boudreau Stock of bottlenose dolphins is 901 (CV=0.63) based on a winter 2012 aerial survey.

Recent surveys and abundance estimates

The Southeast Fisheries Science Center conducted aerial surveys of continental shelf waters (shoreline to 200 m depth) along the U.S. Gulf of Mexico coast from the Florida Keys to the Texas/Mexico border during spring (March-April) 2011, summer (July-August) 2011, fall (October-November) 2011 and winter (January-February) 2012. The surveys were conducted along tracklines oriented perpendicular to the shoreline and spaced 20-30 km apart. The total survey effort varied during each survey due to weather conditions, but ranged between 13,500 – 15,600 km. Each of these surveys was conducted using a two-team approach to develop estimates of visibility bias using the independent observer approach with Distance analysis (Laake and Borchers 2004). A model for the probability of detection on the trackline as a function of sighting conditions (seas state, glare, water color, etc.) was developed using data across all four surveys. This model was then applied to detection probability functions specific to each survey to account for the probability of detection as a function of distance from the trackline and additional environmental covariates. A bootstrap resampling approach was used to estimate the variance of the estimates. The survey data were post-stratified into spatial boundaries corresponding to the defined boundaries of bottlenose dolphin stocks within the surveyed area. The abundance estimates for the Mississippi Sound, Lake Borgne, Bay Boudreau Stock of bottlenose dolphins were based upon tracklines and sightings in waters along the Alabama, Mississippi and Louisiana coasts inside of the barrier islands. The surveys did not include tracklines in Lake Borgne, but the estimated density was extrapolated to include the entire stock area. The seasonal abundance estimates for this stock were: spring – 2,395 (CV=0.42), summer – 1,709 (CV= 0.59), fall – 1,140 (CV=0.41) and winter – 900 (CV=0.63). As with other bay, sound and estuary stocks, it is possible that there is movement of transient animals from coastal waters into the MS Sound region on a seasonal basis. In order to assure that the abundance estimate for the stock reflects primarily resident animals, the lowest seasonal estimate (winter) was used to determine N_{best} for this stock. The resulting best estimate of abundance for the Mississippi Sound, Lake Borgne, Bay Boudreau Stock of bottlenose dolphins was 900 (CV=0.63).

Earlier abundance estimates

Aerial and small boat surveys conducted in the MS Sound Region covered different portions of the region and yielded a wide range of abundance estimates for bottlenose dolphins. Because of the differences in techniques and areas surveyed, it is very difficult to compare results. Aerial strip transect surveys conducted by Leatherwood *et al.* (1978) compared aerial survey techniques for bottlenose dolphins, but the study also produced population estimates for bottlenose dolphins in Mississippi Sound and the adjacent Gulf of Mexico (to about 10 km south of the barrier islands) of 1,342±847 in 1974 and 879±368 in 1975. Thompson (1982) surveyed central Mississippi Sound ("off Pascagoula") in 1980 using aerial line-transect sampling methods, and abundance estimates ranged from 93 dolphins (SE=22) in December 1980 to 140 dolphins (SE=86) in September 1980. While line-transect is a rigorous and repeatable survey method, this study produced negatively biased estimates of density and abundance (Thompson 1982) due to the fact that the strip of transect directly under the aircraft was not observed. Scott *et al.* (1989) attempted to correct this bias by utilizing an aircraft with a glass bubble nose and placing an observer in it to observe the track-line at all times. Their estimates for the MS Sound Region ranged from 205 in winter to 858 in summer. (Abundances for Mississippi Sound only ranged from 136 dolphins in winter to 719 dolphins in summer.) Boat-based mark-recapture surveys using dolphins freeze-branded during a previous live-capture study were performed by Lohoefener *et al.* (1990a) to assess the impacts of removing 30 dolphins from the population for captivity. The pre-removal estimate was 2,392 dolphins, and the post-removal estimate was 7,052 dolphins (Lohoefener *et al.*

1990a), but these were probably not accurate estimates, as too many assumptions of mark-recapture analysis were likely violated in this study (Lohoefener *et al.* 1990a). Boat-based line-transect abundance surveys of Mississippi Sound (about 55% of the MS Sound Region) were carried out by Lohoefener *et al*. (1990b) in 1984 and 1985, yielding much higher abundance estimates than aerial strip- or line-transect surveys and suggesting a seasonal shift in bottlenose dolphin abundance. For the entire Sound, abundance estimates were 2,400 and 500 dolphins for summer and winter, respectively. Another series of line-transect aerial surveys were performed in fall of 1992 by Blaylock and Hoggard (1994), where the abundance was reported as 1,401 for the MS Sound Region. The two most recent abundance estimates from Mississippi Sound were boat-based line-transect surveys and only covered a portion of Mississippi Sound. Hubard *et al.* (2004) surveyed an area bounded by the western end of Horn Island and the eastern end of Petit Bois Island that was roughly one-quarter the size of the entire Sound. Again, abundances were found to fluctuate seasonally with higher abundances observed in summer months in 1995 (584 dolphins) and 1996 (555 dolphins) versus winter 1995-1996 months (268 dolphins). Miller *et al.* (2013) reported abundance estimates for a study area in eastern Mississippi Sound roughly 2,104 km^2 in size that included areas up to 15 km south of the barrier islands. Abundance estimates were 2,255 dolphins in summer 2007 and 1,413 dolphins in winter 2007-2008 (Miller *et al.* 2013).

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for this stock of bottlenose dolphins is 901 (CV=0.63). The minimum population estimate for the MS Sound Region is 551 bottlenose dolphins.

Current Population Trend

There are insufficient data to determine the population trends for this stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of bottlenose dolphins in the MS Sound Region is 551. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is of unknown status. PBR for the Mississippi Sound, Lake Borgne, Bay Boudreau Stock of bottlenose dolphins is 5.6.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury of bottlenose dolphins in the MS Sound Region during 2008-2012 is unknown. During 2008-2012, 2 mortalities were documented in the Gulf of Mexico menhaden purse seine fishery, 3 mortalities were documented involving the Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) fishery, and 1 mortality was documented in the Gulf of Mexico blue crab trap/pot fishery. In addition, 1 mortality was documented in a research gillnet, and 1 mortality occurred incidental to sea turtle relocation trawling. It is not possible to estimate the total number of mortalities or serious injuries associated with menhaden purse seine, hook and line, or blue crab trap/pot fisheries since there are no systematic observer programs for those fisheries.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

The commercial fisheries that potentially could interact with this stock are the Category II Southeastern U.S. Atlantic, Gulf of Mexico shrimp trawl, Gulf of Mexico menhaden purse seine and the Category III Gulf of Mexico blue crab trap/pot and Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) fisheries (Appendix III).

Menhaden Purse Seine Fishery

During 2008-2012, there were 2 mortalities and 1 animal released alive without serious injury documented within waters of the MS Sound Region involving the menhaden purse seine fishery.

There is currently no observer program for the Gulf of Mexico menhaden purse seine fishery; however, recent incidental takes have been reported via two sources. First, during 2011, a pilot observer program operated from May through September, and observers documented 3 dolphins trapped within purse seine nets. All 3 were released alive without serious injury (Maze-Foley and Garrison in prep). Two of the 3 dolphins were trapped within a single purse seine within waters of the Western Coastal Stock, and the third animal was trapped in waters of the MS Sound Region. Second, through the Marine Mammal Authorization Program (MMAP), there have been 13 self-reported incidental takes (all mortalities) of bottlenose dolphins in northern Gulf of Mexico coastal and estuarine waters by the menhaden purse seine fishery. These takes likely affected the following stocks: Western Coastal Stock; Northern Coastal Stock; Mississippi Sound, Lake Borgne, Bay Boudreau Stock; and Mississippi River Delta Stock. Specific self-reported takes under the MMAP likely involving the MS Sound Region are as follows: two dolphins were reported taken in a single purse seine during 2012 in waters of Mississippi Sound; one take of a single unidentified dolphin was reported during 2002 in waters of Mississippi Sound; and during 2000, 3 bottlenose dolphins were reported taken in a single purse seine in waters of Mississippi Sound.

Without an ongoing observer program it is not possible to obtain statistically reliable information for this fishery on the number of sets annually, the incidental take and mortality rates, and the communities from which bottlenose dolphins are being taken.

Hook and Line Fisheries

During 2008-2012 there were 3 mortalities for which hook and line gear entanglement or ingestion were documented. Two mortalities occurred during 2011 and 1 during 2012. These mortalities were included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 [for 2008-2011 data] and 15 April 2013 [for 2012 data]) and are included in the totals presented in Table 1.

Blue Crab Trap/Pot Fishery

During 2008-2012 there was 1 documented mortality of a bottlenose dolphin in commercial blue crab trap/pot gear. The mortality occurred during 2011 and was included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 and 15 April 2013) and in the totals presented in Table 1. There is no systematic observer coverage of crab trap/pot fisheries, so it is not possible to quantify total mortality.

Shrimp Trawl Fishery

During 2008-2012 there were no documented interactions with the commercial shrimp trawl fishery within the MS Sound Region; however, it should be noted that observer coverage of the shrimp trawl fishery does not extend into bay, sound and estuary waters.

Other Mortality

From 2008 to 2012, 306 bottlenose dolphins were reported stranded within the MS Sound Region (Table 1; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, 13 September 2012 and 15 April 2013). Evidence of human interactions was detected for 18 stranded dolphins. Human interactions were from numerous sources, including 3 entanglements with hook and line gear, 1 entanglement with commercial blue crab trap/pot gear, 1 incidental take in a research gillnet, 1 incidental take during turtle relocation trawling, 2 gunshot wounds, and 2 animals that were visibly oiled (see Table 1). Stranding data probably underestimate the extent of human-caused mortality and serious injury because not all of the marine mammals that die or are seriously injured in human interactions are discovered, reported or investigated, nor will all of those that are found necessarily show signs of entanglement or other human interaction. Finally, the level of technical expertise among stranding

network personnel varies widely as does the ability to recognize signs of human interactions.

The MS Sound Region has been affected by several bottlenose dolphin die-offs or Unusual Mortality Events (UMEs). From January through May 1990, a total of 367 bottlenose dolphins stranded in the northern Gulf of Mexico including Mississippi. Overall this represented a two-fold increase in the prior maximum recorded number of strandings for the same period, but in some locations (i.e., Alabama) strandings were 10 times the average number. The cause of the 1990 mortality event could not be determined (Hansen 1992). In 1996 a UME was declared for bottlenose dolphins in Mississippi when 27 bottlenose dolphins stranded during November and December. The cause was not determined, but a *Karenia brevis* (red tide) bloom was suspected to be responsible. A UME was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010; and, as of 2013, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, 92 stranded dolphins from this stock were considered to be part of the UME; during 2011, 115 dolphins, and during 2012, 45 dolphins.

One mortality was documented in 2011 in the MS Sound Region as a result of an entanglement in a research gillnet. This mortality was included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 and 15 April 2013) and in the totals presented in Table 1.

As part of its annual coastal dredging program, the Army Corps of Engineers conducts sea turtle relocation trawling during hopper dredging as a protective measure for marine turtles. One bottlenose dolphin mortality was documented during 2011 in MS Sound Region incidental to relocation trawling activities. This mortality was included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 and 15 April 2013) and in the totals presented in Table 1.

The problem of dolphin depredation of fishing gear is increasing in Gulf of Mexico coastal and estuary waters and illegal feeding or provisioning of wild bottlenose dolphins has been documented in Florida and Texas (Bryant 1994; Samuels and Bejder 2004; Cunningham-Smith *et al.* 2006; Powell and Wells 2011). There are emerging questions regarding potential linkages between provisioning and depredation of recreational fishing gear and associated entanglement and ingestion of gear. To date there are no records of provisioning for this stock area. However, one recent case of a shrimp fisherman illegally "taking" a dolphin in Mississippi Sound occurred during summer 2012. In December 2013 the fisherman was convicted under the MMPA for knowingly shooting a dolphin with a shotgun while shrimping.

Table 1. Common bottlenose dolphin strandings occurring in the Mississippi Sound, Lake Borgne, Bay Boudreau Stock area from 2008 to 2012, as well as number of strandings for which evidence of human interaction was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interaction (HI). Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 13 September 2012 [for 2008-2011 data] and 15 April 2013 [for 2012 data]). Please note human interaction does not necessarily mean the interaction caused the animal's death.

Stock	**Category**	**2008**	**2009**	**2010**	**2011**	**2012**	**Total**
Mississippi Sound, Lake Borgne, Bay Boudreau Stock	Total Stranded	16	36	93[a]	116[b]	45[c]	306
	Human Interaction						
	---Yes	0	1	7[d]	7[e]	3[f]	18
	---No	2	3	2	5	1	13
	---CBD	14	32	84	104	41	275

[a] 92 strandings were part of the ongoing UME event in the northern Gulf of Mexico.
[b] 115 strandings were part of the ongoing UME event in the northern Gulf of Mexico.
[c] All 45 strandings were part of the ongoing UME event in the northern Gulf of Mexico.
[d] Includes 2 strandings that were visibly oiled.
[e] Includes 2 entanglement interactions (mortalities) with hook and line fishing gear, 1 entanglement interaction (mortality) with commercial blue crab trap/pot gear, 1 mortality incidental to sea turtle relocation trawling, and 1 entanglement interaction (mortality) with a research gillnet.
[f] Includes 1entanglement interaction (mortality) with hook and line fishing gear and 2 stranded animals (mortalities) with gunshot wounds.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and over 87 days ~4.9 million barrels of oil were discharged from the wellhead until it was capped on 15 July 2010 (McNutt *et al.* 2012). During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al*. 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Given the trajectory of the surface oil during the spill and the documented oiling of shoreline (Michel *et al.* 2013), it is likely the Mississippi Sound, Lake Borgne, Bay Boudreau Stock of bottlenose dolphins was exposed to oil during the event. Light to trace oil was reported along the majority of Mississippi's mainland coast, from Gulf Breeze to Panama City, Florida, and outside of Atchafalaya and Vermilion Bays in western Louisiana. Heavy to light oiling occurred on Mississippi's barrier islands (Michel *et al.* 2013). A substantial number of beaches and wetlands along the Louisiana coast experienced heavy or moderate oiling (OSAT-2 2011; Michel *et al.* 2013). The heaviest oiling in Louisiana occurred west of the Mississippi River on the Mississippi Delta and in Barataria and Terrebonne Bays, and to the east of the river on the Chandeleur Islands. Some heavy to moderate oiling occurred on Alabama and Florida beaches, with the heaviest stretch occurring from Dauphin Island, Alabama, to Gulf Breeze, Florida.

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, continental shelf, coastal and estuarine marine mammals. The research is ongoing. For coastal and estuarine dolphins, the NOAA-led efforts include: active surveillance to detect stranded animals in remote locations; aerial surveys to document the distribution, abundance, species and exposure of marine mammals and sea turtles relative to oil from DWH spill; assessment of sublethal and chronic health impacts on coastal and estuarine bottlenose dolphins in Barataria Bay, Louisiana, and a reference site in Sarasota Bay, Florida; and assessment of injuries to dolphin stocks in Barataria Bay and Chandeleur Sound, Louisiana, Mississippi Sound, and as a reference site, St. Joseph Bay, Florida.

Coastal dolphins have been observed with tar balls attached to them and seen swimming through oil slicks close to shore and inland bays. The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal’s ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990).

Besides oil exposure, another habitat concern for the MS Sound Region is environmental contaminants. Persistent organic pollutant (PCBs, chlordanes, mirex, DDTs, HCB and dieldrin) and polybrominated diphenyl ether concentrations were determined from bottlenose dolphin blubber samples from 14 locations, including Mississippi Sound, along the U.S. Atlantic and Gulf coasts and Bermuda (Kucklick *et al.* 2011). Dolphins from both rural and urban estuarine and coastal waters were sampled. Dolphins sampled from Mississippi Sound had relatively high concentrations of some pollutants, like PBDEs, HCB, mirex and DDTs, and more intermediate concentrations of dieldrin, PCBs and chlordanes, when compared to dolphins sampled from the other 13 locations (Kucklick *et al.* 2011).

The presence of vessels may impact bottlenose dolphin behavior in bays, sounds and estuaries. Miller *et al.* (2008) investigated the immediate responses of bottlenose dolphins to “high-speed personal watercraft” (i.e., boats) in Mississippi Sound. They found an immediate impact on dolphin behavior demonstrated by an increase in traveling behavior and dive duration, and a decrease in feeding behavior for non-traveling groups. The findings suggested dolphins attempted to avoid high-speed personal watercraft. It is unclear whether repeated short-term effects will result in long-term consequences like reduced health and viability of dolphins. Further studies are needed to determine the impacts throughout the Gulf of Mexico.

STATUS OF STOCK

Bottlenose dolphins are not listed as threatened or endangered under the Endangered Species Act. However, because an UME of unprecedented size and duration (began 1 February 2010 and is ongoing) has impacted the northern Gulf of Mexico, including the Mississippi Sound, Lake Borgne, Bay Boudreau Stock, NMFS considers this stock to be strategic under the MMPA. The total human-caused mortality and serious injury for this stock is unknown and there is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. The status of this stock relative to OSP is unknown. There are insufficient data to determine population trends for this stock.

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Appendix I: Estimated serious injury and mortality (SI&M) of Western North Atlantic marine mammals listed by U.S. observed fisheries. Marine mammal species with zero (0) observed SI&M are not shown in this table. (unk = unknown).

Category, Fishery, Species	Yrs. observed	observer coverage	Est. SI by Year (CV)	Est. Mortality by Year (CV)	Mean Annual Mortality (CV)	PBR
CATEGORY I						
Gillnet Fisheries: Northeast gillnet						
Harbor porpoise	2008-2012	.05, .04, .17, .19, .15		666 (.48), 591(.23), 387(.27), 273(.20), 277(.59)	439(.18)	706
Atlantic white sided dolphin	2008-2012	.05, .04, .17, .19, .15	5, 0, 4, 1, 0	81(.57), 0, 66(.9), 18(.43), 9(.92)	35(.44)	304
Short-beaked common dolphin	2008-2012	.05, .04, .17, .19, .15		34(.77), 43(.77), 69(.81), 49(.71), 95(.40)	56(.29)	1,125
Long-finned pilot whale	2008-2012	.05, .04, .17, .19, .15		0, 0, 3(.82), 0, 0	0.6(.82)	199
Risso's dolphin	2008-2012	.05, .04, .17, .19, .15		0, 0, 0, 0, 6(.87)	1.2 (.87)	126
Harbor seal	2008-2012	.05, .04, .17, .19, .15		242(.41), 513(.28), 540(.25), 343(.19), 252(.26)	378 (.13)	2,006
Gray seal	2008-2012	.05, .04, .17, .19, .15		618(.23), 1063(.26), 1,155(.28), 1,550(.22), 542(.19)	974(.12)	unk
Harp seal	2007-2011	.07, .05, .04, .17, .19		119(.35), 238(.38), 415(.27), 253(.61), 14(.46)	218(.20)	unk
Gillnet Fisheries:US Mid-Atlantic gillnet						
Harbor porpoise	2008-2012	.03, .03, .04, .02, .02		350(.75), 201(.55), 259(.88), 123(.41), 63(.83)	199(.37)	706
Short-beaked common dolphin	2008-2012	.03, .03, .04, .02, .02		0, 0, 30(.48), 29(.53), 15(.93)	15(.34)	1,125
Harbor seal	2008-2012	.03, .03, .04, .02, .02		88(.74), 47(.68), 89(.39), 21(.67), 0	49(.33)	2,006
Harp Seal	2007-2011	.06, .03, .03, .04, .02		38(.9), 176(.74), 70(.67), 32(.93), 0	63(.46)	unk
Gray Seal	2008-2012	.03, .03, .04, .02, .02		0, 0, 267(.75), 19(.60), 14(98)	60(.67)	unk
Longline Fisheries: Pelagic longline (excluding NED-E)						
Risso's dolphin	2008-2012	.07, .10, .08, .09, .07	17(.73), 11(.71), 0, 12(.63), 15 (1.0)	0, 0, 0, 0, 0	11(.41)	126
Short-finned pilot whale	2008-2012	.07, .10, .08, .09, .07	80(.50), 17(.70), 127(.78), 286 (.29), 170(.33)	0, 0, 0, 19, 0	140 (.21)	159
Short-beaked common dolphin	2008-2012	.07, .10, .08, .09, .07	0, 0, 0, 0, 0	0, 8.5(1.0), 0, 0, 0	1.7(1.0)	1,125
Common bottlenose dolphin (offshore)	2008-2012	.07, .10, .08, .09, .07	0,8.8(1.0),0,0, 61.8(.68)	0, 0, 0, 0, 0	141(.61)	561
CATEGORY II						
Mid-Atlantic Mid-Water Trawl – Including Pair Trawl						
Risso's dolphin	2008-2012	.13, .13, .25, .41,		na, 0, 0, 0, 0	0.2	126

		.21				
White-sided dolphin	2008-2012	.13, .13, .25, .41, .21		15(.73), 4.3(.92), 0, 0, 0	3.8(0.61)	304
Short-beaked common dolphin	2008-2012	.13, .13, .25, .41, .21		3.2(.70), 0, 0, 0, 0	0.6 (.70)	1,125
Gray Seal	2008-2012	.13, .13, .25, .41, .21		0, 0, na, 0, 0	0.2	unk
Harbor Seal	2008-2012	.13, .13, .25, .41, .21		0, 0, na, 0, 0	0.2	2,006
Trawl Fisheries:Northeast bottom trawl						
Harp seal	2007-2011	.06, .08, .09, .16, .26		unk, 0, 0, 0, unk	unk	unk
Harbor seal	2008-2012	.08, .09, .16, .26, .17	0, 0, 0, 0, 0	0, 0, 0, 9(.58), 3(1)	2.4(0.5)	2,006
Gray seal	2008-2012	.08, .09, .16, .26, .17		16(.52), 22(.46), 30(.34), 58(.25), 37(.49)	33(.18)	unk
Risso's dolphin	2008-2012	.08, .09, .16, .26, .17		2(.56), 3(.53), 2(.55), 3(.55), 0	2.0 (.30)	126
Common bottlenose dolphin (offshore)	2008-2012	.08, .09, .16, .26, .17	0, 0, 0, 0, 0	19(.88),18(.92),4(.53),10(.84), 0	10(.49)	561
Long-finned pilot whale	2008-2012	.08, .09, .16, .26, .17		21(.51, 13(.70), 30 (43), 55(.18), 33(.32)	31(0.16)	199
Short-beaked common dolphin	2008-2012	.08, .09, .16, .26, .17	0, 1, 3, 2, 0	6(.99), 23(.60), 111(.32), 70(.37), 40(.54)	55 (.21)	1,125
Atlantic white-sided dolphin	2008-2012	.08, .09, .16, .26, .17	0, 3, 1, 3, 0	13(.57), 168(.28), 36(.32), 138(.24), 27(.47)	77(.16)	304
Minke whale	2008-2012	.08, .09, .16, .26, .17		7.8(.69), 0, 0, 0, 0	1.6(.69)	162
Harbor porpoise	2008-2012	.08, .09, .16, .26, .17	1.9, 0, 0, 2.0, 0	3.7(.97), 0, 0, 3.9(.71), 0	2.3(.60)	706
Mid-Atlantic Bottom Trawl						
Atlantic white-sided dolphin	2008-2012	.03, .05, .06, .08, .05		21(.24), 16(.18), 16(.16), 22(.14)	20(.09)	304
Short-beaked common dolphin	2008-2012	.03, .05, .06, .08, .05	1, 5, 1, 8, 7	22(1.0), 162(.46), 20(.96), 263(.25), 316(.26)	161 (.17)	1,125
Risso's dolphin	2008-2012	.03, .05, .06, .08, .05		39(.69), 23(.50), 54(.74), 62(.56), 7(1.0)	37 (.36)	126
Common bottlenose dolphin (offshore)	2008-2012	.03, .05, .06, .08, .05	0, 0, 0, 0, 0	16(.36),21(.45),20(.34),34(.31), 16(1.0)	21(.22)	561
Harbor seal	2008-2012	.03, .05, .06, .08, .05	0, 0, 0, 0, 0	0, 24(.92), 11(1.1), 0, 23(1)	11.6(0.59)	2,006
Gray seal	2008-2012	.03, .05, .06, .08, .05	0, 0, 0, 0, 0	0, 38(.70), 0, 25(.57) 30(1.1)	19(.048)	unk
Northeast Mid-Water Trawl Including Pair Trawl						
Long -finned pilot whale	2008-2012	.20, .42, .41, .17, .45	0, 0, 0, 0, 0,	16(.61), 0, 0, 1, 1	3.6(.61)	199
Short-beaked common dolphin	2008-2012	.20, .42, .41, .17, .45		0, 0 ,na, 0, na	na	1,125
Harbor seal	2008-2012	.20, .42, .41, .17, .45		0, 1.3 (.81), na, 0, na	0.9(.81)	2,006
Gray seal	2008-2012	.20, .42, .41, .17, .45	0, 0, 0, 0, 0,	0, 0, 0, 0, na	0.2	unk

Appendix II. Summary of the confirmed human-caused mortality and serious injury (SI) events involving baleen whale stocks along the Gulf of Mexico Coast, US East Coast, and adjacent Canadian Maritimes, 2008-2012, with number of events attributed to entanglements or vessel collisions by year.

Stock	Mean annual mortality and SI rate (PBR[1] for reference)	Entanglements			Vessel Collisions		
		Annual rate (US waters / Canadian waters/unknown first sighted in US/unknown first sighted in Canada)	Number of confirmed mortality events (2008, 2009, 2010, 2011, 2012)	Number of confirmed injury events (2008, 2009, 2010, 2011, 2012)	Annual rate (US waters / Canadian waters/unknown first sighted in US/unknown first sighted in Canada)	Number of confirmed mortality events (2008, 2009, 2010, 2011, 2012)	Number of confirmed injury events (2008, 2009, 2010, 2011, 2012)
Western North Atlantic right whale *(Eubalaena glacialis)*	4.75 (0.9)	3.85 (0.20/ 0.00/ 2.50/ 1.15)	(0, 0, 3, 1, 2)	(1, 3, 1, 6, 2)	0.9 (0.70/ 0.00/ 0.20/ 0.00)	(0, 0, 1, 1, 0)	(0, 0, 0, 2, 1)
Gulf of Maine humpback whale *(Megaptera novaeangliae)*	10.15 (2.7)	8.75 (2.3/ 0.50/ 4.95/ 1.00)	(2, 2, 4, 0, 0)	(10, 9, 8, 9, 5)	1.4 (1.40/ 0.00/ 0.00/ 0.00)	(1, 0, 3, 3, 0)	0
Western North Atlantic fin whale *(Balaenoptera physalus)*	3.35 (2.5)	1.55 (0.20/ 0.40/ 0.65/ 0.30)	(0, 0, 0, 3, 0)	(0, 3, 0, 1, 2)	1.8 (1.80/ 0.00/ 0.00/ 0.00)	(1, 1, 2, 1, 4)	0
Nova Scotian sei whale *(B. borealis)*	0.8 (0.5)	0.4 (0.00/ 0.20/ 0.20/ 0.00)	(1, 0, 0, 0, 0)	(1, 0, 0, 0, 0)	0.4 (0.40/ 0.00/ 0.00/ 0.00)	(0, 1, 0, 1, 0)	0
Western North Atlantic blue whale[2] *(B. musculus)*	0 (0.9)	0	0	0	0	0	0
Canadian East Coast minke whale *(B. acutorostrata)*	9.45 (162)	6.65 (1.75/ 2.60/ 2.00/ 0.30)	(4, 0, 0, 4, 6)	(6, 5, 1, 5, 6)	1.2 (1.20/ 0.00/ 0.00/ 0.00)	(0, 1, 1, 3, 1)	0
Northern Gulf of Mexico Bryde's whale *(B. edeni)*	0.4 (0.16)	0	0	0	0.2 (0.2 / 0)	(0, 1, 0, 0, 0)	0

[1] Potential Biological Removal (PBR) [2] Calculated using assigned mortality and injury values (see table ##) [3] Includes animals with serious and prorated injuries. Does not include non-serious injuries. [4] Stock abundance estimates outdated; no PBR established for this stock.

Appendix III
Fishery Descriptions

This appendix is broken into two parts: Part A describes commercial fisheries that have documented interactions with marine mammals in the Atlantic Ocean; and Part B describes commercial fisheries that have documented interactions with marine mammals in the Gulf of Mexico. A complete list of all known fisheries for both oceanic regions, the 2013 List of Fisheries, is published in the *Federal Register*, (78 FR 53336;August 29, 2013). Each part of this appendix contains three sections: I. data sources used to document marine mammal mortality/entanglements and commercial fishing effort trip locations, II. fishery descriptions for Category I, II and some category III fisheries that have documented interactions with marine mammals and their historical level of observer coverage, and III. historical fishery descriptions.

Part A. Description of U.S Atlantic Commercial Fisheries

I. Data Sources

Items 1-5 describe sources of marine mammal mortality, serious injury or entanglement data; items 6-9 describe the sources of commercial fishing effort data used to summarize different components of each fishery (i.e. active number of permit holders, total effort, temporal and spatial distribution) and generate maps depicting the location and amount of fishing effort.

1. Northeast Region Fisheries Observer Program (NEFOP)

In 1989 a Fisheries Observer Program was implemented in the Northeast Region (Maine-Rhode Island) to document incidental bycatch of marine mammals in the Northeast Region Multi-species Gillnet Fishery. In 1993 sampling was expanded to observe bycatch of marine mammals in Gillnet Fisheries in the Mid-Atlantic Region (New York-North Carolina). The Northeast Fisheries Observer Program (NEFOP) has since been expanded to sample multiple gear types in both the Northeast and Mid-Atlantic Regions for documenting and monitoring interactions of marine mammals, sea turtles and finfish bycatch attributed to commercial fishing operations. At sea observers onboard commercial fishing vessels collect data on fishing operations, gear and vessel characteristics, kept and discarded catch composition, bycatch of protected species, animal biology, and habitat (NMFS-NEFSC 2003).

2. Southeast Region Fishery Observer Programs

Three Fishery Observer Programs are managed by the Southeast Fisheries Science Center (SEFSC) that observe commercial fishery activity in U.S. Atlantic waters. The Pelagic Longline Observer Program (POP) administers a mandatory observer program for the U.S. Atlantic Large Pelagics Longline Fishery. The program has been in place since 1992 and randomly allocates observer effort by eleven geographic fishing areas proportional to total reported effort in each area and quarter. Observer coverage levels are mandated under the Highly Migratory Species Fisheries Management Plan (HMS FMP, 50 CFR Part 635). The second program is the Shark Gillnet Observer Program that observes the Southeastern U.S. Atlantic Shark Gillnet Fishery. The Observer Program is mandated under the HMS FMP, the Atlantic Large Whale Take Reduction Plan (ALWTRP) (50 CFR Part 229.32), and the Biological Opinion under Section 7 of the Endangered Species Act. Observers are deployed on any active fishing vessel reporting shark drift gillnet effort. In 2005, this program also began to observe sink gillnet fishing for sharks along the southeastern U.S. coast. The observed fleet includes vessels with an active directed shark permit and fish with sink gillnet gear (Carlson and Bethea 2007). The third program is the Southeastern Shrimp Otter Trawl Fishery Observer Program. Prior to 2007, this was a voluntary program administered by SEFSC in cooperation with the Gulf and South Atlantic Fisheries Foundation. The program was funding and project dependent, therefore observer coverage is not necessarily randomly allocated across the fishery. In 2007, the observer program was expanded, and it became mandatory for fishing vessels to take an observer if selected. The program now includes more systematic sampling of the fleet based upon reported landings and effort patterns. The total level of observer coverage for this program is approximately 1% of the total fishery effort. In each Observer Program, the observers record information on the total target species catch, the number and type of interactions with protected species (including both marine mammals and sea turtles), and biological information on species caught.

3. Regional Marine Mammal Stranding Networks

The Northeast and Southeast Region Stranding Networks are components of the Marine Mammal Health and

Stranding Response Program (MMHSRP). The goals of the MMHSRP are to facilitate collection and dissemination of data, assess health trends in marine mammals, correlate health with other biological and environmental parameters, and coordinate effective responses to unusual mortality events (Becker *et al.* 1994). Since 1997, the Northeast Region Marine Mammal Stranding Network has been collecting and storing data on marine mammal strandings and entanglements that occur from Maine through Virginia. The Southeast Region Strandings Program is responsible for data collection and stranding response coordination along the Atlantic coast from North Carolina to Florida, along the U.S. Gulf of Mexico coast from Florida through Texas, and in the U.S. Virgin Islands and Puerto Rico. Prior to 1997, stranding and entanglement data were maintained by the New England Aquarium and the National Museum of Natural History, Washington, D.C. Volunteer participants, acting under a letter of agreement, collect data on stranded animals that include: species; event date and location; details of the event (i.e., signs of human interaction) and determination on cause of death; animal disposition; morphology; and biological samples. Collected data are reported to the appropriate Regional Stranding Network Coordinator and are maintained in regional and national databases.

4. Marine Mammal Authorization Program

Commercial fishing vessels engaging in Category I or II fisheries are automatically registered under the Marine Mammal Authorization Program (MMAP) in order to lawfully take a non-endangered/threatened marine mammal incidental to fishing operations. These fishermen are required to carry an Authorization Certificate onboard while participating in the listed fishery, must be prepared to carry a fisheries observer if selected, and must comply with all applicable take reduction plan regulations. All vessel owners, regardless of the category of fishery they are operating in, are required to report, within 48 hours of the incident and even if an observer has recorded the take, all incidental injuries and mortalities of marine mammals that have occurred as a result of fishing operations (NMFS-OPR 2003). Events are reported by fishermen on the Marine Mammal Mortality/Injury forms then submitted to and maintained by the NMFS Office of Protected Resources. The data reported include: captain and vessel demographics; gear type and target species; date, time and location of event; type of interaction; animal species; mortality or injury code; and number of interactions. Reporting forms are available online at http://www.nmfs.noaa.gov/pr/pdfs/interactions/mmap_reporting_form.pdf.

5. Other Data Sources for Protected Species Interactions/Entanglements/Ship Strikes

In addition to the above, data on fishery interactions/entanglements and vessel collisions with large cetaceans are reported from a variety of other sources including the New England Aquarium (Boston, Massachusetts); Provincetown Center for Coastal Studies (Provincetown, Massachusetts); U.S. Coast Guard; whale watch vessels; Canadian Department of Fisheries and Oceans (DFO)); and members of the Atlantic Large Whale Disentanglement Network. These data, photographs, etc. are maintained by the Protected Species Division at the Northeast Regional Office (NERO), the Protected Species Branch at the Northeast Fisheries Science Center (NEFSC) and the Southeast Fisheries Science Center (SEFSC).

6. Northeast Region Vessel Trip Reports

The Northeast Region Vessel Trip Report Data Collection System is a mandatory, but self-reported, commercial fishing effort database (Wigley *et al.* 1998). The data collected include: species kept and discarded; gear types used; trip location; trip departure and landing dates; port; and vessel and gear characteristics. The reporting of these data is mandatory only for vessels fishing under a federal permit. Vessels fishing under a federal permit are required to report in the Vessel Trip Report even when they are fishing within state waters.

7. Southeast Region Fisheries Logbook System

The Fisheries Logbook System (FLS) is maintained at the SEFSC and manages data submitted from mandatory Fishing Vessel Logbook Programs under several FMPs. In 1986 a comprehensive logbook program was initiated for the Large Pelagics Longline Fishery and this reporting became mandatory in 1992. Logbook reporting has also been initiated since the 1990s for a number of other fisheries including: Reef Fish Fisheries; Snapper-Grouper Complex Fisheries; federally managed Shark Fisheries; and King and Spanish Mackerel Fisheries. In each case, vessel captains are required to submit information on the fishing location, the amount and type of fishing gear used, the total amount of fishing effort (e.g., gear sets) during a given trip, the total weight and composition of the catch, and the disposition of the catch during each unit of effort (e.g., kept, released alive, released dead). FLS data are used to estimate the total amount of fishing effort in the fishery and thus expand bycatch rate estimates from observer data to estimates of the total incidental take of marine mammal species in a given fishery. More information is available at http://www.sefsc.noaa.gov/fisheries/logbook.htm.

8. Northeast Region Dealer Reported Data

The Northeast Region Dealer Database houses trip level fishery statistics on fish species landed by market category, vessel ID, permit number, port location and date of landing, and gear type utilized. The data are collected by both federally permitted seafood dealers and NMFS port agents. Data are considered to represent a census of both vessels actively fishing with a federal permit and total fish landings. It also includes vessels that fish with a state permit (excluding the state of North Carolina) that land a federally managed species. Some states submit the same trip level data to the Northeast Region, but contrary to the data submitted by federally permitted seafood dealers, the trip level data reported by individual states does not include unique vessel and permit information. Therefore, the estimated number of active permit holders reported within this appendix should be considered a minimum estimate. It is important to note that dealers were previously required to report weekly in a dealer call in system. However, in recent years the NER regional dealer reporting system has instituted a daily electronic reporting system. Although the initial reports generated from this new system did experience some initial reporting problems, these problems have been addressed and the new daily electronic reporting system is providing better real time information to managers.

9. Northeast At Sea Monitoring Program

At-sea monitors collect scientific, management, compliance, and other fisheries data onboard commercial fishing vessels through interviews of vessel captains and crew, observations of fishing operations, photographing catch, and measurements of selected portions of the catch and fishing gear. At-sea monitoring requirements are detailed under Amendment 16 to the NE Multispecies Fishery Management Plan with a planned implementation date of May 1st, 2010. At-sea monitoring coverage is an integral part of catch monitoring to ensure that Annual Catch Limits are not exceeded. At-sea monitors collect accurate information on catch composition and the data are used to estimate total discards by sectors (and common pool), gear type, and stock area. Coverage levels are expected around 30%.

II. Marine Mammal Protection Act's List of Fisheries

The List of Fisheries (LOF) classifies U.S. commercial fisheries into one of three Categories according to the level of incidental mortality or serious injury of marine mammals:

I. frequent incidental mortality or serious injury of marine mammals
II. occasional incidental mortality or serious injury of marine mammals
III. remote likelihood of/no known incidental mortality or serious injury of marine mammals

The Marine Mammal Protection Act (MMPA) mandates that each fishery be classified by the level of serious injury and mortality of marine mammals that occurs incidental to each fishery as reported in the annual Marine Mammal Stock Assessment Reports for each stock. A fishery may qualify as one Category for one marine mammal stock and another Category for a different marine mammal stock. A fishery is typically categorized on the LOF according to its highest level of classification (e.g., a fishery that qualifies for Category III for one marine mammal stock and Category II for another marine mammal stock will be listed under Category II). The classifications listed below are based on the Final 2013 LOF published in the Federal Register (78 FR 53336; August 29, 2013)

III. U.S Atlantic Commercial Fisheries

Northeast Sink Gillnet

Current category: Category I

Basis for current classification on the LOF: The annual mortality and serious injury to harbor porpoises (Gulf of Maine/Bay of Fundy [GME/BF] stock), humpback whales (Gulf of Maine stock), minke whales (Canadian East Coast stock), and North Atlantic right whales (Western North Atlantic [WNA] stock) in this fishery exceeds 50% of each stock's Potential Biological Removal (PBR) level.

Current list of marine mammal species/stocks killed/injured (a (1) indicates those stocks driving the fishery's classification): Bottlenose dolphin, WNA offshore; Common dolphin, WNA; Fin whale, WNA; Gray seal, WNA; Harbor porpoise, GME/BF(1); Harbor seal, WNA; Harp seal, WNA; Hooded seal, WNA; Humpback whale, GME;

Minke whale, Canadian East Coast; North Atlantic right whale, WNA; Risso's dolphin, WNA; White-sided dolphin, WNA; Long-finned pilot whale, WNA; Short-finned pilot whale, WNA. Not mentioned here are possible interactions with sea turtles and sea birds.

Gear description/method for fishing: This fishery uses sink gillnet gear, which is anchored gillnet (bottom tending net) fished in the lower one-third of the water column. The dominant material is monofilament twine with stretched mesh sizes from 6-12 in (15-30.5 cm) and string lengths from 600-10,500 ft (183-3,200 m), depending on the target species. The mesh size and string length vary by the primary fish species targeted for catch.

Target species: Atlantic cod, haddock, pollock, yellowtail flounder, winter flounder, witch flounder, American plaice, windowpane flounder, spiny dogfish, monkfish, silver hake, red hake, white hake, ocean pout, skate spp, mackerel, redfish, and shad.

Spatial/temporal distribution of effort: The fishery operates from the U.S.-Canada border to Long Island, New York, at 72° 30'W. long. south to 36° 33.03'N. lat. (corresponding with the Virginia-North Carolina border) and east to the eastern edge of the Exclusive Economic Zone (EEZ), including the Gulf of Maine, Georges Bank, and Southern New England, and excluding Long Island Sound and other waters where gillnet fisheries are listed as Category II and III. At this time, these Category II and III fisheries include: the Northeast anchored float gillnet; Northeast drift gillnet; Long Island Sound inshore gillnet; and RI, southern MA (to Monomoy Island), and NY Bight (Raritan and Lower NY Bays) inshore gillnet. Fishing effort occurs year-round, peaking from May-July primarily on continental shelf regions in depths from 30-750 ft. (9-228.6 m), with some nets deeper than 800 ft. (244 m). Figures 1-5 document the distribution of sets and marine mammal interactions observed from 2008 to 2012, respectively.

Management and Regulations: This gear is addressed by several federal and state FMPs; the Atlantic Large Whale Take Reduction Plan (ALWTRP) and Harbor Porpoise Take Reduction Plan (HPTRP). These fisheries are primarily managed by total allowable catch (TACs); individual trip limits (i.e., quotas); effort caps (i.e., limited number of days at sea per vessel); time and area closures; and gear restrictions.

Total Effort (includes descriptions of Northeast anchored float and Northeast drift gillnets): Total metric tons of fish landed from 1998 to 2012 were 22,933, 18,681, 14,487, 14, 634, 15,201, 17,680, 19,080, 15.390, 14,950, 15,808, 18,808, 17,207, 18,170, 19,279 and 17,490 respectively (NMFS). Data on total quantity of gear fished (i.e., number of sets) have not been reported consistently among commercial gillnet fishermen on vessel logbooks, and therefore will not be reported here.

Observer Coverage (includes descriptions of Northeast anchored float and Northeast drift gillnets): During the period 1990-2012, estimated percent observer coverage (number of trips observed/total commercial trips reported) was 1, 6, 7, 5, 7, 5, 4, 6, 5, 6, 6, 4, 2, 3, 6, 7, 4, 7, 5, 4, 17,19, and 15 respectively.

Comments: Effort patterns in this fishery are heavily influenced by fish time/area closures, and gear restrictions due to fish conservation measures, time/area closures and gear restrictions under the ALWTRP, and seasonal pinger requirements and time/area closures under the HPTRP.

Northeast Anchored Float Gillnet Fishery

Current category: Category II

Basis for current classification on the LOF: Based on analogy with other Category II gillnet fisheries that use similar gear and operate in a similar manner to this fishery.

Current list of marine mammal species/stocks killed/injured: Harbor seal, Western North Atlantic (WNA); Humpback whale, Gulf of Maine; White-sided dolphin, WNA.

Gear description/method for fishing: This fishery uses gillnet gear of any size anchored and fished in the upper two-thirds of the water column.

Target species: Mackerel, herring (particularly for bait), shad, and menhaden.

Spatial/temporal distribution of effort: The fishery operates from the U.S.-Canada border to Long Island, New York, at 72° 30'W. long south to 36° 33.03'N. lat. (corresponding with the Virginia-North Carolina border) and east to the eastern edge of the EEZ, not including Long Island Sound or other waters where gillnet fisheries are listed as Category III.

Management and regulations: The fishery is managed by the Atlantic States Marine Fisheries Commission [ASMFC] under the Interstate Fishery Management Plans (ISFMP) for Atlantic Menhaden and Shad and is subject to ALWTRP implementing regulations. A total closure of the American shad ocean intercept fishery was fully implemented in January, 2005.

Total Effort (includes descriptions of Northeast anchored float and Northeast drift gillnets): Total metric tons of fish landed from 1998 to 2012 were 22,933, 18,681, 14,487, 14, 634, 15,201, 17,680, 19,080, 15.390, 14,950, 15,808, 18,808, 17,207, 18,170, 19,279 and 17,490 respectively (NMFS). Data on total quantity of gear fished (i.e., number of sets) have not been reported consistently among commercial gillnet fishermen on vessel logbooks, and therefore will not be reported here.

Observer Coverage (includes descriptions of Northeast anchored float and Northeast drift gillnets): During the period 1990-2012, estimated percent observer coverage (number of trips observed/total commercial trips reported) was 1, 6, 7, 5, 7, 5, 4, 6, 5, 6, 6, 4, 2, 3, 6, 7, 4, 7, 5, 4, 17, 19 and 15 respectively.

Comments: Effort patterns in this fishery are heavily influenced by fish time/area closures, and gear restrictions due to fish conservation measures, time/area closures and gear restrictions under the ALWTRP, and seasonal pinger requirements and time/area closures under the HPTRP.

Northeast Drift Gillnet Fishery

Current category: Category II

Basis of current classification on the LOF: Based on analogy to other Northeast gillnet fisheries that use similar gear and operate in a similar manner to this fishery.

Current list of marine mammal species/stocks killed/injured: None documented

Gear description/method for fishing: This fishery uses drift gillnet gear, which is gillnet gear not anchored to the bottom and is free-floating on both ends or free-flowing at one end and attached to the vessel at the other end. Mesh sizes are likely less than those used to target large pelagics.

Target species: This fishery targets species including shad, herring, mackerel, and menhaden and any residual large pelagic driftnet effort in New England.

Spatial/temporal distribution of effort: The fishery includes any residual large pelagic driftnet effort in New England and occurs at any depth in the water column from the U.S.-Canada border to Long Island, New York, at 72° 30'W. long. south to 36° 33.03'N. lat. (corresponding with the Virginia-North Carolina border) and east to the eastern edge of the Exclusive Economic Zone (EEZ).

Management and regulations: The fishery is managed under the Interstate Fishery Management Plans (ISFMPs) for Atlantic Menhaden and Shad (managed by the Atlantic States Marine Fisheries Commission [ASMFC]) and is subject to ALWTRP implementing regulations. A total closure of the American shad ocean intercept fishery was fully implemented in January, 2005.

Total Effort (includes descriptions of Northeast anchored float and Northeast drift gillnets): Total metric tons of fish landed from 1998 to 2011 were 22,933, 18,681, 14,487, 14, 634, 15,201, 17,680, 19,080, 15.390, 14,950, 15,808, 18,808, 17,207, 18,170, 19,279 and 17,490 respectively (NMFS). Data on total quantity of gear fished (i.e., number of sets) have not been reported consistently among commercial gillnet fishermen on vessel logbooks, and therefore will not be reported here.

Observer Coverage (includes descriptions of Northeast anchored float and Northeast drift gillnets): During the

period 1990-2012, estimated percent observer coverage (number of trips observed/total commercial trips reported) was 1, 6, 7, 5, 7, 5, 4, 6, 5, 6, 6, 4, 2, 3, 6, 7, 4, 7, 5, 4, 17, 19, and 15 respectively.

Comments: Effort patterns in this fishery are heavily influenced by fish time/area closures, and gear restrictions due to fish conservation measures, time/area closures and gear restrictions under the ALWTRP, and seasonal

Mid-Atlantic Gillnet

Current category: Category I

Basis for current classification on the LOF: The species listed in the section below with a "(1)" following the stock name drive the classification because the annual mortality and serious injury of that stock in this fishery was greater than 50% of the stock's PBR level.

Current list of marine mammal species/stocks killed/injured (a (1) indicates those stocks driving the fishery's classification): Bottlenose dolphin, Northern Migratory coastal (1); Bottlenose dolphin, Southern Migratory coastal(1); Bottlenose dolphin, Northern North Carolina (NC) estuarine system (1); Bottlenose dolphin, Southern NC estuarine system (1) ; Bottlenose dolphin, WNA offshore; Common dolphin, WNA; Gray seal, WNA; Harbor porpoise, Gulf of Maine/Bay of Fundy; Harbor seal, WNA; Harp seal, WNA; Humpback whale, Gulf of Maine; Long-finned pilot whale, WNA; Minke whale, Canadian East Coast; Short-finned pilot whale, WNA; White-sided dolphin, WNA; Risso's dolphin, WNA. Not mentioned here are possible interactions with sea turtles and sea birds and interactions with large whale species in which the gear may not be identified to a specific area or gear.

Gear description/method for fishing: This fishery uses drift and sink gillnets, including nets set in a sink, stab, set, strike, run-around or drift fashion, with some unanchored drift or sink nets used to target specific species. The dominant material is monofilament twine with stretched mesh sizes from 2.5-12 in (6.4-30.5 cm), and string lengths from 150-8,400 ft. (46-2,560 m).

Target Species: Monkfish, Spiny and Smooth Dogfish, Bluefish, Weakfish, Menhaden, Spot, Croaker, Striped Bass, Coastal Sharks, Spanish Mackerel, King Mackerel, American Shad, Black Drum, Skate spp., Yellow perch, White Perch, Herring, Scup, Kingfish, Spotted Seatrout, and Butterfish.

Spatial/temporal distribution of effort: This fishery operates year-round, extending from New York to North Carolina, not including waters where Category II and III inshore gillnet fisheries operate in bays, sounds, estuaries, and rivers. It is comprised of a combination of small vessels that target a variety of fish species. This fishery includes any residual large pelagic driftnet effort in the mid-Atlantic, shark and dogfish gillnet effort in the mid-Atlantic, and those North Carolina small and large mesh beach-anchored gillnets formerly placed in the Category II Mid-Atlantic haul/ beach seine fishery in the mid-Atlantic zone described. For more details on construction of this gear specifically please refer to 2009 Proposed List of Fisheries, published in the *Federal Register*, (73 FR 73760; June 13, 2008). This fishery can be prosecuted right off the beach (6 feet) or in nearshore coastal waters to offshore waters (250 feet). The eastern boundary of this fishery is a line drawn at 72° 30' W long. from Long Island south to 36º 33.03' N lat., then east to the EEZ, and then south to the North Carolina/South Carolina border. The area does not include waters where Category II and III inshore gillnet fisheries operate in bays, estuaries, and rivers. Figures 6-10 document the distribution of sets and marine mammal interactions observed from 2008 to 2012, respectively.

Management and Regulations: Gear in this fishery is managed by several federal and interstate Fishery Management Plans by the Atlantic States Marine Fisheries Commission, ALWTRP, HPTRP, and BDTRP. Fisheries are primarily managed by total allowable catch limits; individual trip limits (quotas); effort caps (limited number of days at sea per vessel); time and area closures; and gear restrictions and modifications.

Total Effort: Total metric tons of fish landed from 1998 to 2012 were 15,494, 19,130, 16,333, 14,855, 13,389, 13,107, 15,124, 12, 994, 8,755, 9,359, 8,622, 8,703, 10,725, 11,292 and 9,035 respectively (NMFS). Data on total quantity of gear fished (i.e. number of sets) have not been reported consistently among commercial gillnet fishermen on vessel logbooks, therefore will not be reported here.

Observer Coverage: During the period 1995-2012, the estimated percent observer coverage was 5, 4, 3, 5, 2, 2, 2, 1,

1, 2, 3, 4, 4, 3, 3, 4, 2 and 2 respectively.

Comments: Effort patterns in this fishery are heavily influenced by marine mammal time/area closures and /or gear restrictions under the ALWTRP, HPTRP, and BDTRP; and gear restrictions due to fish conservation measures.

Mid-Atlantic Bottom Trawl

Current category: Category II

Basis for current classification on the LOF: The total mortality and serious injury of common dolphins (Western North Atlantic [WNA] stock), long-finned pilot whales (WNA stock), Risso's dolphins (WNA), and short-finned pilot whales (WNA stock) in this fishery is greater than 1% and less than 50% of each of the stocks' PBR.

Current list of marine mammal species/stocks killed/injured (a (1) indicates those stocks driving the fishery's classification): Bottlenose dolphin, WNA offshore; Common dolphin, Western North Atlantic (WNA)(1); Gray seal, WNA; Harbor seal, WNA; Long-finned pilot whale, WNA (1); Risso's dolphin, WNA (1); Short-finned pilot whale, WNA(1); White-sided dolphin, WNA. Not mentioned here are possible interactions with sea turtles and sea birds.

Gear description/method for fishing: This fishery uses bottom trawl gear. Gear types such as flynets utilized in the mid-Atlantic region. The Mid-Atlantic bottom trawls using flynets target species through nearshore and offshore components that operate along the east coast of the mid-Atlantic United States. Flynets typically range from 80–120 ft. (24–36.6 m) in headrope length, with wing mesh sizes of 16–64 in (41–163 cm), following a slow 3:1 taper to smaller mesh sizes in the body, extension, and codend sections of the net.

Target species: Target species include, but are not limited to: bluefish, croaker, monkfish, summer flounder (fluke), winter flounder, silver hake (whiting), spiny dogfish, smooth dogfish, scup, and black sea bass. The nearshore fishery targets Atlantic croaker, weakfish, butterfish, harvestfish, bluefish, menhaden, striped bass, kingfish species, and other finfish species; the deeper water fisheries target bluefish, Atlantic mackerel, Loligo squid, black sea bass, and scup.

Spatial/temporal distribution of effort: The fishery occurs year-round from all waters due east from the NC/SC border to the EEZ and north to Cape Cod, MA in waters west of 70° W. long. In areas where 70° W. long. is east of the EEZ, the EEZ serves as the eastern boundary. The nearshore fishery operates from October to April inside of 30 fathoms (180 ft.; 55 m.) from NJ to NC. Flynet fishing is no longer permitted in Federal waters south of Cape Hatteras in order to protect weakfish stocks. The offshore component operates from November to April outside of 30 fathoms (180 ft.; 55 m.) from the Hudson Canyon off NY, south to Hatteras Canyon off NC. Figures 11-15 document the distribution of tows and marine mammal interactions observed from 2008 to 2012, respectively.

Management and regulations: There are at least two distinct components to this fishery. One is the mixed groundfish bottom trawl fishery. It is managed by several federal and state FMPs that range from Massachusetts to North Carolina. The relevant FMPs include, but may not be limited to, Monkfish (FR 68(81), 50 CFR Part 648); Spiny Dogfish (FR 65(7), 50 CFR Part 648); Summer Flounder, Scup, and Black Sea Bass (FR 68(1), 50 CFR part 648); and Northeast Skate Complex (FR 68(160), 50 CFR part 648). The second major component is the squid, mackerel, butterfish fishery. This component is managed by the federal Squid, Mackerel, Butterfish FMP. The *Illex* and *Loligo* Squid Fisheries are managed by moratorium permits, gear and area restrictions, quotas, and trip limits. The Atlantic Mackerel and Atlantic Butterfish Fisheries are managed by an annual quota system.

Mixed Groundfish Bottom Trawl Total Effort: Total effort, measured in trips, for the Mixed Groundfish Trawl from 1998 to 2012 was 27,521, 26,525, 24,362, 27,890, 28,103, 25,725, 22,303, 15,070, 12,457, 11,279, 10,785, 10,497, 10,849, 10,528, and 12,021 respectively (NMFS). The number of days absent from port, or days at sea, is yet to be determined.

Squid, Mackerel, Butterfish Bottom Trawl Total Effort: Total effort, measured in trips, for the domestic Atlantic Mackerel Fishery in the Mid-Atlantic Region (bottom trawl only) from 1997 to 2012 was 373, 278, 262, 102, 175, 310, 238, 231, 0, 117, 88, 0, 66, 19, 13, and 15 respectively (NMFS). Total effort, measured in trips, for the *Illex* Squid Fishery from 1998 to 2012 was 412, 141, 108, 51, 39, 103, 445, 181, 159, 103, 172, 177, 231, 232, and 151

respectively (NMFS). Total effort, measured in trips, for the *Loligo* Squid Fishery from 1998 to 2012 was 1,048, 495, 529, 413, 3,585, 1,848, 1,124, 1,845, 3,058, 2,137, 2,578, 2,234, 2.039, 2,157, and 3,186 respectively (NMFS). Atlantic Butterfish is a bycatch (non-directed) fishery; therefore effort on this species will not be reported. The number of days absent from port or days at sea, is yet to be determined.

Observer Coverage: During the period 1996-2012, estimated percent observer coverage (measured in trips) for the Mixed Groundfish Bottom Trawl Fishery was 0.24, 0.22, 0.15, 0.14,1, 1, 1, 1, 3, 3, 2, 3, 3, 5, 5, 7, and 5 respectively.
During the period 1996-2012, estimated percent observer coverage (trips) in the *Illex* Fishery was 3.7, 6.21, 0.97, 2.84, 11.11, 0, 0, 8.74, 5.07, 6, 15, 14, 5, 10, 14, 11, and 1 respectively. During the period 1996-2012, estimated percent observer coverage (trips) of the *Loligo* Fishery was 0.37, 1.07, 0.72, 0.69, 0.61, 0.95, 0.42, 0.65, 5.07, 4, 3, 2, 2, 7, 8, 11, and 4 respectively. During the period 1997-2012, estimated percent observer coverage (trips) of the domestic Atlantic Mackerel Fishery was 0.81, 0, 1.14, 4.90, 3.43, 0.97, 5.04, 18.61, 0, 3, 2, 0, 8, 11, 8, and 20 respectively. Observer coverage for 2010-2012 includes both observers and at-sea monitors.

Comments: Mobile Gear Restricted Areas (GRAs) were put in place for fishery management purposes in November 2000. The intent of the GRAs is to reduce bycatch of scup. The GRAs are spread out in time and space along the edge of the Southern New England and Mid-Atlantic Continental Shelf Region (between 100 and 1000 meters). These seasonal closures are targeted at trawl gear with small-mesh sizes (<4.5 inches inside mesh measurement). The Atlantic Herring and Atlantic Mackerel Trawl Fisheries are exempt from the GRAs. Access to the GRAs to harvest non-exempt species (*Loligo* Squid, Black Sea Bass, and Silver Hake) can be granted by a special permit. For detailed information regarding GRAs refer to (FR 70(2), (50 CFR Part 648.122 parts A and B)).

Northeast Bottom Trawl

Current category: Category II

Basis for current classification on the LOF: The total annual mortality and serious injury of white-sided dolphins (Western North Atlantic [WNA] stock) in this fishery is greater than 1% and less than 50% of the stock's Potential Biological Removal (PBR) level.

Current list of marine mammal species/stocks killed/injured (a (1) indicates those stocks driving the fishery's classification): Bottlenose dolphin, WNA offshore; Common dolphin, WNA; Gray seal, WNA; Harbor porpoise, Gulf of Maine/Bay of Fundy (GME/BF); Harbor seal, WNA; Harp seal, WNA; Long-finned pilot whale, WNA; Short-finned pilot whale, WNA; White-sided dolphin, WNA(1); Minke whale, Canadian East Coast stock . Not mentioned here are possible interactions with sea turtles and sea birds.

Gear description/method for fishing: The average footrope length for the bottom trawl fleet was about 84 feet from 1996 – 1999; in 2000 there was a sharp increase to almost 88 feet followed by a steady decline to 85 feet in 2004. Seasonality was evident, with larger footrope lengths in the first quarter, which drop sharply from March to the low in May, and followed by a steady increase in size until December. There are some differences in mean gear size between species. Compared to other species, gear size was smaller for trips that caught winter flounder, cod, yellowtail flounder, fluke, skate, dogfish, and Atlantic herring. Trips that caught haddock, *Illex* squid, and monkfish tended to have larger gear. For most species, seasonal variation was limited. Seasonality was evident for witch flounder, American plaice, scup, butterfish, both squid species, and monkfish. Further characterization of the Northeast and Mid-Atlantic bottom and mid-water trawl fisheries based on Vessel Trip Report (VTR) data can be found at
http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0715/).

Target species: This fishery targets species including, but not limited to: Atlantic cod, haddock, pollock, yellowtail flounder, winter flounder, witch flounder, American plaice, Atlantic halibut, redfish, windowpane flounder, summer flounder, spiny dogfish, monkfish, silver hake, red hake, white hake, ocean pout, and skate species.

Management and regulations: The fishery is primarily managed by TACs, individual trip limits (quotas), effort caps (limited number of days at sea per vessel), time and area closures, and gear restrictions under several interstate and federal FMPs.

Total Effort: Total effort, measured in trips, for the Northeast Bottom Trawl Fishery from 1998 to 2012 was 13,263, 10,795, 12,625, 12,384, 12,711, 11,577, 10,354, 10,803, 8,603, 8,950, 8,900, 6,791, 5,747, and 8,219 respectively (NMFS).

Spatial/temporal distribution of effort: The fishery operates year-round, with a peak from May-July. The Northeast bottom trawl fishery includes all U.S. waters south of Cape Cod, MA that are east of 70° W and extending south to the intersection of the Exclusive Economic Zone (EEZ) and 70° W (approximately 37° 54' N), as well as all U.S. waters north of Cape Cod to the Maine-Canada border.Figures 16-20 document the distribution of tows and marine mammal interactions observed from 2008 to 2012 respectively.

Observer Coverage: During the period 1994-2012, estimated percent observer coverage (measured in trips) was 0.4, 1.1, 0.2, 0.2, 0.1, 0.3, 1.0, 1.0, 3, 4, 5, 12, 6, 6, 8 , 9, 16, 26, and 17 respectively. Observer coverage for 2010-2012 includes both observers and at-sea monitors.

Comments: Mobile Gear Restricted Areas (GRAs) were put in place for fishery management purposes in November 2000. The intent of the GRAs is to reduce bycatch of Scup. The GRAs are spread out in time and space along the edge of the Southern New England and mid-Atlantic continental shelf region (between 100 and 1000 meters). These seasonal closures are targeted at trawl gear with small-mesh sizes (<4.5 inches inside mesh measurement). The Atlantic Herring and Atlantic Mackerel Trawl Fisheries are exempt from the GRAs. For detailed information regarding GRAs refer to (50 CFR Part 648.122 parts A and B).

Northeast Mid-Water Trawl Fishery (includes pair trawls)

Current category: Category II

Basis for current classification on the LOF: The total annual mortality and serious injury of long-finned pilot whales (Western North Atlantic [WNA] stock) and short-finned pilot whales (WNA stock) in this fishery is greater than 1% and less than 50% of the stocks' Potential Biological Removal (PBR).

Current list of marine mammal species/stocks injured/killed (a (1) indicates those stocks driving the fishery's classification): Harbor seal, WNA; Long-finned pilot whale, WNA (1); Short-finned pilot whale, WNA(1); Whitesided dolphin, WNA; Short-beaked common dolphin, WNA; Gray seal, WNA. Not mentioned here are possible interactions with sea turtles and sea birds.

Gear description/method for fishing: This fishery uses primarily mid-water (pelagic) trawls (single and paired), which is trawl gear designed, capable, or used to fish for pelagic species with no portion designed to be operated in contact with the bottom.

Target species: This fishery targets Atlantic herring with bycatch of several finfish species, predominantly mackerel, spiny dogfish, and silver hake.

Spatial/temporal distribution of effort: The fishery occurs primarily in Maine state waters, Jeffrey's Ledge, southern New England, and Georges Bank during the winter months when the target species continues its southerly migration from the Gulf of Maine/Georges Bank, into mid-Atlantic waters. This fishery includes all U.S. waters south of Cape Cod, MA that are east of 70° W and extending south to the intersection of the EEZ and 70° W (approximately 37° 54'N), as well as all U.S. waters north of Cape Cod to the Maine-Canada border." Figures 21-25 document the distribution of tows and marine mammal interactions observed from 2008 to 2012 respectively.

Management and regulations: The fishery is managed jointly by the Mid-Atlantic Fishery Management Council, Mid-Atlantic Fishery Management Council, and the Atlantic States Marine Fisheries Commission. This fishery is included in the Atlantic Trawl Gear Take Reduction Strategy which recommends voluntary measures to reduce incidental interactions with marine mammals.

Total Effort: Total effort, measured in trips, for the Northeast Mid-Water Trawl Fishery (across all gear types) from

1997 to 2012 was 578, 289, 553, 1,312, 2,404, 1,736, 2,158, 1,564, 717, 590, 286, 236, 236, 294, 331, and 413 respectively (NMFS).

Observer Coverage: During the period 1997-2012, estimated percent observer coverage (trips) was 0, 0, 0.73, 0.46, 0.06, 0, 2.25, 11.48, 19.9, 3.1, 8.04, 19.92, 42, 53, 41, and 45 respectively. Observer coverage for 2010 -2012 includes both observers and at-sea monitors.

Comments: Mobile Gear Restricted Areas (GRAs) were put in place for fishery management purposes in November 2000. The intent of the GRAs is to reduce bycatch of Scup. The GRAs are spread out in time and space along the edge of the Southern New England and mid-Atlantic continental shelf region (between 100 and 1000 meters). These seasonal closures are targeted at trawl gear with small-mesh sizes (<4.5 inches inside mesh measurement). The Atlantic Herring and Atlantic Mackerel Trawl Fisheries are exempt from the GRAs. For detailed information regarding GRAs refer to (50 CFR Part 648.122 parts A and B)

Mid-Atlantic Mid-Water Trawl Fishery (includes pair trawls)

Current category: Category II

Basis for current classification on the LOF: The total annual mortality and serious injury of white-sided dolphins (Western North Atlantic [WNA] stock) in this fishery is greater than 1% and less than 50% of the stock's Potential Biological Removal (PBR) level.

Current list of marine mammal species/stocks killed/injured (a (1) indicates those stocks driving the fishery's classification): Bottlenose dolphin, WNA offshore; Common dolphin, WNA; Long-finned pilot whale, WNA; Risso's dolphin, WNA; Short-finned pilot whale, WNA; White-sided dolphin, WNA (1). Not mentioned here are possible interactions with sea turtles and sea birds.

Gear description/method for fishing: This fishery uses both single and pair trawls, which are designed, capable, or used to fish for pelagic species with no portion of the gear designed to be operated in contact with the bottom of the ocean.

Target species: Atlantic mackerel, chub mackerel, and miscellaneous other pelagic species.

Spatial/temporal distribution of effort: The fishery for Atlantic mackerel occurs primarily from southern New England through the mid-Atlantic from January-March and in the Gulf of Maine during the summer and fall (May-December). The Mid-Atlantic mid-water trawl fishery includes all waters due east from the NC/SC border to the EEZ and north to Cape Cod, MA in waters west of 70° W. long. Figures 26-30 document the distribution of tows and marine mammal interactions observed from 2008 to 2012 respectively.

Management and regulations: This fishery is managed under the Federal Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan using an annual quota system. This fishery is included in the Atlantic Trawl Gear Take Reduction Strategy which recommends voluntary measures to reduce incidental interactions with marine mammals.

Total Effort: Total effort, measured in trips, for the Mid-Atlantic Mid-Water Trawl Fishery (across both gear types) from 1997 to 2012 was 331, 223, 374, 166, 408, 261, 428, 360, 359, 405, 312, 255, 280,173, 140, and 143 respectively (NMFS).

Observer Coverage: During the period 1997-2012, estimated percent observer coverage (trips) was 0, 0, 1.01, 8.43, 0, 0.77, 3.50, 12.16, 8.40, 8.90, 3.85, 13.33, 13.2, 25, 41, and 21 respectively. Observer coverage for 2010-2012 includes both observers and at-sea monitors.

Comments: Mobile Gear Restricted Areas (GRAs) were put in place for fishery management purposes in November 2000. The intent of the GRAs is to reduce bycatch of Scup. The GRAs are spread out in time and space along the edge of the Southern New England and mid-Atlantic continental shelf region (between 100 and 1000 meters). These

seasonal closures are targeted at trawl gear with small-mesh sizes (<4.5 inches inside mesh measurement). The Atlantic Herring and Atlantic Mackerel Trawl Fisheries are exempt from the GRAs. For detailed information regarding GRAs refer to (50 CFR Part 648.122 parts A and B).

Bay of Fundy Herring Weir

Category: N/A

Protected Species Interactions: Documented interactions with harbor porpoise and minke whales were reported in this fishery. Right whales are also vulnerable to entrapment, though very rarely.

Gear description/method for fishing: Weirs are large, heart-shaped structures (roughly 100 feet across) consisting of long wooden stakes (50-80 feet) pounded 3-6 feet into the sea floor and surrounded by a mesh net (the "twine") of about ¾ inch stretch mesh. Weirs are typically located within 100-400 feet of shore. The twine runs from the sea floor to the surface, and the only opening (the "mouth") is positioned close to shore. Herring swimming along the shore at night, encounter a fence (net of the same twine from sea floor to surface) that runs from the weir to the shoreline and directs the fish into the weir. At dawn, the weir fisherman tends the weir and if Herring are present, he/she may close off the weir until the fish can be harvested. Harvesting takes place when the tidal current is the slackest, usually just before low tide. A large net ("seine") is deployed inside the weir, and, much like a purse seine, it is drawn up to the surface so that the fish become concentrated. They are then pumped out with a vacuum hose into the waiting carrier for transport to the processing plant.

Target Species: Atlantic herring

Spatial/temporaldistribution of effort: In Canadian waters, the Herring Weir Fishery occurs from May to October along the southwestern shore of the Bay of Fundy, and is scattered along the coasts of western Nova Scotia.

Management and Regulations: To Be Determined

Total Effort: Effort is difficult to measure. Weirs may or may not have twine (i.e., be actively fishing) on them in a given year and the amount of time the twine is up varies from year to year. Most weirs tend to fish (i.e., have twine on them) during July, August, and September. Some fishermen keep their twine on longer, into October and November, if it is a good year or there haven't been any storms providing incentive to take the twine down. Effort cannot simply be measured by multiplying the number of weirs with twine times the average number of fishing days (this will provide a very generous estimation of effort) because if a weir fills up with fish the fisherman will pull up the drop (close the net at the mouth) which prevents loss of fish, but also means no new fish can get in, therefore the weir is not actively fishing during that period.

Observer Coverage: From mid-July to early September, on a daily basis, scientists from the Grand Manan Whale & Seabird Research Station check only the weirs around Grand Manan Island for the presence of cetaceans.

Comments: Marine mammals occasionally swim into weirs, in which they can breathe and move about. Marine mammals are vulnerable during the harvesting/seining process where they can become tangled in the seine and suffocate if care is not taken to remove them from the net or to remove them from the weir prior to the onset of the seining process. Small marine mammals, like porpoises, can be removed from the net, lifted into small boats, and taken out of the weir for release without interrupting the seining process. Larger marine mammals, such as whales, must be removed from the weir either through the creation of a large enough escape hole in the back of the weir (taking down the twine and removing some poles) or sometimes by sweeping them out with a specialized mammal net, although this approach carries with it a few more risks to the animal than the "escape hole" technique.

Through the cooperation of weir fishermen and the Grand Manan Whale & Seabird Research Station, weir-associated mortality of cetaceans is relatively low. Over 91% of all entrapped porpoises, dolphins and whales are successfully released from weirs around Grand Manan Island. Thus the total number of entrapments (which can vary annually from 6 to 312) is in no way reflective or indicative of cetacean mortality caused by this fishery.

Gulf of Maine Atlantic Herring Purse Seine Fishery

Category: III

Basis for current classification on the LOF: There are no reports of marine mammal mortalities in this fishery. Marine mammals can be captured by the gear, but because the mesh size of nets used is small there is only a small chance of entanglement. When marine mammals including harbor seals, grey seals, humpback whales, fin whale and/or sei whales are caught in this gear, they are released alive without injury and thus are not included as species/stocks that are incidentally killed/injured by this fishery.

Current list of marine mammal species/stocks killed/injured: Harbor seal, WNA; Gray seal, WNA.

Gear description/method for fishing: The purse seine is a deep nylon mesh net with floats on the top and lead weights on the bottom. Rings are fastened at intervals to the lead line and a purse line runs completely around the net through the rings (www.gma.org, Gulf of Maine Research Institute, GOMRI). One end of the net remains in the vessel and the other end is attached to a power skiff or "bug boat" that is deployed from the stern of the vessel and remains in place while the vessel encircles a school of fish with the net. Then the net is pursed and brought back aboard the vessel through a hydraulic power block. Purse seines vary in size according to the size of the vessel and the depth to be fished. Most purse seines used in the New England Herring Fishery range from 30 to 50 meters deep (100-165 ft.) (NMFS 2005). Purse seining is a year round pursuit in the Gulf of Maine, but is most active in the summer when herring are more abundant in coastal waters and are mostly utilized at night, when herring are feeding near the surface. This fishing technique is less successful when fish remain in deeper water and when they do not form "tight" schools.

Target Species: Atlantic herring

Spatial/temporal distribution of effort: Most U.S. Atlantic herring catches occur between May and October in the Gulf of Maine, consistent with the peak season for the lobster fishery. The connection between the herring and lobster fisheries is the reliance of the lobster industry on herring for bait. In addition, there is a relatively substantial winter fishery in southern New England, and catches from Georges Bank have increased somewhat in recent years. There is a very small recreational fishery for Atlantic herring that generally occurs from early spring to late fall, and herring is caught by tuna boats with gillnets for use as live bait in the recreational tuna fisheries. In addition, there is a Canadian fishery for Atlantic herring from New Brunswick to the Gulf of St. Lawrence, which primarily utilizes fixed gear. Fish caught in the New Brunswick (NB) weir fishery are assumed to come from the same stock (inshore component) as that targeted by U.S. fishermen (http://www.nefmc.org/herring/index.html, Northeast Fisheries Management Council, NEFMC). Figures 31-35 document the distribution of sets and marine mammal interactions observed from 2008 to 2012, respectively.

Management and Regulations: The Gulf Of Maine Atlantic Herring Purse Seine Fishery is defined as a Category III fishery in the 2010 List of Fisheries (74 FR 58859, November 16, 2009).fishery. This gear is managed by federal and state FMPs that range from Maine to North Carolina. The relevant FMPs include, but may not be limited to the Atlantic Herring FMP (FR 70(19), 50 CFR Part 648.200 through 648.207) and the Northeast Multi-species (FR 67, CFR Part 648.80 through 648.97). This fishery is primarily managed by total allowable catch (TACs).

Total Effort: Total metric tons of fish landed from 1998 to 2012 were 24,256, 39,866, 29,609, 20,691, 20,096, 17,939, 19,958, 16,306, 18,700, 31,019, 27,327, 22,547, 8,566, 16,981 and 19,413 respectively (NMFS, Unpbl.). Total effort, measured in trips, for the Gulf of Maine Atlantic Herring Purse Seine Fishery from 2002 to 2012 was 343, 339, 276, 202, 173, 249, 344, 249, 228, 242, 273, 273, and 288 respectively (NMFS, Unpbl.).

Observer Coverage: During the period 1994 to 2002, estimated observer coverage (number of trips observed/total commercial trips reported) was 0. From 2003 to 2012, percent observer coverage was 0.34, 9.8, 0.27, 0, 3.2, 12, 21, 12, 33 and 17respectively.

Northeast/Mid-Atlantic American Lobster Trap/Pot

Current category: Category I

Basis for current classification on the LOF: The annual level of serious injury and mortality of North Atlantic right whales (Western North Atlantic [WNA] stock), humpback whales (Gulf of Maine stock), and minke whales

(Canadian East Coast stock) in this fishery exceeds 50% of each stocks' Potential Biological Removal (PBR) level.

Current list of marine mammal species/stocks killed/injured (a (1) indicates those stocks driving the fishery's classification): Harbor seal, WNA; Humpback whale, Gulf of Maine; Minke whale, Canadian East Coast; North Atlantic right whale, WNA (1)
.
Gear description/method for fishing: This fishery operates with traps. 2-3% of the target species are taken by mobile gear (trawls and dredges), that are classified within the Category III Northeast Shellfish Bottom Trawl fishery.

Target species: American lobster.

Spatial/temporal distribution of effort: The fishery operates in inshore and offshore waters from Maine to New Jersey and may extend as far south as Cape Hatteras, North Carolina. Approximately 80% of American lobsters are harvested from state waters.

Management and regulations: The Atlantic States Marine Fisheries Commission has a primary regulatory role for this fishery because the majority of the harvest is taken from state waters. The Exclusive Economic Zone (EEZ) portion of the fishery operates under regulations from the Federal American Lobster Fishery Management Plan (FMP). Both the EEZ and state fishery are operating under Federal regulations from the Atlantic Large Whale Take Reduction Plan.

Observer coverage: There has not been observer coverage in this fishery.

Atlantic Mixed Species Trap/Pot Fishery

Current category: Category II

Basis for current classification on the LOF: Based on analogy with the Category I "Northeast/Mid-Atlantic American lobster trap/pot fishery" and the Category II "Atlantic blue crab trap/pot fishery." The gear used in these lobster and crab pot fisheries, which have been involved in entanglement events, is similar to the gear used in this fishery.

Current list of marine mammal species/stocks killed/injured: Fin whale, Western North Atlantic (WNA); Humpback whale, Gulf of Maine.

Gear description/method for fishing: This fishery uses trap/pot gear.

Target species: Target species include, but are not limited to, hagfish, shrimp, conch/whelk, red crab, Jonah crab, rock crab, black sea bass, scup, tautog, cod, haddock, Pollock, redfish (ocean perch) white hake, spot, skate, catfish, stone crab, and cunner.

Spatial/temporal distribution of effort: The fishery includes all trap/pot operations from the U.S.-Canada border south through the waters east of the fishery management demarcation line between the Atlantic Ocean and the Gulf of Mexico (50 CFR 600.105), but does not include the following Category I, II, and III trap/pot fisheries: Northeast/Mid-Atlantic American lobster trap/pot; Atlantic blue crab trap/pot; FL spiny lobster trap/ pot; Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot; U.S. Mid-Atlantic eel trap/pot; and the Southeastern U.S. Atlantic, Gulf of Mexico golden crab fisheries.

Management and regulations: The fishery is managed under various Interstate Fishery Management Plans and is subject to ALWTRP implementing regulations.
Observer coverage: There has not been observer coverage in this fishery.

Atlantic Ocean, Caribbean, Gulf of Mexico Large Pelagics Longline

Current category: Category I

Basis for current classification on the LOF: The total annual mortality and serious injury of long-finned pilot whale (Western North Atlantic [WNA] stock), pygmy sperm whale (WNA stock), and short-finned pilot whale (WNA

stock) in this fishery is greater than 50% of the stocks' Potential Biological Removal (PBR) levels.

Current list of marine mammal species/stocks killed/injured (a (1)indicates those stocks driving the fishery's classification): Atlantic spotted dolphin, Gulf of Mexico (GMX) continental and oceanic; Atlantic spotted dolphin, WNA; Bottlenose dolphin, Northern GMX oceanic; Bottlenose dolphin, WNA offshore; Common dolphin, WNA; Cuvier's beaked whale, WNA; Gervais beaked whale, GMX oceanic stock; Killer whale, GMX oceanic stock; Long-finned pilot whale, WNA(1); Mesoplodon beaked whale, WNA; Northern bottlenose whale, WNA; Pantropical spotted dolphin, Northern GMX; Pantropical spotted dolphin, WNA; Risso's dolphin, Northern GMX; Risso's dolphin, WNA; Short-finned pilot whale, Northern GMX; Short-finned pilot whale, WNA(1); Sperm whale, GMX oceanic stock. Not mentioned here are documented interactions with sea turtles and sea birds.

Gear description/method for fishing: The fishery uses a mainline of >700 lb (317.5 kg) test monofilament typically ranging from 10-45 mi (16-72 km) long (although limited to 20 nm in the Mid-Atlantic Bight) . Bullet-shaped floats are suspended at regular intervals along the mainline and long sections of gear are marked by radio beacons. Long gangion lines of 200-400 lb (91-181 kg) test monofilament of typically 100-200 ft (30.5-61 m) are suspended from the mainline. Only certain sized hooks and baits are allowed based on fishing location. Hooks are typically fished at depths between 40-120 ft (12-36.6 m). Longlines targeting tuna are typically set at dawn are hauled near dusk, while longlines targeting swordfish are typically set at night and hauled in the morning. Gear remains in the water typically for 10-14 hours. Fishermen generally modify only select sections of longline gear to target dolphin fish or wahoo, with the remaining gear configured to target swordfish, tuna, and/or sharks.

Target species: Swordfish, tuna (yellowfin, bigeye, bluefin, and albacore), dolphin fish, wahoo, shortfin mako shark, and a variety of other shark species.

Temporal and Spatial Distribution: Fishing effort occurs year round and operates in waters both inside and outside the U.S. EEZ throughout Atlantic, Caribbean and Gulf of Mexico waters. The "Atlantic" component of the fleet operates both in coastal and continental shelf waters along the U.S. Atlantic coast from Florida to Massachusetts. The fle*et al*so operates in distant waters of the Atlantic including the central equatorial Atlantic Ocean and the Canadian Grand Banks. Fishing effort is reported in 11 defined fishing areas including the Gulf of Mexico. During 2012, the majority of fishing effort was reported in the Gulf of Mexico (441 sets) fishing areas (Garrison and Stokes 2013).

Management and regulations: This fishery is managed under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (FMP). The dolphin fish and wahoo portions of the fishery are managed under the South Atlantic FMP for Dolphin and Wahoo. Regulations under the Magnuson-Stevens Fishery Conservation and Management Act address the target fish species, as well as bycatch species protected under the Endangered Species Act and/or the MMPA. A portion of this fishery is subject to regulations under the Pelagic Longline Take Reduction Plan (50 CFR 229.36).

Total Effort: The total fishing effort in the Atlantic component of the Pelagic Longline Fishery has been declining since a peak reported effort of 12,318 sets (7.41 million hooks) during 1995. The mean effort reported to the Fisheries Logbook System between 1995 and 2000 was 9,370 sets (5.62 million hooks). Between 2001 and 2007, a mean of 4,551 sets (3.19 million hooks) was reported each year. During 2011, the total reported fishing effort was 8,044 sets and 5.9 thousand hooks (Garrison and Stokes 2012). During 2012, the total reported fishing effort was 11,025 sets and 8.04 thousand hooks (Garrison and Stokes 2013).

Observer Coverage: The Pelagic Longline Observer Program (POP) is a mandatory observer program managed by the SEFSC that has been in place since 1992. Observers are placed upon randomly selected vessels with total observer effort allocated on a geographic basis proportional to the total amount of fishing effort reported by the fleet. The target observer coverage level was 5% of reported sets through 2001, and was elevated to 8% of total sets in 2002. In 2011, the overall percent observer coverage during regular fishing was 10.9% expressed as a proportion of reported hooks and 10.1% as a proportion of reported sets (Garrison and Stokes 2012). Observed longline sets and marine mammal interactions are shown for 2008-2012 in Figures 36 through 45.

Comments: This fishery has been the subject of numerous management actions since 2000 associated with bycatch of both billfish and sea turtles. These changes have resulted in a reduction of overall fishery effort and changes in

the behaviors of the fishery. The most significant change was the closure of the NED area off the Canadian Grand Banks and near the Azores as of June 1, 2001 (50 CFR Part 635). An experimental fishery was conducted in this area during both 2001 and 2002 to evaluate gear characteristics and fishing practices that increase the bycatch rate of sea turtles. Several marine mammals, primarily Risso's Dolphins, were seriously injured during this experimental fishery. In addition, there have been a number of time-area closures since late 2000 including year-round closures in the DeSoto Canyon area in the Gulf of Mexico and the Florida East Coast area; and additional seasonal closures in the Charleston Bump area and off of New Jersey (NMFS 2003). Additionally, a ban on the use of live fish bait was initiated in 1999 due to concerns over billfish bycatch. The June 2004 Biological Opinion has resulted in a significant change in the gear and fishing practices of this fishery that will likely impact marine mammal bycatch. The majority of interactions with marine mammals in this fishery have been with Pilot Whales and Risso's Dolphin. These interactions primarily occurred along the shelf break in the Mid-Atlantic Bight region during the third and fourth quarters (Garrison 2003; 2005; Fairfield Walsh and Garrison 2006; Fairfield Walsh and Garrison 2007, Garrison *et al.* 2009). The Pelagic Longline Take Reduction Team was convened during 2005 to develop approaches to reduce the serious injury of pilot whales in the mid-Atlantic, and the resulting take reduction plan is currently being implemented by NOAA Fisheries (http://www.nmfs.noaa.gov/pr/pdfs/fr/fr74-23349.pdf).

Southeast Atlantic Gillnet

Current category: Category II

Basis for current classification on the LOF: Based on analogy to other Atlantic gillnet fisheries that use similar gear and operate in a similar manner to this fishery. Also, based on a 2001 recommendation by the Atlantic Scientific Review Group (SRG) to elevate all gillnet fisheries to Category II (unless there is evidence to the contrary).

Current list of marine mammal species/stocks killed/injured: Bottlenose dolphin, Southern Migratory coastal; Bottlenose dolphin, Central FL coastal; Bottlenose dolphin, Northern FL coastal; Bottlenose dolphin, SC/GA.

Gear description/method for fishing: This fishery uses gillnets set in sink, stab, set, or strike fashion.

Target species: This fishery targets finfish including, but not limited to: king mackerel, Spanish mackerel, whiting, bluefish, pompano, spot, croaker, little tunny, bonita, jack crevalle, cobia, and striped mullet.

Spatial/temporal distribution of effort: This fishery operates in waters south of a line extending due east from the North Carolina/South Carolina border and south and east of the fishery management council demarcation line between the Atlantic Ocean and the Gulf of Mexico. The majority of fishing effort occurs in Federal waters because South Carolina, Georgia, and Florida prohibit the use of gillnets, with limited exceptions, in state waters. This fishery does not include gillnet effort targeting sharks, which are a target species of the "Southeastern U.S. Atlantic shark gillnet fishery."

Management and regulations: Fishing for king mackerel, Spanish mackerel, cobia, cero, and little tunny in Federal waters is managed under the Coastal Migratory Pelagic Resources FMP. None of the other target species are Federally managed under the Magnuson-Stevens Fishery Conservation and Management Act. In state waters, state and Atlantic States Marine Fisheries Commission Interstate FMPs apply. The fishery is also subject to BDTRP and ALWTRP implementing regulations (because of the potential for interactions with North Atlantic right whales in the Southeast U.S. Restricted Areas).

Observer Coverage: ?

Southeastern U.S. Atlantic Shark Gillnet Fishery

Current category: Category II

Basis for current classification on the LOF: The 2010 LOF included a superscript "1" following bottlenose dolphin (WNA coastal stock) because the annual mortality and serious injury of that stock in this fishery was greater than 1% and less than 50% of the stock's Potential Biological Removal (PBR) level. When the stocks of bottlenose dolphins killed/injured in this fishery were updated on the 2011 LOF, the superscript "1" was retained after the new stocks because NMFS cannot yet differentiate to which stock a killed/injured animal belongs. In this case, there is only one stock the killed/injured animals could have come from.

Current list of marine mammal species/stocks killed/injured (a (1)indicates those stocks driving the fishery's classification): Bottlenose dolphin, Central Florida (FL) coastal (1); Bottlenose dolphin, Northern FL coastal; North Atlantic right whale, WNA.

Gear description/method for fishing: This fishery uses gillnets set in a sink, set, strike, or drift fashion. Mesh size is typically greater than 5 in (13 cm), but may be as small as 2.87 in (7.3 cm) when targeting small coastal sharks. Drift gillnets most commonly use a mesh size of 6.1-15.2 cm, and average 4.07 hours from setting the gear through completion of haulback; sink gillnets most frequently use a mesh size of 6.4-19.1 cm, soaking for approximately 7.64 hours; and strike gillnets use the largest mesh size of 8.9 -12.1cm), soaking for approximately 8.46 hours. (Sources for this information include Passerotti et al. 2010, Passerotti et al. 2011, Gulack et al. 2012, and Mathers et al. 2013).

Target species: Large and small coastal sharks (blacktip, blacknose, finetooth, bonnethead, and sharpnose).

Spatial/temporal distribution of effort: This fishery has traditionally operated in coastal waters off Florida and Georgia. However, more recently sets ranged from North Carolina to the Florida Keys in both the Atlantic and Gulf of Mexico (Mathers et al. 2013).

Management and regulations: This fishery is managed under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (FMP), ALWTRP, and BDTRP. Regulations implemented under the Magnuson-Stevens Fishery Conservation and Management Act address managed target species, as well as bycatch species, including some protected under the ESA and Marine Mammal Protection Act (e.g., sea turtles, smalltooth sawfish, and right whales). Due to Amendment 2 and 3 to the Consolidated Atlantic Highly Migratory Species FMP, the large and small coastal shark gillnet fishery has been significantly reduced (NMFS 2007).

Total Effort: Gillnets targeting sharks in the southeastern U.S. Atlantic are fished in a variety of configurations including long soak drift sets, short soak encircling strike sets, and short duration sink sets. In addition, sink gillnets are used to target other finfish species. The same fishing vessels will fish the different types of sets. In the reported logbook data, it is difficult to identify these different gear types and distinguish sets targeting sharks from those targeting finfish. The total amount of effort was therefore estimated based upon observer data and reported fishing gear and catch characteristics (Garrison 2007). Between 2001 and 2005, an annual average of 74 drift sets, 40 strike sets, and 241 sink sets targeting sharks were reported and/or observed. The number of drift sets has been declining steadily while the number of strike sets has been increasing. During 2006, there were 8 drift sets, 40 strike sets, and 301 sink sets targeting sharks reported or observed (Garrison 2007). However, there is direct evidence of under-reporting as some observed sets were not reported to the FLS system, and the total effort remains highly uncertain. In 2007, a total of 85 drift net sets were observed with 4 of those targeting sharks and the remainder Spanish mackerel. A total of 112 sink net sets were observed, with 60 of those targeting sharks and the remainder targeting various fish species (Baremore *et al.* 2007). During 2008, there was very limited targeted fishing for sharks off the coast of Florida due to the closure of the large coastal shark fishery during the first half of the year, and there were no strike sets observed targeting sharks and only a few sink sets (Passerotti and Carlson 2009).

Observer coverage: A dedicated observer program for the Shark Drift Gillnet Fishery has been in place since 1998. Since 2000, due to the provisions of the ALWTRP, observer coverage has been high during the winter months. However, due to limited funding, observer coverage outside of this period was generally low (less than 5%) prior to 2000, and has been increasing since. From 2001 to 2006, the annual observer coverage of the drift gillnet fishery was 68%, 85%, 50%, 66%, 58%, and 48%, respectively. The annual coverage of the strike component from 2001 to 2006 was 63%, 86%, 72%, 81%, and 84%, respectively. The sink component of the fishery was observed in 2005 and 2006 with coverage levels of 10% and 22%, respectively. However, given the uncertainties in the level of reported effort, these estimates of observer coverage are highly uncertain. Due to these uncertainties, effort levels for the fishery and estimated observer coverage for 2007 and 2008 are not available.

Comments: There is a significant level of uncertainty surrounding estimating the total level of effort in this fishery. There is direct evidence of inconsistency in reporting. It is not possible to reliably distinguish trips targeting sharks from those targeting other fish species, and it is not possible to distinguish different types of sets in the logbook data. In fact, many gillnet fishers now target Spanish and king mackerel as well as bluefish (Passerotti et al. 2010) .

However, the overall marine mammal and sea turtle bycatch rate is very low, therefore it is unlikely that even severe biases would result in large increases in the estimated total protected species bycatch in this fishery. In addition to marine mammal interactions, this fishery has been the subject of management concern due to recent interactions with endangered sea turtles including leatherback and loggerhead turtles.

Atlantic Blue Crab Trap/Pot

Current category: Category II

Basis for current classification on the LOF: The total annual mortality and serious injury West Indian manatees (FL stock) in this fishery is greater than 1% and less than 50% of the stocks' Potential Biological Removal (PBR) level. Also, when the stocks of bottlenose dolphins killed/injured in this fishery were updated on the 2011 LOF, the superscript "1" was retained after each of these stocks. The 2010 LOF included a superscript "1" following bottlenose dolphin (WNA coastal stock) and NMFS cannot yet differentiate to which stock a killed/injured animal belongs. Until NMFS is able to do so, each stock of bottlenose dolphin is considered to be driving the classification of the fishery.

Current list of marine mammal species/stocks killed/injured (a (1) indicates those stocks driving the fishery's classification): Bottlenose dolphin, Northern North Carolina (NC) estuarine system (1); Bottlenose dolphin, Southern NC estuarine system (1); Bottlenose dolphin, Charleston estuarine system (1); Bottlenose dolphin, Northern Georgia (GA)/Southern South Carolina (SC) estuarine system (1); Bottlenose dolphin, Southern GA estuarine system (1); Bottlenose dolphin, Jacksonville estuarine system (1); Bottlenose dolphin, Indian River Lagoon estuarine system (1); Bottlenose dolphin, Northern Migratory coastal (1); Bottlenose dolphin, Southern Migratory coastal (1); Bottlenose dolphin, Northern Florida (FL) coastal (1); Bottlenose dolphin, Central FL coastal(1); Bottlenose dolphin, SC/GA coastal (1); West Indian manatee, FL (1).

Gear description/method for fishing: This fishery uses pots baited with fish or poultry typically set in rows in shallow water. The pot position is marked by a buoy line attached to a surface buoy.

Target species: Blue crab.

Spatial/temporal distribution of effort: The fishery occurs year-round from the south shore of Long Island at 72° 30'W. long. in the Atlantic and east of the fishery management demarcation line between the Atlantic Ocean and the Gulf of Mexico (50 CFR 600.105), including state waters.

Management and Regulations: It is managed under state Fishery Management Plans, the Bottlenose Dolphin Take Reduction Plan (voluntary measures), and Atlantic Large Whale Take Reduction Plan.

Levels of observer coverage each year: There has not been observer coverage in this fishery.

Comments: In recent years, reports of strandings with evidence of interactions between bottlenose dolphins and both recreational and commercial crab pot fisheries have been increasing in the Southeast region (McFee and Brooks 1998; Burdett and McFee 2004). Interactions with crab pots appear to generally involve a dolphin becoming wrapped in the buoy line. The total number of these interactions and associated mortality rates has not been documented; however, based on stranding data from 2007-2012, there have been 36 reports of interactions between bottlenose dolphins and Atlantic trap/pots or possible trap/pot gear, and of those 18 were confirmed as Altantic blue crab trap/pot gear..

Mid-Atlantic Haul/Beach Seine

Current category: Category II

Basis for current classification on the LOF: The 2010 LOF included a superscript "1" following bottlenose dolphin (WNA coastal stock) because the annual mortality and serious injury of that stock in this fishery was greater than 1% and less than 50% of the stock's Potential Biological Removal (PBR) level. When the stocks of bottlenose dolphins killed/injured in this fishery were updated on the 2011 LOF, the superscript "1" was retained after each of these stocks because NMFS cannot yet differentiate to which stock a killed/injured animal belongs. Until NMFS is

able to do so, each stock of bottlenose dolphin is considered to be driving the classification of the fishery.

Current list of marine mammal species/stocks killed/injured (a (1) indicates those stocks driving the fishery's classification): Bottlenose dolphin, Northern North Carolina (NC) estuarine system (1); Bottlenose dolphin, Northern Migratory coastal (1); Bottlenose dolphin, Southern Migratory coastal (1).

Gear description/method for fishing: This fishery uses seines with one end secured (e.g., swipe nets and long seines); both ends secured; or those anchored to hauled up on the beach. The beach seine system is generally constructed of a wash, wing, and bunt that are attached to the beach and extend into the surf and are traditionally used to encircle or encompass fish.

Target Species: Striped bass, mullet, spot, weakfish, sea trout, bluefish, kingfish, and harvestfish.

Spatial/temporal distribution of effort: This fishery operates in waters west of 72° 30'W. long. and north of a line extending due east from the North Carolina/South Carolina border and includes haul seining in other areas of the mid-Atlantic, including Virginia, Maryland, and New Jersey. The North Carolina Atlantic Ocean Striped Bass fishery operates primarily along the Outer Banks using small and large mesh nets and primarily during the fall and winter months.

Management and Regulations: The fishery is managed under several state and Interstate Fishery Management Plans and is an affected fishery under the BDTRP. Large mesh nets are regulated in North Carolina via North Carolina Marine Fisheries Commission rules and NCDMF proclamations.

Observer Coverage: North Carolina beach-based fishing has been observed since April 7, 1998 by the NMFS Fisheries Sampling Program (Observer Program) based at the NEFSC and the North Carolina Alternate Platform Observer Program. The numbers of observed beach seine sets from 1998 to 2008 were 63, 60, 52, 12, 6, 23, 36, 29, 9, 27, and 39. Overall, there has been very limited observer coverage by the NEFSC and the NC Alternate Platform Observer program.

Comments: The only haul/beach seine gear operating in North Carolina included in this Category II fishery is the ''Atlantic Ocean striped bass beach seine fishery'' during the winter.NCDMF defines a beach seine operating under the Atlantic Ocean Striped Bass beach seine fishery as a ''swipe net constructed of multifilament, multifiber webbing fished from the ocean beach that is deployed from a vessel launched from the ocean beach where the fishing operation takes place, and one end of the beach seine is attached to the shore at all times during the operation.'' All other NC small and large mesh beach- anchored gillnets with webbing constructed of all monofilament material or a combination of monofilament and multifilament.

North Carolina Inshore Gillnet Fishery

Current category: Category II

Basis for current classification on the LOF: The 2010 LOF included a superscript "1" following bottlenose dolphin (WNA coastal stock) because the annual mortality and serious injury of that stock in this fishery was greater than 1% and less than 50% of the stock's Potential Biological Removal (PBR) level. When the stocks of bottlenose dolphins killed/injured in this fishery were updated on the 2011 LOF, the superscript "1" was retained after each of these stocks because NMFS cannot yet differentiate to which stock a killed/injured animal belongs. Until NMFS is able to do so, each stock of bottlenose dolphin is considered to be driving the classification of the fishery.

Current list of marine mammal species/stocks killed/injured (a (1) indicates those stocks driving the fishery's classification): Bottlenose dolphin, Northern North Carolina (NC) estuarine (1); Bottlenose dolphin, Southern NC estuarine (1).

Gear description/method for fishing: This fishery includes any fishing effort using any type of gillnet gear, including set (float and sink), drift, and runaround gillnet.

Target species: Target species include, but are not limited to: southern flounder, weakfish, bluefish, Atlantic croaker, striped mullet, spotted seatrout, Spanish mackerel, striped bass, spot, red drum, black drum, and shad.

Spatial/temporal distribution of effort: This fishery includes any gillnet effort for any target species inshore of the COLREGS demarcation lines in North Carolina (COLREGS demarcation lines delineate those waters upon which mariners shall comply with the International Regulations for Preventing Collisions at Sea and those waters upon which mariners shall comply with the Inland Navigation Rules).

Management and Regulations: This fishery is managed under state and Interstate Fishery Management Plans, applying net and mesh size regulations, and seasonal area closures in the Pamlico Sound Gillnet Restricted Area. It is an affected fishery under the BDTRP and Endangered Species Act.

Observer Coverage: Observer coverage, up to 10% in some cases, is provided by the North Carolina Division of Marine Fisheries, primarily during the fall flounder fishery in Pamlico Sound. The Northeast Fishery Observer Program has observed the fishery at low levels, as well as the North Carolina Alternative Platform Observer Program.

North Carolina Long Haul Seine

Current category: Category II

Basis for current classification on the LOF: The 2010 LOF included a superscript "1" following bottlenose dolphin (WNA coastal stock) because the annual mortality and serious injury of that stock in this fishery was greater than 1% and less than 50% of the stock's Potential Biological Removal (PBR) level. When the stocks of bottlenose dolphins killed/injured in this fishery were updated on the 2011 LOF, the superscript "1" was retained after the new stocks because NMFS cannot yet differentiate to which stock a killed/injured animal belongs. In this case, there is only one stock the killed/injured animals could have come from.

Current list of marine mammal species/stocks killed/injured (a (1) indicates those stocks driving the fishery's classification): Bottlenose dolphin, Northern North Carolina (NC) estuarine system (1); Bottlenose dolphin, Southern NC estuarine system.

Gear description/method for fishing: This fishery uses multi-filament seines consisting of a 1,000-2,000 yard (3,000-6,000 ft) net pulled by two boats for 1-2 nmi (2-4 km). Fish are encircled and concentrated by pulling the net around a fixed stake.

Target species: This fishery targets species including, but not limited to: weakfish, spot, croaker, menhaden, bluefish, spotted seatrout, and hogfish

Spatial/temporal distribution of effort: The fishery includes fishing with long haul seine gear to target any species in waters off North Carolina, including estuarine waters in Pamlico and Core Sounds and their tributaries. The fishery occurs from February-November, with peak effort occurring from June-October.

Management and regulations: The fishery is managed under Atlantic States Marine Fisheries Commission Interstate Fishery Management Plans, and is an affected fishery under the BDTRP.

Observer coverage: There has not been observer coverage in this fishery.

North Carolina Roe Mullet Stop Net

Current category: Category II

Basis for current classification on the LOF: The 2010 LOF included a superscript "1" following bottlenose dolphin (WNA coastal stock) because the annual mortality and serious injury of that stock in this fishery was greater than 1% and less than 50% of the stock's Potential Biological Removal (PBR) level. When the stocks of bottlenose dolphins killed/injured in this fishery were updated on the 2011 LOF, the superscript "1" was retained after the new stocks because NMFS cannot yet differentiate to which stock a killed/injured animal belongs. In this case, there is only one stock the killed/injured animals could have come from.

Current list of marine mammal species/stocks killed/injured (a (1) indicates those stocks driving the fishery's

classification): Bottlenose dolphin, Southern North Carolina (NC) estuarine system (1).
.
Gear description/method for fishing: This fishery uses a stop net and a beach seine. The stop net is a stationary, multi-filament net set in an "L" shape that is anchored to the beach and extended out perpendicular to the beach. The stop net herds schools of fish, while the beach haul seine is used to capture fish and bring them ashore. The beach seine is constructed of multi-filament and monofilament panels with stretched mesh ranging from 3-4 inches stretched. The stop net is traditionally left in the water for 1-5 days, but can be left as long as 15 days.

Target species: Traditionally striped mullet, but has now expanded to include other teleost species as well.

Spatial/temporal distribution of effort: Effort occurs from October-November and is unique to Bogue Banks, North Carolina.

Management and regulations: This fishery is managed under the North Carolina Striped Mullet Fishery Management Plan, North Carolina Department of Marine Fisheries, and is an affected fishery under the BDTRP.

Observer coverage: There has not been Federal observer coverage in this fishery; however, the NMFS Beaufort laboratory observed this fishery in 2001-2002.

Virginia Pound Net

Current category: Category II

Basis for current classification on the LOF: The 2010 LOF included a superscript "1" following bottlenose dolphin (WNA coastal stock) because the annual mortality and serious injury of that stock in this fishery was greater than1% and less than 50% of the stock's Potential Biological Removal (PBR) level. When the stocks of bottlenose dolphins killed/injured in this fishery were updated on the 2011 LOF, the superscript "1" was retained after each of these stocks because NMFS cannot yet differentiate to which stock a killed/injured animal belongs. Until NMFS is able to do so, each stock of bottlenose dolphin is considered to be driving the classification of the fishery.

Current list of marine mammal species/stocks killed/injured (a (1)indicates those stocks driving the fishery's classification): Bottlenose dolphin, Northern Migratory coastal (1); Bottlenose dolphin, Northern North Carolina (NC) estuarine system; Bottlenose dolphin, Southern Migratory coastal (1).

Gear description/method for fishing: This fishery uses stationary gear. Pound net gear includes a large mesh lead posted perpendicular to the shoreline and extending outward to the corral, or "heart," where the catch accumulates.

Target species: Weakfish, spot, and croaker.

Spatial/temporal distribution of effort: Effort in this fishery occurs in nearshore coastal and estuarine waters off Virginia. This fishery includes all pound net effort in Virginia state waters, including waters inside the Chesapeake Bay.

Management and regulations: The fishery is managed by the Atlantic States Marine Fisheries Commission under the Interstate Fishery Management Plans for Atlantic Croaker and Spot, and is an affected fishery under the BDTRP and Endangered Species Act.

Observer Coverage: There has not been formal observer coverage in this fishery; however, the Northeast Fishery Observer Program (NEFOP) has monitoring and characterization that occurs sporadically in this fishery.

Comments: In 2004 and 2005, an experimental fishery was conducted in an area of the Chesapeake Bay that was closed to commercial pound net fishing effort from May to July for sea turtle conservation. The results from these studies determined a modified pound net leader could be used for pound net fishing while providing sea turtle conservation benefits. The modified leader design is also an effective solution to reduce dolphin interactions with Virginia pound net leaders. The reduced mesh webbing and spacing and design of the vertical lines of the modified leader reduce areas for dolphin entanglements. Therefore, the modified leader likely reduces the bycatch of

dolphins (Schaffler et al. 2011). Stranding and observer data also indicate the modified leader design reduces bottlenose dolphin interactions.

Mid-Atlantic Menhaden Purse Seine

Current category: Category II

Basis for current classification on the LOF: Based on analogy to other purse seine fisheries, such as the Category II Gulf of Mexico Menhaden purse seine fishery, and potential interactions with bottlenose dolphins (Northern Migratory coastal and Southern Migratory coastal stocks).

Current list of marine mammal species/stocks killed/injured: Bottlenose dolphin, Northern Migratory coastal; Bottlenose dolphin, Southern Migratory coastal.

Gear description/method for fishing: This fishery uses purse seine gear for reduction or baitfish. The purse seine net is made of nylon fiber and is about 1 ¾ inch stretched mesh; net length is about 1,000-1,400 ft; and net depth is from 65-90 ft. Soak time is approximately 35-45 minutes from deployment of net until the purse is closed. Fishing vessels are either large (up to 200 ft) carrying two smaller purse seine boats (39 ft), or small snapper rigs (60-75 ft).Schools of menhaden are spotted from larger vessels and/or spotted planes. Purse seines are deployed over schools vertically from large vessel or two smaller boats. The floatline and leadline has a series of rings threaded with a purse line that is winched closed around the school. The net is retrieved by power block.

Target species: Menhaden and thread herring.

Spatial/temporal distribution of effort: Most sets occur within 3 mi (4.8 km) of shore with the majority of the effort occurring off North Carolina from November-January, and moving northward during warmer months to southern New England. Fishing effort is year-round with concentrated migratory peaks from May-September from Virginia northward, and November-January in North Carolina. A majority of the fishing effort by the Virginia fleet occurs in the Virginia portion of Chesapeake Bay, and along the ocean beaches of Eastern Shore Virginia. Most sets in Chesapeake Bay are in the main stem of the Bay, greater than one mile from shore. In summer, the Virginia fleet occasionally ranges as far north as northern New Jersey. Purse-seining for reduction purposes is prohibited by state law in Maryland, Delaware, and New Jersey; hence, purse-seine sets in the ocean off Delmarva and New Jersey are by definition greater than 3 miles from shore.

Management and regulations: The fishery is managed by the Atlantic States Marine Fisheries Commission under the Interstate Fishery Management Plan for Atlantic Menhaden.

Observer coverage: There has been very limited observer coverage since 2008.

Southeastern U.S. Atlantic/Gulf of Mexico Shrimp Trawl

Current category: Category II

Basis for current classification on the LOF: Based on interactions reported through observer reports, stranding data, and fisheries research data, with multiple strategic and non-strategic marine mammal stocks. Due to the lack of PBR data for most of the stocks and the low observer coverage in this fishery, NMFS conducted a qualitative analysis to determine the appropriate classification for this fishery. Even with low coverage, NMFS observed 12 dolphin takes (of which 11 were serious injuries or mortalities) from 1993-2009; 11 of which were taken since 2002. Also, the final 2009 SARs note that "occasional interactions with bottlenose dolphins have been observed.and there is infrequent evidence of interactions from stranded animals." Further, Marine Mammal Authorization Program (MMAP) records list 1 dolphin take in shrimp trawl gear in South Carolina in 2002. Lastly, 13 dolphin takes since 2009, 10 of which were taken since 2002, have been documented by NMFS in Southeast U.S. research trawl operations, and/or relocation trawls conducted.

Current list of marine mammal species/stocks killed/injured (a (1) indicates those stocks driving the fishery's classification): Atlantic spotted dolphin, Gulf of Mexico (GMX) continental and oceanic; Bottlenose dolphin, GMX

continental shelf; Bottlenose dolphin, Northern GMX coastal; Bottlenose dolphin, South Carolina/Georgia(SC/GA) coastal (1); Bottlenose dolphin, Eastern GMX coastal (1); Bottlenose dolphin, Western GMX coastal(1); Bottlenose dolphin, GMX bay, sound, estuarine (1)

Gear description/method for fishing: The most commonly employed gear in this fishery is a double-rig otter trawl, which normally includes a lazy line attached to each bag's codend. The lazy line floats free during active trawling, and as the net is hauled back, it is retrieved with a boat- or grappling-hook to assist in guiding and emptying the trawl nets. Shrimp trawl soak time is about three hours. Skimmer nets for shrimp are also included in this LOF fishery classification.

Target species: Brown, pink and white shrimp within estuaries, and near coastal and offshore regions. Royal Red shrimp along the deep continental slope.

Spatial/temporal distribution of effort: The pelagic or bottom trawl fishery operating virtually year-round in the Atlantic Ocean from NC through FL, and in the Gulf of Mexico from FL through TX. Effort occurs in estuarine, near shore coastal waters, and along the continental slope of the Atlantic and estuarine, near shore coastal, and offshore continental shelf and slope waters in the Gulf of Mexico. Fishery typically operates from sunset to sunrise when shrimp are most likely to swim higher in the water column.

Management and regulations: The shrimp fishery is managed by both by state and federal regulations. The shrimp trawl fishery is affected under the Bottlenose Dolphin Take Reduction Plan and Endangered Species Act.

Levels of observer coverage each year: This fishery was observed between 1992 and 2006 under a voluntary program, which became mandatory in 2007. Observer coverage was less than 1% for all observed years.

Comments: Although shrimp trawlers are required under Endangered Species Act regulations to use turtle excluder devices to reduce sea turtle bycatch (50 CFR 223.206), the fishery currently does not use any method or gear modification to deter, or reduce bycatch of, marine mammals.

Southeastern U.S. Atlantic, Gulf of Mexico Stone Crab Trap/Pot Fishery

Current category: Category II

Basis for current classification on the LOF: Based on analogy to the Category II "Atlantic blue crab trap/pot" fishery, and serious injury and mortality to bottlenose dolphins (multiple stocks) reported in stranding data.

Current list of marine mammal species/stocks killed/injured: Bottlenose dolphin, Biscayne Bay estuarine; Bottlenose dolphin, Central Florida (FL) coastal; Bottlenose dolphin, Eastern Gulf of Mexico (GMX) coastal; Bottlenose dolphin, FL Bay; Bottlenose dolphin, GMX bay, sound, estuarine (FL west coast portion); Bottlenose dolphin, Indian River Lagoon estuarine system; Bottlenose dolphin, Jacksonville estuarine system; Bottlenose dolphin, Northern GMX coastal.

Gear description/method for fishing: Traps are the most typical gear type used for the commercial and recreational stone crab fishery. Baited traps are frequently set in waters of 65 ft (19.8 m) depth or less in a double line formation, generally 100-300 ft (30.5-91.4 m) apart, running parallel to a bottom contour. Buoys are attached to the trap/pot via float line.

Target Species: Florida stone crab (*Menippe mercenaria*).

Spatial/temporal distribution of effort: Operates primarily nearshore in the State of Florida. Stone crab fishing outside of this area is likely very minimal. The margins of seagrass flats and bottoms with low rocky relief are also favored areas for trap placement. The season for commercial and recreational stone crab harvest is from October 15 to May 15.

Management and regulations: There is not fishery management plan for stone crab, but rather, the federal and state fishery is managed by the Florida Fish and Wildlife Commission in order to streamline state and federal

management. Besides Florida, Southeastern states do not specifically offer stone crab permits, rather they provide general trap/pot endorsements.

Total Effort: Due to the Stone Crab Trap Reduction Schedule [F.A.C Chapter 68B-13.010(3)(f) Florida Statutes], the number of commercial trap certificates issued by the State of Florida has decreased from approximately 1,475,000 in the 2002-2003 fishing season to 1,119,449 in the 2011-2012 fishing season. The Stone Crab Trap Reduction Schedule [F.A.C Chapter 68B-13.010(3)(f) Florida Statutes] will eventually reduce the number of trap tags to 600,000 trap/pots statewide. Pots will be reduced by a pre-specified percentage each year until the number of trap tags reaches 600,000 (Muller *et al.* 2006).

Observer Coverage: There is no observer coverage in this fishery.

Comments: Based on the similar gear type used in a number of different pot fisheries (e.g., blue crab, spiny lobster, etc.) especially in coastal Florida waters, bottlenose dolphin strandings associated with this fishery are likely underestimated. Derelict trap/pot gear is also a substantial concern for marine life entanglements. In FL, commercial trap/pot buoys are required to be marked with the letter "X," the trap owner's stone crab endorsement number (in characters at least 2 inches high), and a tag that corresponds to a valid FWC-issued trap certificate.

III. Historical Fishery Descriptions

Atlantic Foreign Mackerel

Prior to 1977, there was no documentation of marine mammal bycatch in DWF activities off the Northeast coast of the U.S. With implementation of the Magnuson Fisheries Conservation and Management Act (MFCMA) in that year, an Observer Program was established which recorded fishery data and information on incidental bycatch of marine mammals. DWF effort in the U.S. Atlantic Exclusive Economic Zone (EEZ) under MFCMA had been directed primarily towards Atlantic Mackerel and Squid. From 1977 through 1982, an average mean of 120 different foreign vessels per year (range 102-161) operated within the U.S. Atlantic EEZ. In 1982, there were 112 different foreign vessels; 16%, or 18, were Japanese Tuna longline vessels operating along the U.S. east coast. This was the first year that the Northeast Regional Observer Program assumed responsibility for observer coverage of the longline vessels. Between 1983 and 1991, the numbers of foreign vessels operating within the U.S. Atlantic EEZ each year were 67, 52, 62, 33, 27, 26, 14, 13, and 9 respectively. Between 1983 and 1988, the numbers of DWF vessels included 3, 5, 7, 6, 8, and 8 respectively, Japanese longline vessels. Observer coverage on DWF vessels was 25-35% during 1977-1982, and increased to 58%, 86%, 95% and 98%, respectively, in 1983-1986. One hundred percent observer coverage was maintained during 1987-1991. Foreign fishing operations for Squid ceased at the end of the 1986 fishing season and for Mackerel at the end of the 1991 season. Documented interactions with white sided dolphins were reported in this fishery.

Pelagic Drift Gillnet

In 1996 and 1997, NMFS issued management regulations which prohibited the operation of this fishery in 1997. The fishery operated during 1998. Then, in January 1999 NMFS issued a Final Rule to prohibit the use of drift net gear in the North Atlantic Swordfish Fishery (50 CFR Part 630). In 1986, NMFS established a mandatory self-reported fisheries information system for Large Pelagic Fisheries. Data files are maintained at the SEFSC. The estimated total number of hauls in the Atlantic Pelagic Drift Gillnet Fishery increased from 714 in 1989 to 1,144 in 1990; thereafter, with the introduction of quotas, effort was severely reduced. The estimated number of hauls from 1991 to 1996 was 233, 243, 232, 197, 164, and 149 respectively. Fifty-nine different vessels participated in this fishery at one time or another between 1989 and 1993. In 1994 to 1998 there were 11, 12, 10, 0, and 11 vessels, respectively, in the fishery. Observer coverage, expressed as percent of sets observed, was 8% in 1989, 6% in 1990, 20% in 1991, 40% in 1992, 42% in 1993, 87% in 1994, 99% in 1995, 64% in 1996, no fishery in 1997, and 99% coverage during 1998. Observer coverage dropped during 1996 because some vessels were deemed too small or unsafe by the contractor that provided observer coverage to NMFS. Fishing effort was concentrated along the southern edge of Georges Bank and off Cape Hatteras, North Carolina. Examination of the species composition of the catch and locations of the fishery throughout the year suggest that the Drift Gillnet Fishery was stratified into two strata: a southern, or winter, stratum and a northern, or summer, stratum. Documented interactions with North Atlantic right whales, humpback whales, sperm whales, pilot whale spp., Mesoplodon spp., Risso's dolphins, common dolphins, striped dolphins and white sided dolphins were reported in this fishery.

Atlantic Tuna Purse Seine

The Tuna Purse Seine Fishery occurring between the Gulf of Maine and Cape Hatteras, North Carolina is directed at large medium and giant Bluefin Tuna (BFT). Spotter aircraft are typically used to locate fish schools. The official start date, set by regulation, is 15 July of each year. Individual Vessel Quotas (IVQs) and a limited access system prevent a derby fishery situation. Catch rates for large medium and giant Tuna can be high and consequently, the season can last only a few weeks, however, over the last number of years, effort expended by this sector of the BFT fishery has diminished dramatically due to the unavailability of BFT on the fishing grounds.

The regulations allocate approximately 18.6% of the U.S. BFT quota to this sector of the fishery (5 IVQs) with a tolerance limit established for large medium BFT (15% by weight of the total amount of giant BFT landed.

Limited observer data is available for the Atlantic Tuna Purse Seine Fishery. Out of 45 total trips made in 1996, 43 trips (95.6%) were observed. Forty-four sets were made on the 43 observed trips and all sets were observed. A total of 136 days were covered. No trips were observed during 1997 through 1999. Two trips (seven hauls) were observed in October 2000 in the Great South Channel Region. Four trips were observed in September 2001. No marine mammals were observed taken during these trips. Documented interactions with pilot whale spp. were reported in this fishery.

Atlantic Tuna Pelagic Pair Trawl

The Pelagic Pair Trawl Fishery operated as an experimental fishery from 1991 to 1995, with an estimated 171 hauls in 1991, 536 in 1992, 586 in 1993, 407 in 1994, and 440 in 1995. This fishery ceased operations in 1996 when NMFS rejected a petition to consider pair trawl gear as an authorized gear type in the Atlantic Tuna Fishery. The fishery operated from August to November in 1991, from June to November in 1992, from June to October in 1993 (Northridge 1996), and from mid-summer to December in 1994 and 1995. Sea sampling began in October of 1992 (Gerrior *et al.* 1994) where 48 sets (9% of the total) were sampled. In 1993, 102 hauls (17% of the total) were sampled. In 1994 and 1995, 52% (212) and 55% (238), respectively, of the sets were observed. Nineteen vessels have operated in this fishery. The fishery operated in the area between 35N to 41N and 69W to 72W. Approximately 50% of the total effort was within a one degree square at 39N, 72W, around Hudson Canyon, from 1991 to 1993. Examination of the 1991-1993 locations and species composition of the bycatch, showed little seasonal change for the six months of operation and did not warrant any seasonal or areal stratification of this fishery (Northridge 1996). During the 1994 and 1995 Experimental Pelagic Pair Trawl Fishing Seasons, fishing gear experiments were conducted to collect data on environmental parameters, gear behavior, and gear handling practices to evaluate factors affecting catch and bycatch (Goudy 1995, 1996), but the results were inconclusive. Documented interactions with pilot whale spp., Risso's dolphin and common dolphins were reported in this fishery.

Part B. Description of U.S. Gulf of Mexico Fisheries

I. Data Sources

Items 1 and 2 describe sources of marine mammal mortality, serious injury or entanglement data, and item 3 describes the source of commercial fishing effort data used to generate maps depicting the location and amount of fishing effort and the numbers of active permit holders. In general, commercial fisheries in the Gulf of Mexico have had little directed observer coverage and the level of fishing effort for most fisheries that may interact with marine mammals is either not reported or highly uncertain.

1. Southeast Region Fishery Observer Programs

Two fishery observer programs are managed by the SEFSC that observe commercial fishery activity in the U.S. Gulf of Mexico. The Pelagic Longline Observer Program (POP) administers a mandatory observer program for the U.S. Atlantic Large Pelagics Longline Fishery. The program has been in place since 1992, and randomly allocates observer effort by eleven geographic fishing areas proportional to total reported effort in each area and quarter. Observer coverage levels are mandated under the Highly Migratory Species FMP (HMS FMP, 50 CFR Part 635). The second is the Southeastern Shrimp Otter Trawl Fishery Observer Program. Prior to 2007, this was a voluntary program administered by SEFSC in cooperation with the Gulf and South Atlantic Fisheries Foundation. The program was funding and project dependent, therefore observer coverage is not necessarily randomly allocated across the fishery. In 2007, the observer program was expanded, and it became mandatory for fishing vessels to take an observer if selected. The program now includes more systematic sampling of the fleet based upon reported landings and effort patterns. The total level of observer coverage for this program is ~ 1% of the total fishery effort. In each Observer Program, the observers record information on the total target species catch, the number and type of

interactions with protected species (including both marine mammals and sea turtles), and biological information on species caught. In each Observer Program, the observers record information on the total target species catch, the number and type of interactions with protected species including both marine mammals and sea turtles, and biological information on species caught.

2. Regional Marine Mammal Stranding Networks

The Southeast Regional Stranding Network is a component of the Marine Mammal Health and Stranding Response Program (MMHSRP). The goals of the MMHSRP are to facilitate collection and dissemination of data, assess health trends in marine mammals, correlate health with other biological and environmental parameters, and coordinate effective responses to unusual mortality events (Becker *et al.* 1994). The Southeast Region Strandings Program is responsible for data collection and stranding response coordination along the U.S. Gulf of Mexico coast from Florida through Texas. Prior to 1997, stranding and entanglement data were maintained by the New England Aquarium and the National Museum of Natural History, Washington, D.C. Volunteer participants, acting under a letter of agreement with NOAA Fisheries, collect data on stranded animals that include: species; event date and location; details of the event including evidence of human interactions; determinations of the cause of death; animal disposition; morphology; and biological samples. Collected data are reported to the appropriate Regional Stranding Network Coordinator and are maintained in regional and national databases.

3. Southeast Region Fisheries Logbook System

The FLS is maintained at the SEFSC and manages data submitted from mandatory fishing vessel logbook programs under several FMPs. In 1986, a comprehensive logbook program was initiated for the Large Pelagics Longline Fisheries, and this reporting became mandatory in 1992. Logbook reporting has also been initiated since the early 1990s for a number of other fisheries including: reef fish fisheries; snapper-grouper complex fisheries; federally managed shark fisheries; and king and Spanish mackerel fisheries. In each case, vessel captains are required to submit information on the fishing location, the amount and type of fishing gear used, the total amount of fishing effort (e.g., gear sets) during a given trip, the total weight and composition of the catch, and the disposition of the catch during each unit of effort (e.g., kept, released alive, released dead). FLS data are used to estimate the total amount of fishing effort in the fishery and thus expand bycatch rate estimates from observer data to estimates of the total incidental take of marine mammal species in a given fishery.

4. Marine Mammal Authorization Program

Commercial fishing vessels engaging in Category I or II fisheries are automatically registered under the Marine Mammal Authorization Program (MMAP) in order to lawfully take a non-endangered/threatened marine mammal incidental to fishing operations. These fishermen are required to carry an Authorization Certificate onboard while participating in the listed fishery, must be prepared to carry a fisheries observer if selected, and must comply with all applicable take reduction plan regulations.. All vessel owners, regardless of the category of fishery they are operating in, are required to report, within 48 hours of the incident even if an observer has recorded the take, all incidental injuries and mortalities of marine mammals that have occurred as a result of fishing operations (NMFS-OPR 2003). Events are reported by fishermen on the Marine Mammal Mortality/Injury forms then submitted to and maintained by the NMFS Office of Protected Resources. The data reported include: captain and vessel demographics; gear type and target species; date, time and location of event; type of interaction; animal species; mortality or injury code; and number of interactions. Reporting forms are available online at http://www.nmfs.noaa.gov/pr/pdfs/interactions/mmap_reporting_form.pdf.

II. Gulf of Mexico Commercial Fisheries

Spiny Lobster Trap/Pot Fishery

Current category: Category III

Basis for current classification on the LOF: Entanglements of cetaceans in trap/pot fisheries have been documented, but the degree to which marine mammals become entangled in this fishery needs to be investigated further.

Current list of marine mammal species/stocks killed/injured: Bottlenose dolphin, Biscayne Bay estuarine; Bottlenose dolphin, FL Bay estuarine; Bottlenose dolphin, Central FL coastal; and Bottlenose dolphin, Eastern GMX coastal.

Gear Description: Spiny lobster trap/pot gear most commonly used in the commercial fishery consists of a cube

made of wooden slats. Wire traps are occasionally used, but more frequently in deeper water. Concrete is typically poured in the bottom of traps to weight them. A buoy is attached to the trap via a float line and floated at the surface. Buoys attached to spiny lobster traps must be marked with the letter "C" in Florida state waters. Tags displaying the crawfish endorsement number are also required on all traps by the state of Florida. Diving to collect spiny lobster is another known fishing method.

The type of bait used in traps depends on fisher preference. Some traps are set unbaited, some are baited with fish scraps, sardines, cat food or cowhide, while others are baited with legal sized or undersized lobsters used to attract larger lobsters. Soak times average from 8 to 28 days, with soak times increasing as the season progresses and catch rates decline (Matthews 2001).

Target Species: Caribbean spiny lobster (*Panulirus argus*), smooth tail spiny lobster (*Panulirus lauvicauda*) and spotted spiny lobster (*Panulirus guttatus*).

Spatial/temporal distribution of effort: The distribution of the commercial and recreational spiny lobster harvest off Florida is almost exclusively limited to the waters of the Florida Keys (GMFMC and SAFMC 1982). Effort occurs on both the Atlantic and Gulf side of the Florida Keys; however, diving for lobster is most common on the Gulf side (NMFS 2009). Fishing occurs from very nearshore areas out to water depths of 200 ft, although most fishing occurs in waters less than 100 ft.

The commercial and regular recreational spiny lobster seasons (in both state and federal waters of Florida and other Gulf states) start on August 6 and end on March 31 (F.A.C. Chapter 68B-24.005(1) Florida Statutes; 50 CFR 640.20(b)) with the exception of the two-day sport season in which trap gear is prohibited.

Management and Regulations: Since the majority of this fishery occurs off South Florida, the management involves both State and Federal jurisdictions. The fishery is currently managed via bag limits, minimum size limits, regulated fishing seasons for the commercial and recreational sectors, gear restrictions, trap construction requirements and a trap limitation and permitting program.

Total Effort: Over the last 10 years, commercial trap fishing has been the dominant gear type in the spiny lobster fishery, accounting for approximately 70 percent of all commercial landings (Robson 2006). The remaining landings are collected via divers by hand or via bully nets (which accounts for only a very small percentage). A trap limitation program initiated by the State of Florida in 1993 has reduced the number of lobster traps available annually from approximately one million to 485,891 trap tag certificates for the 2010 season (A. Podey, Florida Fish and Wildlife Conservation Commission (FFWCC) to A. Herndon, NMFS, pers. comm., 2010).

Observer Coverage: There is no observer coverage in this fishery.

Comments: Based on the similar gear type used in a number of different trap/pot fisheries (e.g., blue crab, stone crab, etc.) especially in coastal Florida waters, bottlenose dolphin strandings associated with this fishery are likely underestimated. Derelict trap/pot gear is also a substantial concern for marine life entanglements. It is estimated that between 10-20% of all traps (i.e., 50,000-100,000) are lost annually.

Southeastern U.S. Atlantic, Gulf of Mexico Stone Crab Trap/Pot Fishery

Current category: Category II

Basis for current classification on the LOF: Based on analogy to the Category II "Atlantic blue crab trap/pot" fishery, and serious injury and mortality to bottlenose dolphins (multiple stocks) reported in stranding data.

Current list of marine mammal species/stocks killed/injured: Bottlenose dolphin, Biscayne Bay estuarine; Bottlenose dolphin, Central Florida (FL) coastal; Bottlenose dolphin, Eastern Gulf of Mexico (GMX) coastal; Bottlenose dolphin, FL Bay; Bottlenose dolphin, GMX bay, sound, estuarine (FL west coast portion); Bottlenose dolphin, Indian River Lagoon estuarine system; Bottlenose dolphin, Jacksonville estuarine system; Bottlenose dolphin, Northern GMX coastal.

Gear description/method for fishing: Traps are the most typical gear type used for the commercial and recreational stone crab fishery. Baited traps are frequently set in waters of 65 ft (19.8 m) depth or less in a double line formation, generally 100-300 ft (30.5-91.4 m) apart, running parallel to a bottom contour. Buoys are attached to the trap/pot via float line.

Target Species: Florida stone crab (*Menippe mercenaria*)

Spatial/temporal distribution of effort: Operates primarily nearshore in the state of Florida. Stone crab fishing outside of this area is likely very minimal. The margins of seagrass flats and bottoms with low rocky relief are also favored areas for trap placement. The season for commercial and recreational stone crab harvest is from October 15 to May 15.

Management and regulations: There is not fishery management plan for stone crab, but rather, the federal and state fishery is managed by the Florida Fish and Wildlife Commission in order to streamline state and federal management. Besides Florida, Southeastern states do not specifically offer stone crab permits, rather they provide general trap/pot endorsements.

Total Effort: Due to the Stone Crab Trap Reduction Schedule [F.A.C Chapter 68B-13.010(3)(f) Florida Statutes], the number of commercial trap certificates issued by the State of Florida has decreased from approximately 1,475,000 in the 2002-2003 fishing season to 1,119,449 in the 2011-2012 fishing season. The Stone Crab Trap Reduction Schedule [F.A.C Chapter 68B-13.010(3)(f) Florida Statutes] will eventually reduce the number of trap tags to 600,000 trap/pots statewide. Pots will be reduced by a pre-specified percentage each year until the number of trap tags reaches 600,000 (Muller *et al.* 2006).

Observer Coverage: There is no observer coverage in this fishery.

Comments: Based on the similar gear type used in a number of different pot fisheries (e.g., blue crab, spiny lobster, etc.) especially in coastal Florida waters, bottlenose dolphin strandings associated with this fishery are likely underestimated. Derelict trap/pot gear is also a substantial concern for marine life entanglements. In FL, commercial trap/pot buoys are required to be marked with the letter "X," the trap owner's stone crab endorsement number (in characters at least 2 inches high), and a tag that corresponds to a valid FWC-issued trap certificate.

Gulf of Mexico Menhaden Purse Seine Fishery

Current category: Category II

Basis for current classification on the LOF: Based on a review of observer data from 1992-1995. Observers recorded 9 incidental takes, 8 (3 mortalities) from the Western Gulf of Mexico [GMX] coastal bottlenose stock and 1 from the Northern GMX coastal stock. All of the lethal takes occurred in an area encompassing the Western GMX coastal stock of bottlenose dolphins. Extrapolating the takes from the average observer effort indicated the annual average mortality and serious injury was 68 animals/year, exceeding 100% of the Potential Biological Removal (PBR) level for the Western coastal stock (PBR=29), qualifying this fishery as a Category I fishery on the LOF. However, NMFS categorized this fishery as a Category II pending a revised analysis of stock structure for bottlenose dolphin in the GMX. If all bottlenose stocks in the GMX were grouped together PBR would equal 154, putting the fishery in Category II (68 animals/year is 44% of PBR when PBR is 154).

Current list of marine mammal species/stocks killed/injured ((1) indicates those stocks driving the fishery's classification): Bottlenose dolphin, GMX bay, sound, estuarine; Bottlenose dolphin, Northern GMX coastal(1); Bottlenose dolphin, Western GMX coastal (1). Gear description/method for fishing: This fishery uses purse seine gear. All catch is processed at the "mother ship."

Target species: Menhaden and thread herring.

Spatial/temporal distribution of effort: This fishery operates in bays, sounds, and nearshore coastal waters along the GMX coast. The majority of the fishing effort is concentrated off Louisiana and Mississippi, with lesser effort off Florida, Alabama, and Texas .

Management and regulations: Florida prohibits the use of purse seines in state waters. This fishery is managed under the Gulf States Marine Fisheries Commission Interstate Gulf Menhaden Fishery Management Plan.

Observer coverage: Observed in 1992, 1994, and 1995 through an observer program conducted by Louisiana State University. There has been no observer coverage since 1995. There was a pilot observer program conducted in 2011.

Gulf of Mexico Gillnet Fishery

Current category: Category II

Basis for current classification on the LOF: Primarily by analogy with other Category I and II Atlantic gillnet fisheries, as well as research takes and stranding data Gulf of Mexico (GMX) bottlenose dolphin stocks showing signs of interaction with gillnets, and a recommendation from the Atlantic Scientific Review Group (SRG) to elevate unless there were data to the contrary.

Current list of marine mammal species/stocks killed/injured: Bottlenose dolphin, GMX bay, sound, and estuarine; Bottlenose dolphin, Northern GMX coastal; Bottlenose
dolphin, Western GMX coastal.

Gear description/method for fishing: This fishery uses any type of gillnet configuration, including strike and straight gillnets.

Target species: This fishery targets a wide variety of target species, including, but not limited to: black drum, sheepshead, weakfish, mullet, spot, croaker, king mackerel, Spanish mackerel, Florida pompano, flounder, shark, menhaden, bluefish, blue runner, ladyfish, spotted seatrout, croaker, kingfish, and red drum.

Spatial/temporal distribution of effort: This fishery operates year-round in waters north of the U.S.-Mexico border and west of the fishery management council demarcation line between the Atlantic Ocean and the Gulf of Mexico. Gillnets are currently prohibited in Texas and Florida state waters. Mississippi currently has no state permits available for gillnet fisheries.

Management and regulations: Gillnet gear is prohibited in Texas and Florida state waters, but fixed and runaround gillnets are currently used in Louisiana and Alabama with highly variable fishing effort. Fishing for king mackerel, Spanish mackerel, cobia, cero, little tunny, dolphin fish, and bluefish are managed under the Coastal Migratory Pelagic Resources Fishery Management Plan (CMPR FMP). In the Gulf of Mexico, CMPR FMP species are the only federally managed species for which gillnet gear is authorized, and only run-around gillnetting for these species is allowed. In state waters, state and Gulf States Marine Fisheries Commission Interstate FMPs apply. Furthermore, Texas state does use gillnets for research that have associated takes of bottlenose dolphins.

Observer coverage: There has not been observer coverage in this fishery.

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Appendix III: Fishery Descriptions - List of Figures

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Figure 45. 2012 Observed sets and marine mammal interactions in the pelagic longline fishery - Gulf of Mexico.

Figure 1. 2008 Northeast sink gillnet observed hauls (A) and observed takes (B).

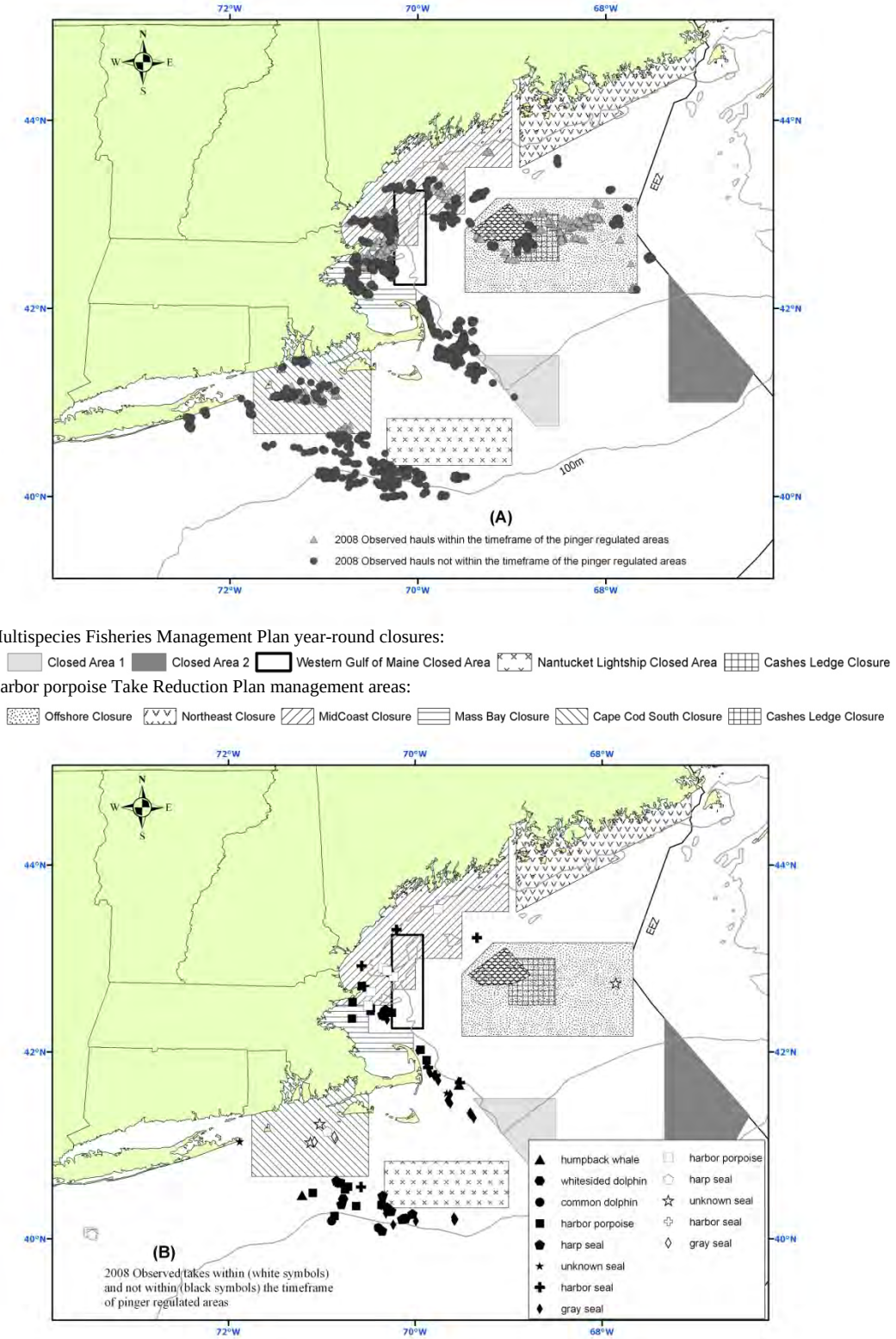
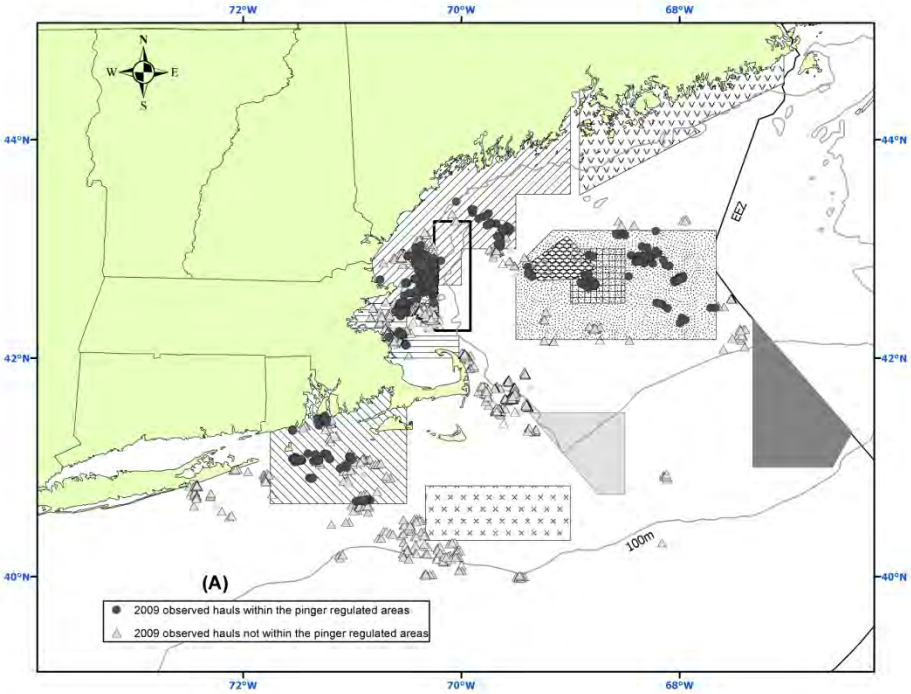


Figure 2. 2009 Northeast sink gillnet observed hauls (A) and observed takes (B).



Multispecies Fisheries Management Plan year-round closures:

Closed Area 1 | Closed Area 2 | Western Gulf of Maine Closed Area | Nantucket Lightship Closed Area | Cashes Ledge Closure

Harbor porpoise Take Reduction Plan management areas:

Offshore Closure | Northeast Closure | MidCoast Closure | Mass Bay Closure | Cape Cod South Closure | Cashes Ledge Closure

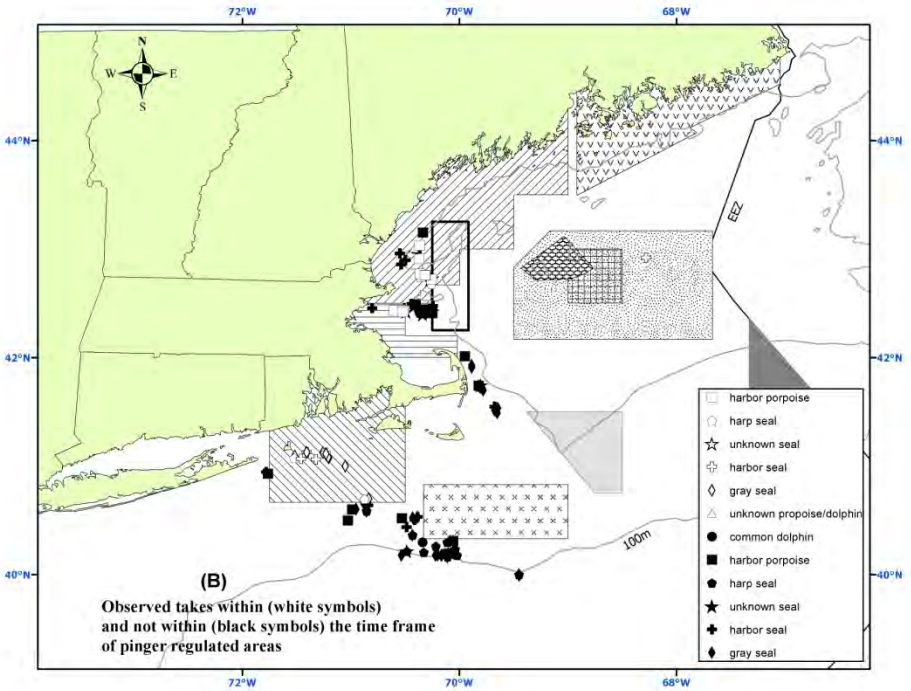


Figure 3. 2010 Northeast sink gillnet observed hauls (A) and observed takes (B).

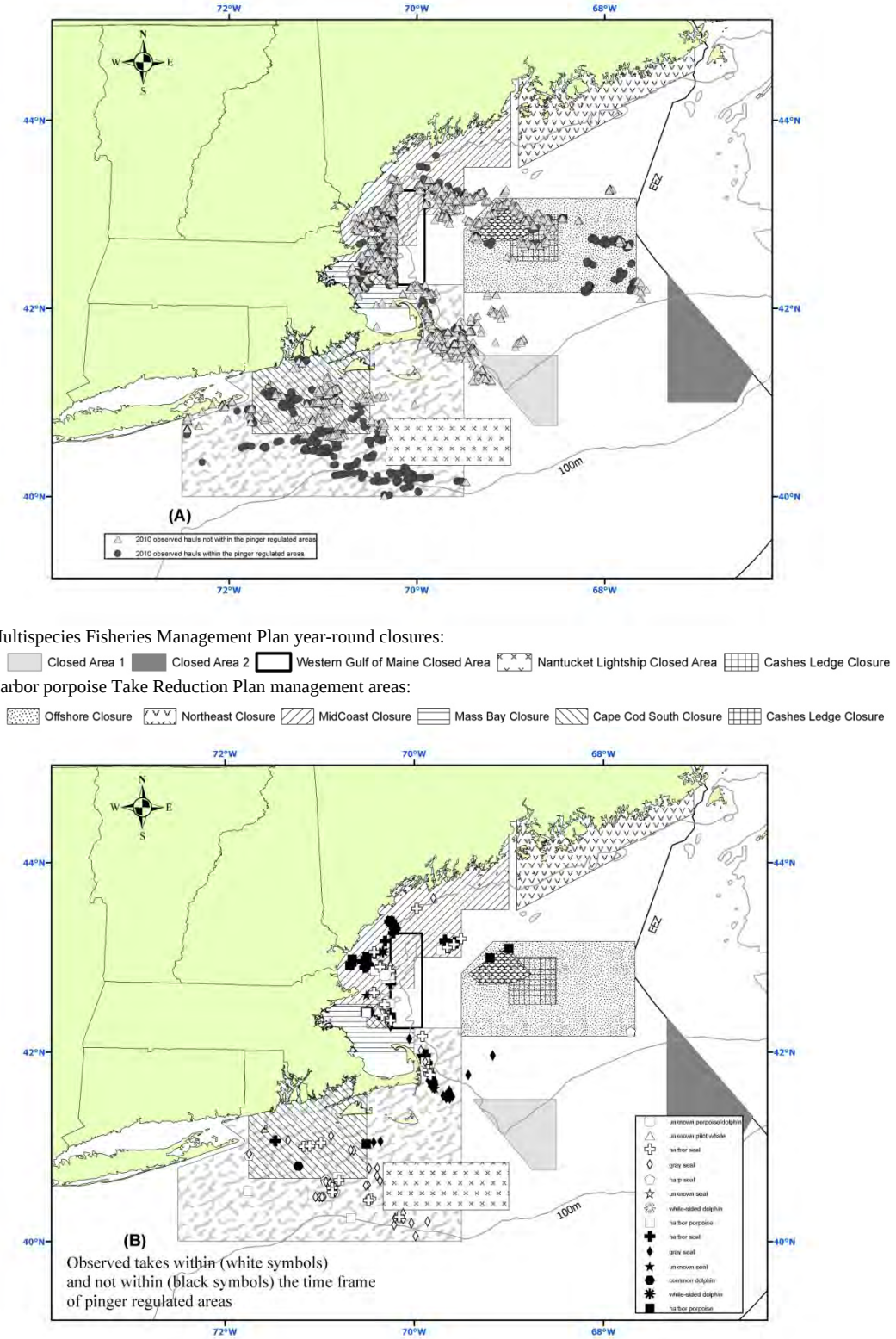
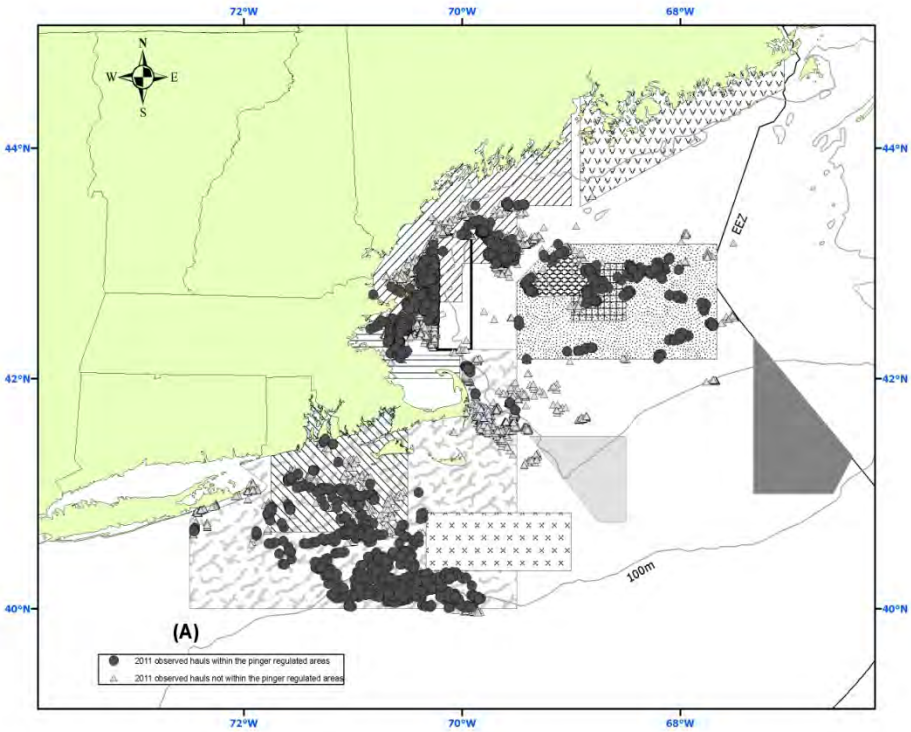


Figure 4. 2011 Northeast sink gillnet observed hauls (A) and observed takes (B).



Multispecies Fisheries Management Plan year-round closures:

Closed Area 1 | Closed Area 2 | Western Gulf of Maine Closed Area | Nantucket Lightship Closed Area | Cashes Ledge Closure

Harbor porpoise Take Reduction Plan management areas:

Offshore Closure | Northeast Closure | MidCoast Closure | Mass Bay Closure | Cape Cod South Closure | Cashes Ledge Closure

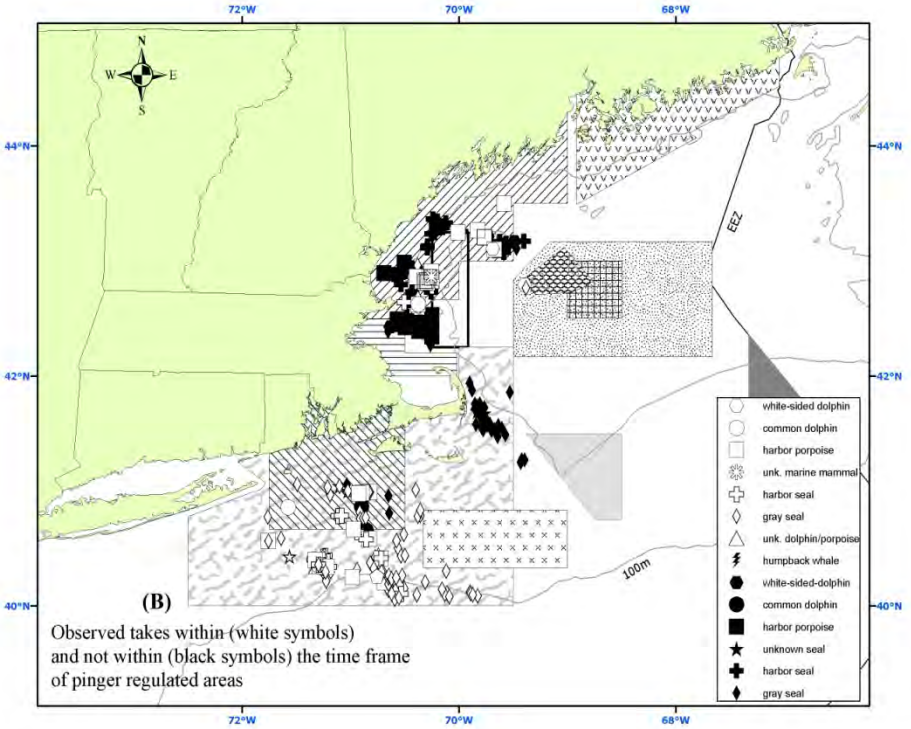


Figure 5. 2012 Northeast sink gillnet observed hauls (A) and observed takes (B).

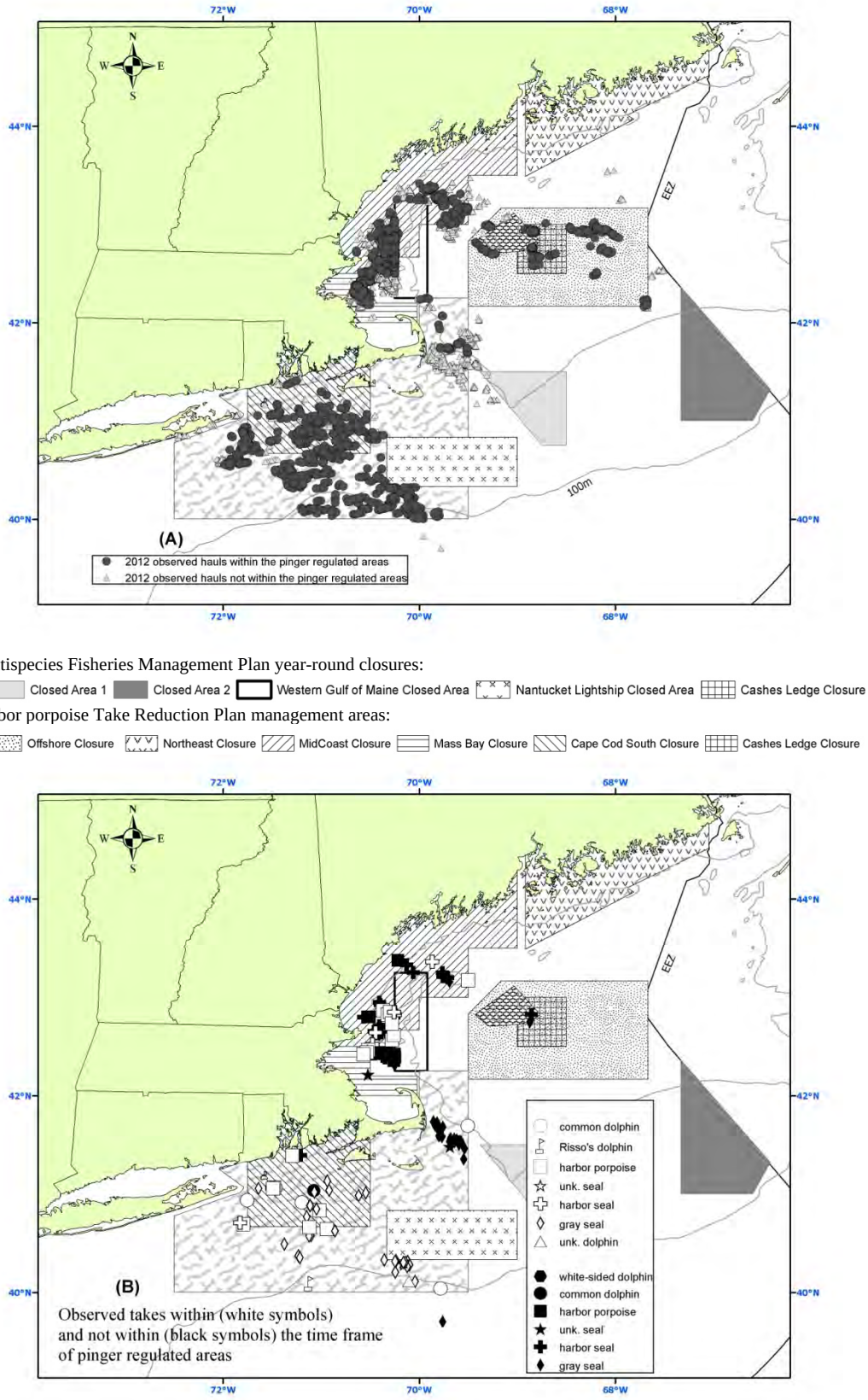
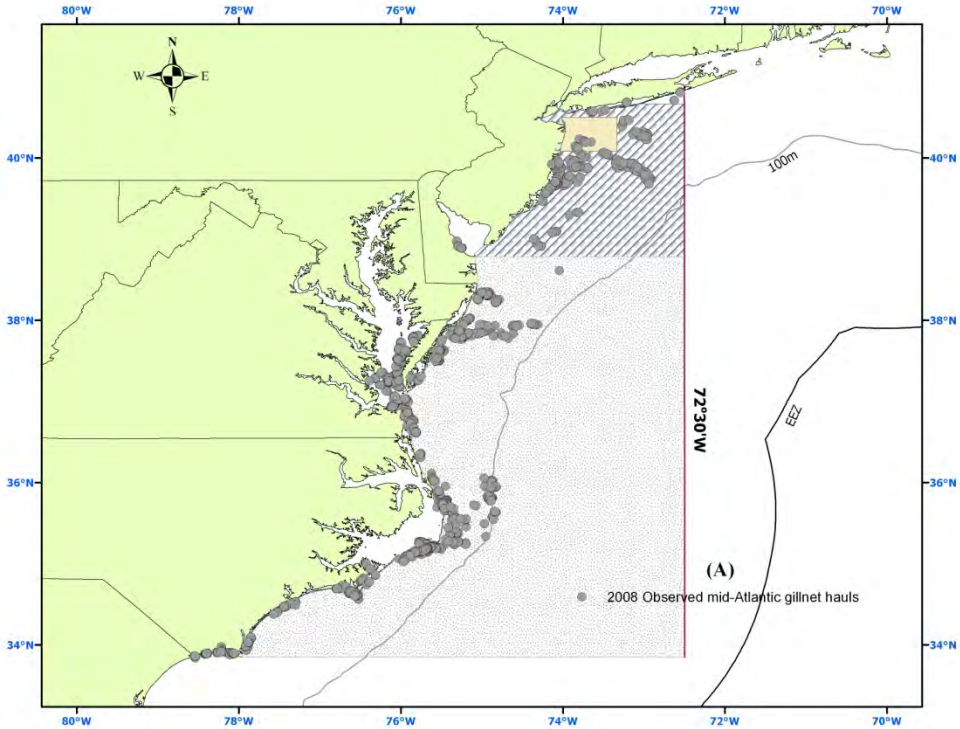
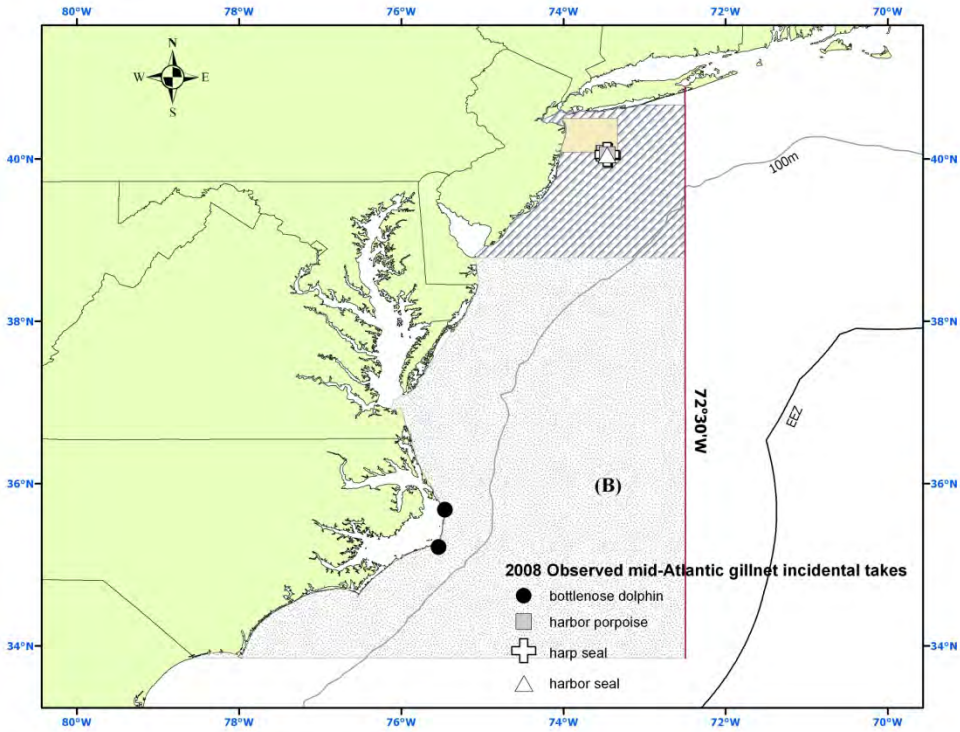


Figure 6. 2008 Mid-Atlantic gillnet observed hauls (A) and observed takes (B).



Harbor porpoise Take Reduction Plan management areas:

Southern mid-Atlantic waters | New Jersey Mudhole | waters off New Jersey



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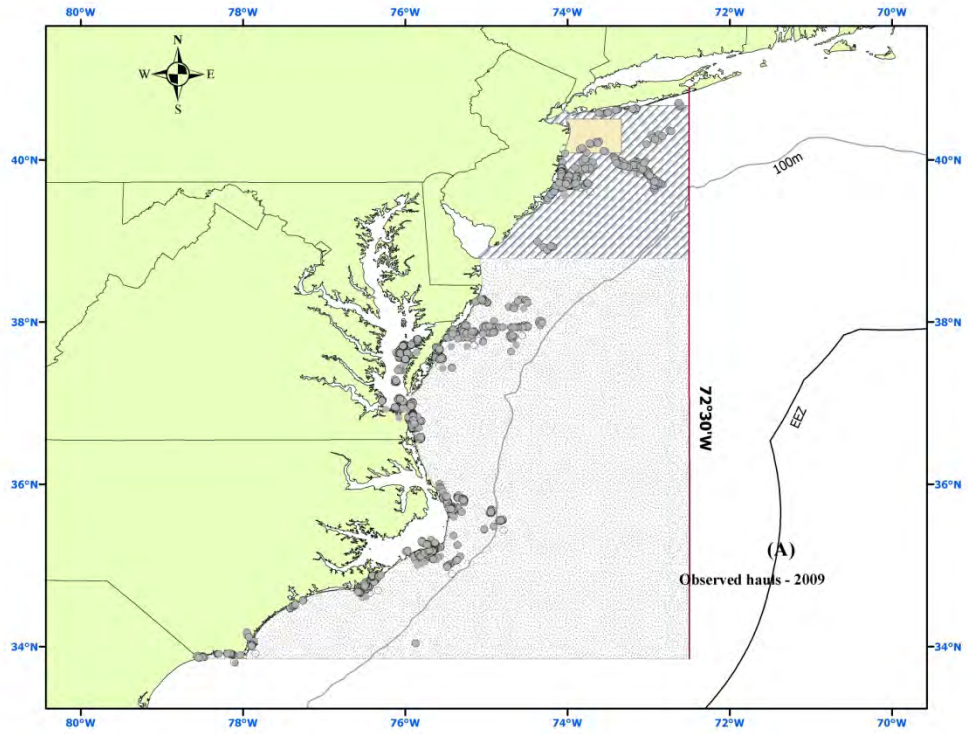


Harbor porpoise Take Reduction Plan management areas:

Southern mid-Atlantic waters | New Jersey Mudhole | waters off New Jersey

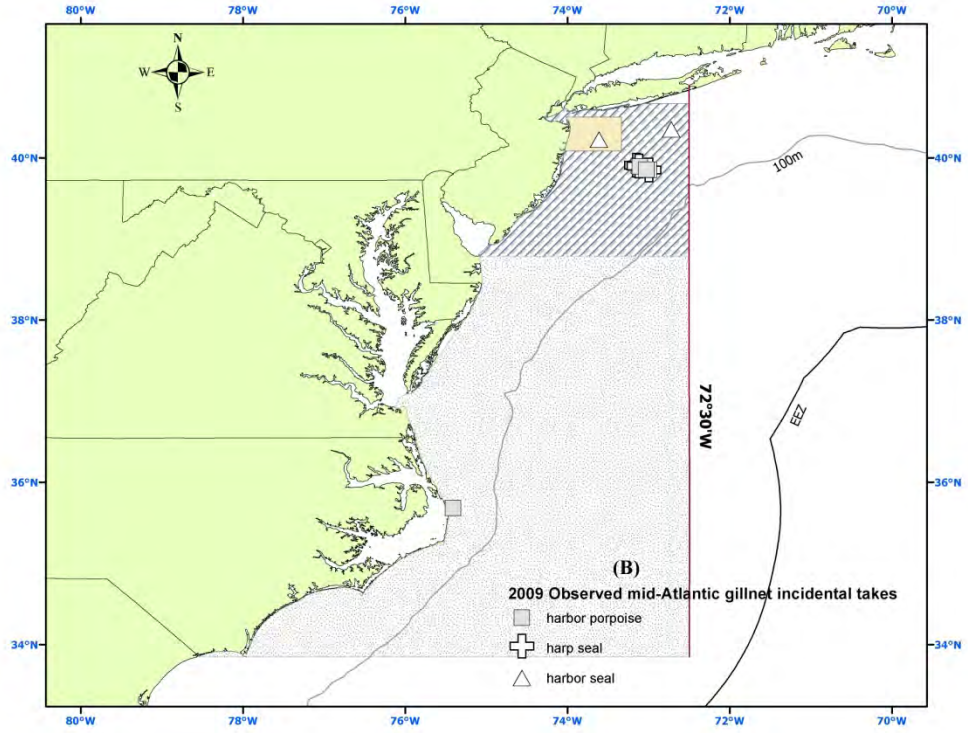
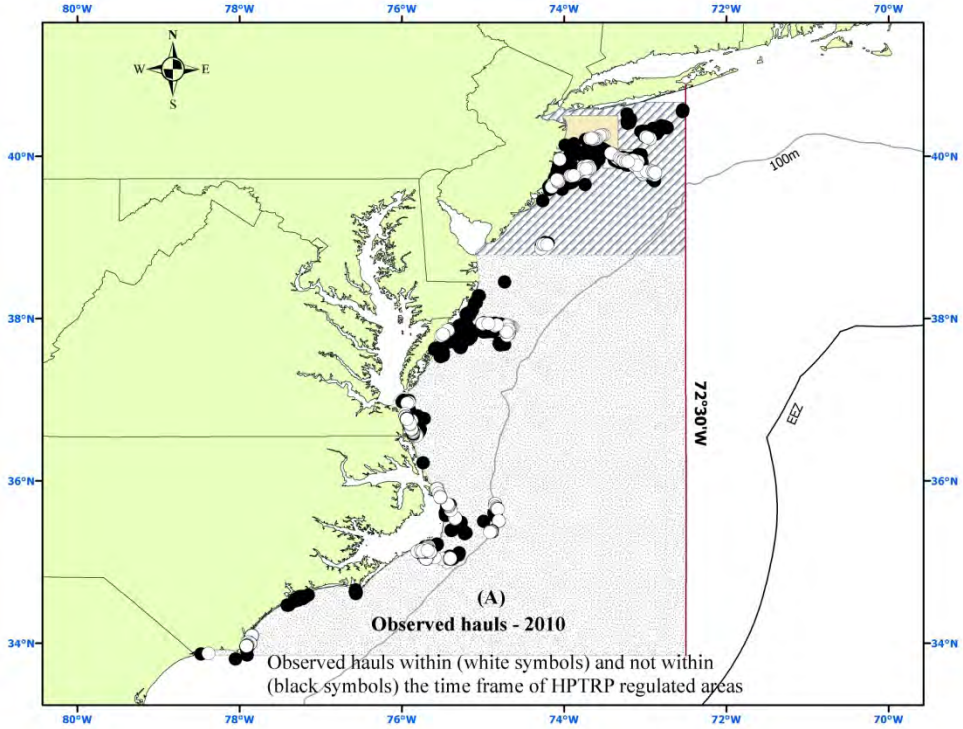


Figure 8. 2010 Mid-Atlantic gillnet observed hauls (A) and observed takes (B).



Harbor porpoise Take Reduction Plan management areas:

Southern mid-Atlantic waters | New Jersey Mudhole | waters off New Jersey

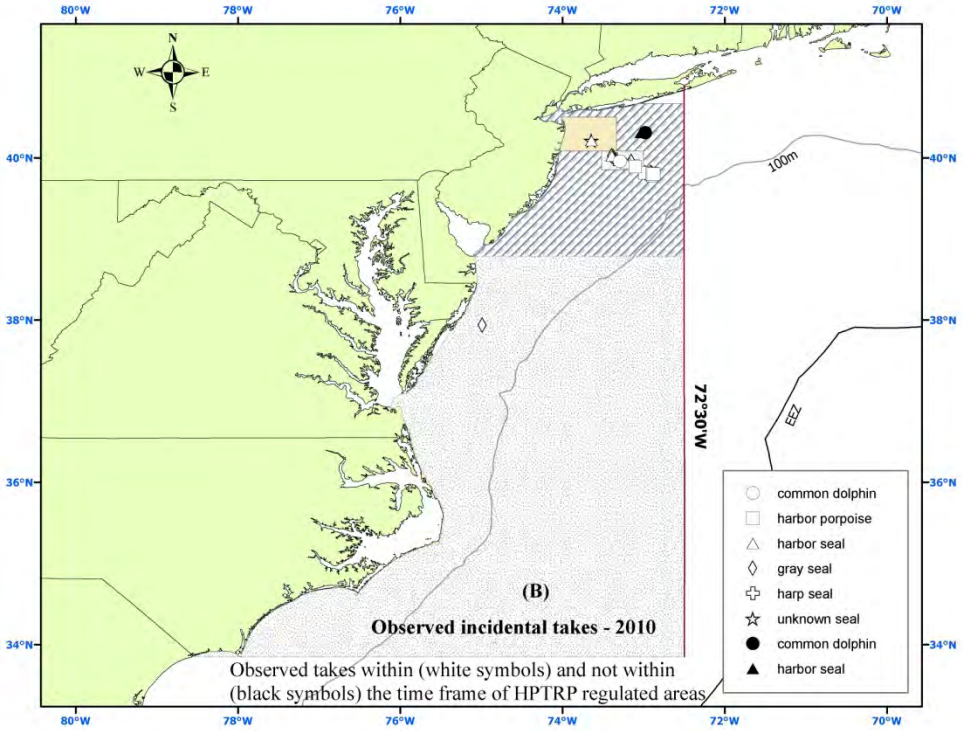
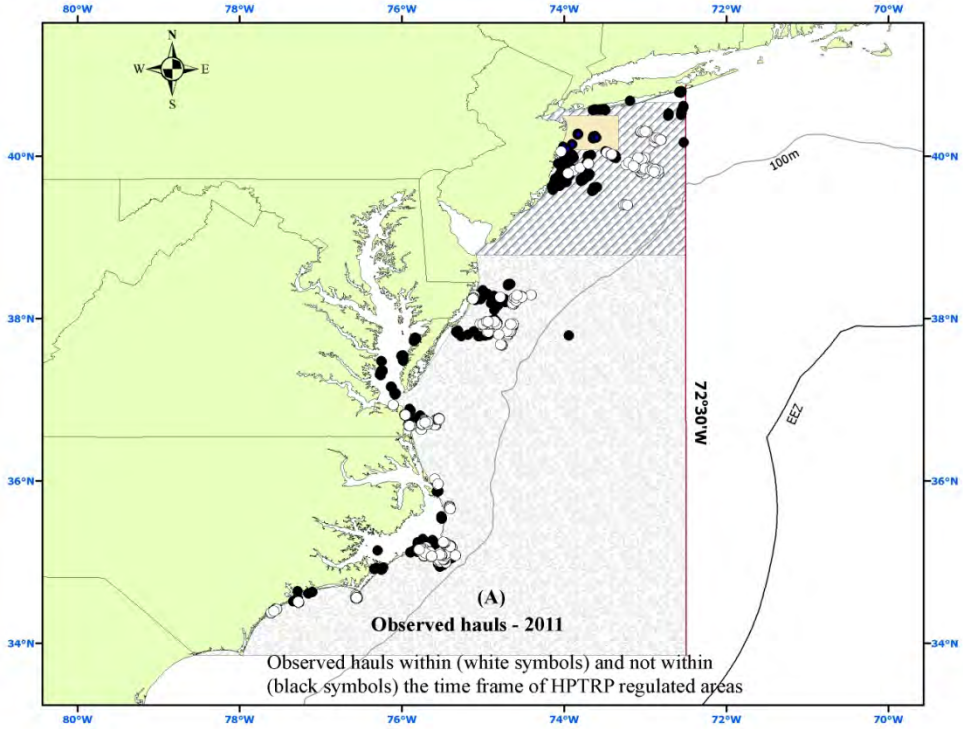


Figure 9. 2011 Mid-Atlantic gillnet observed hauls (A) and observed takes (B).



Harbor porpoise Take Reduction Plan management areas:

Southern mid-Atlantic waters | New Jersey Mudhole | waters off New Jersey

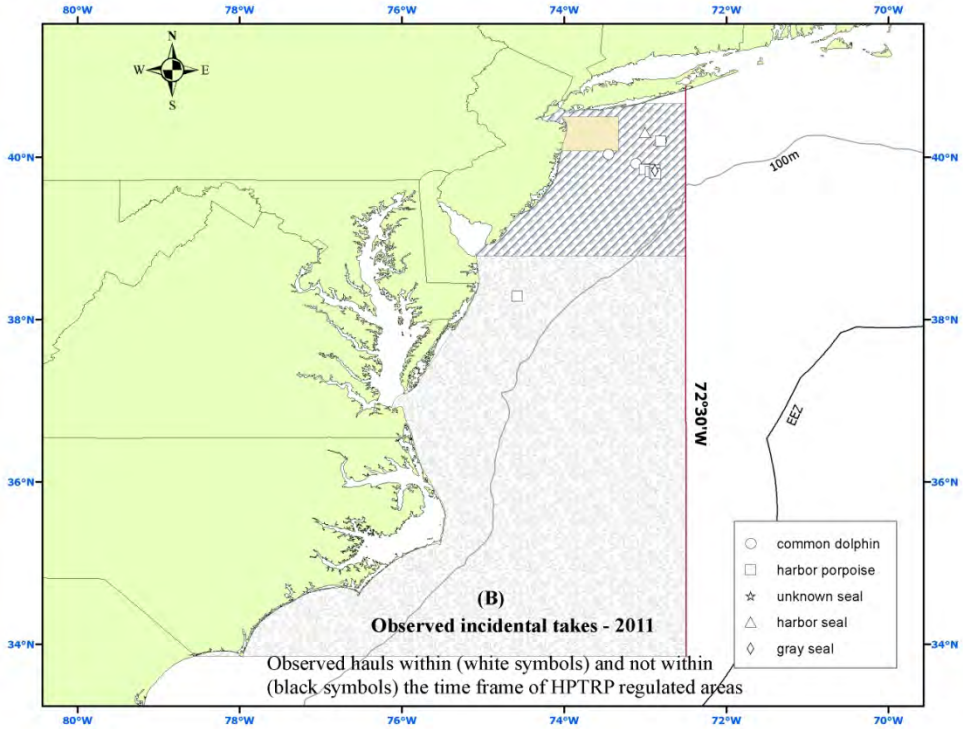


Figure 10. 2012 Mid-Atlantic gillnet observed hauls (A) and observed takes (B).

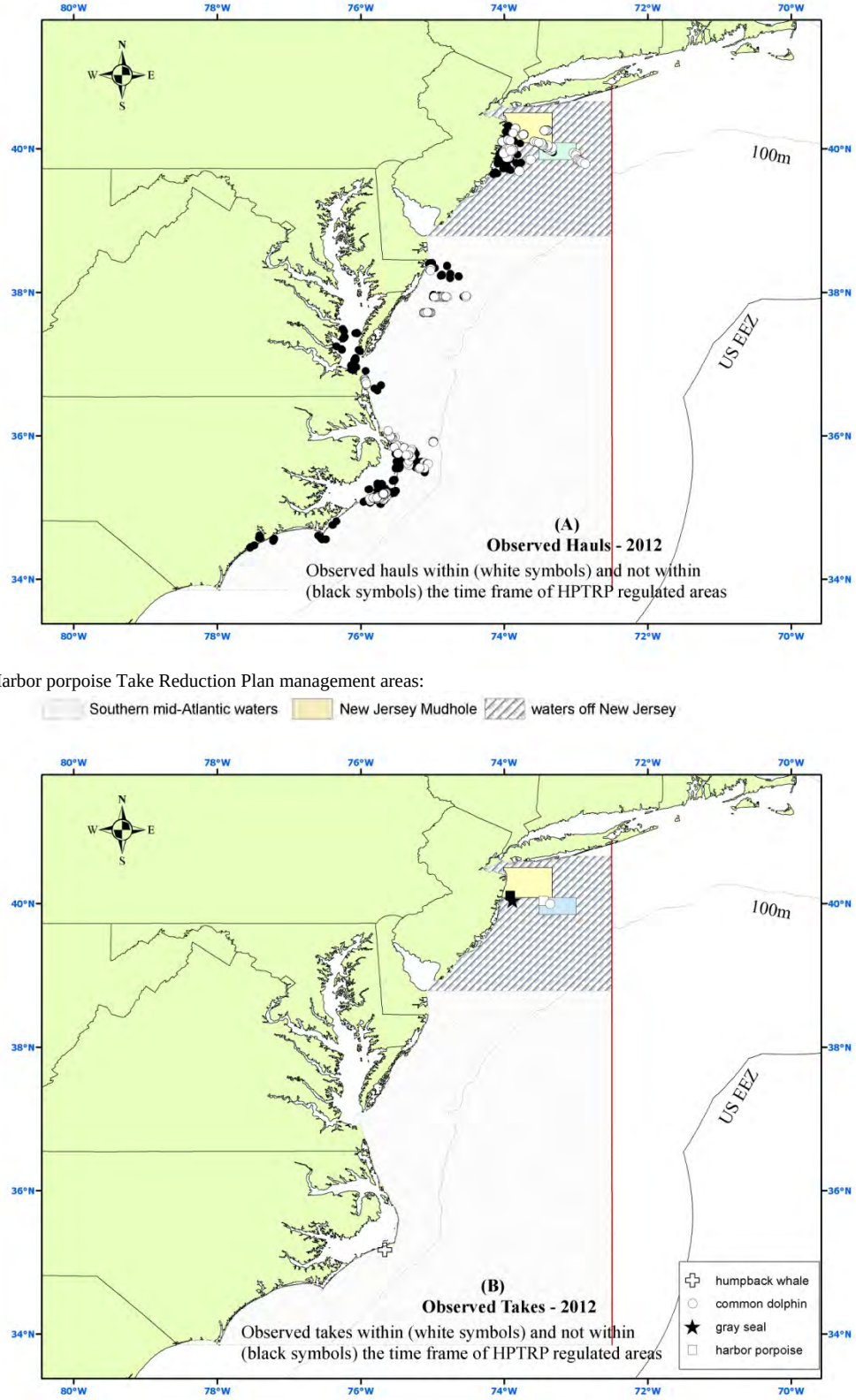


Figure 11. 2008 Mid-Atlantic bottom trawl observed tows (A) and observed takes (B).

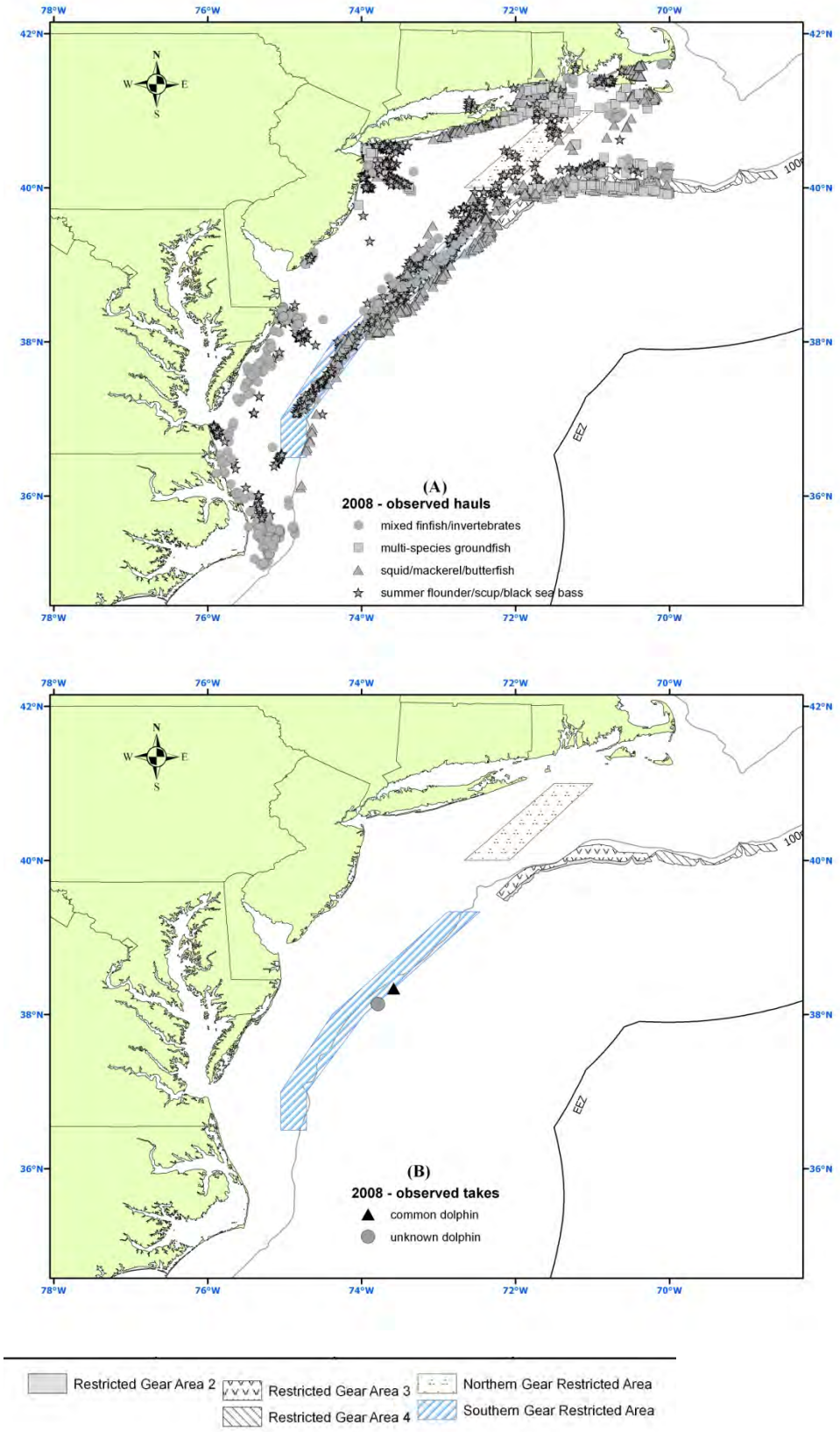


Figure 12. 2009 Mid-Atlantic bottom trawl observed tows (A) and observed takes (B).

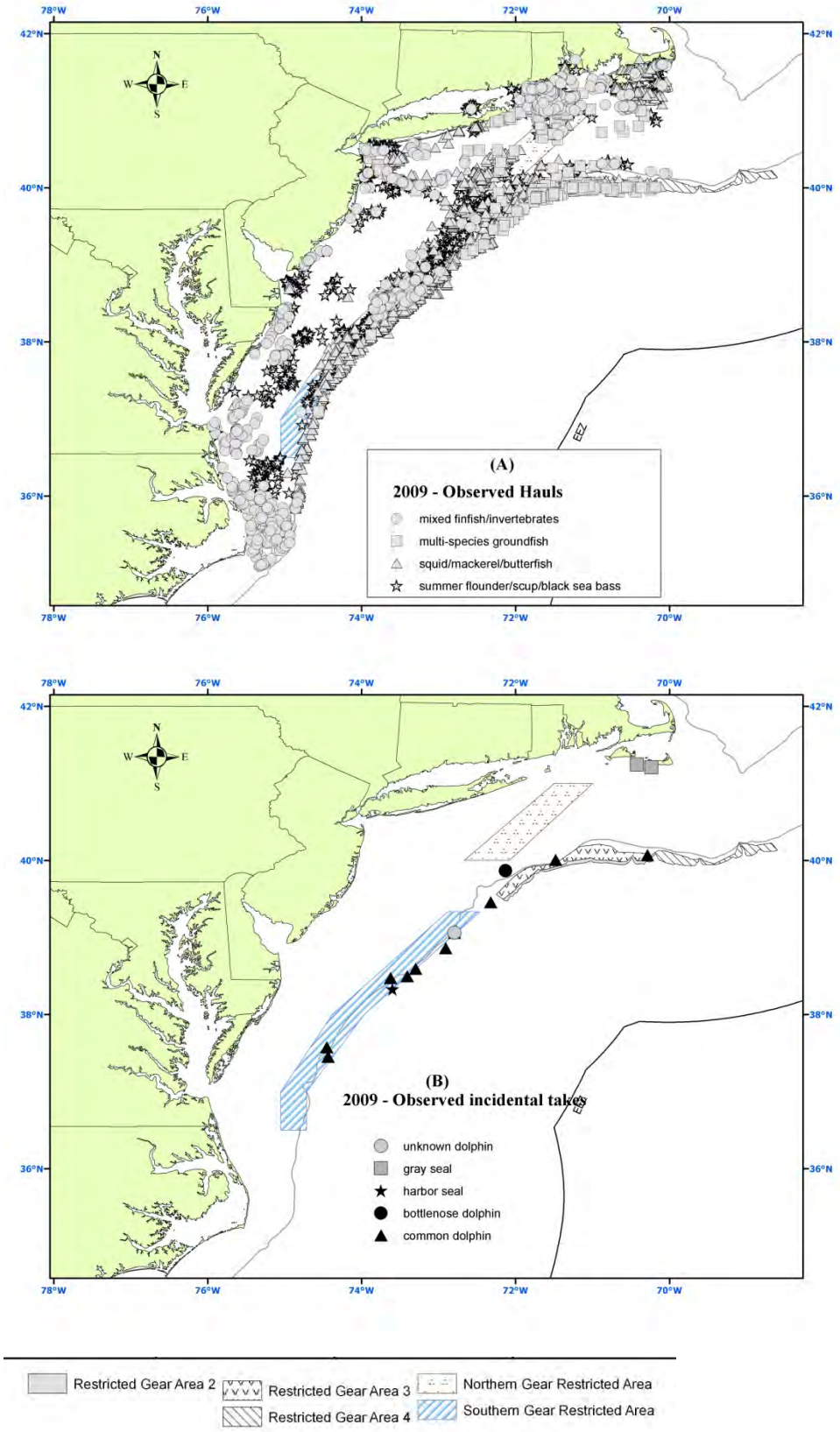


Figure 13. 2010 Mid-Atlantic bottom trawl observed tows (A) and observed takes (B).

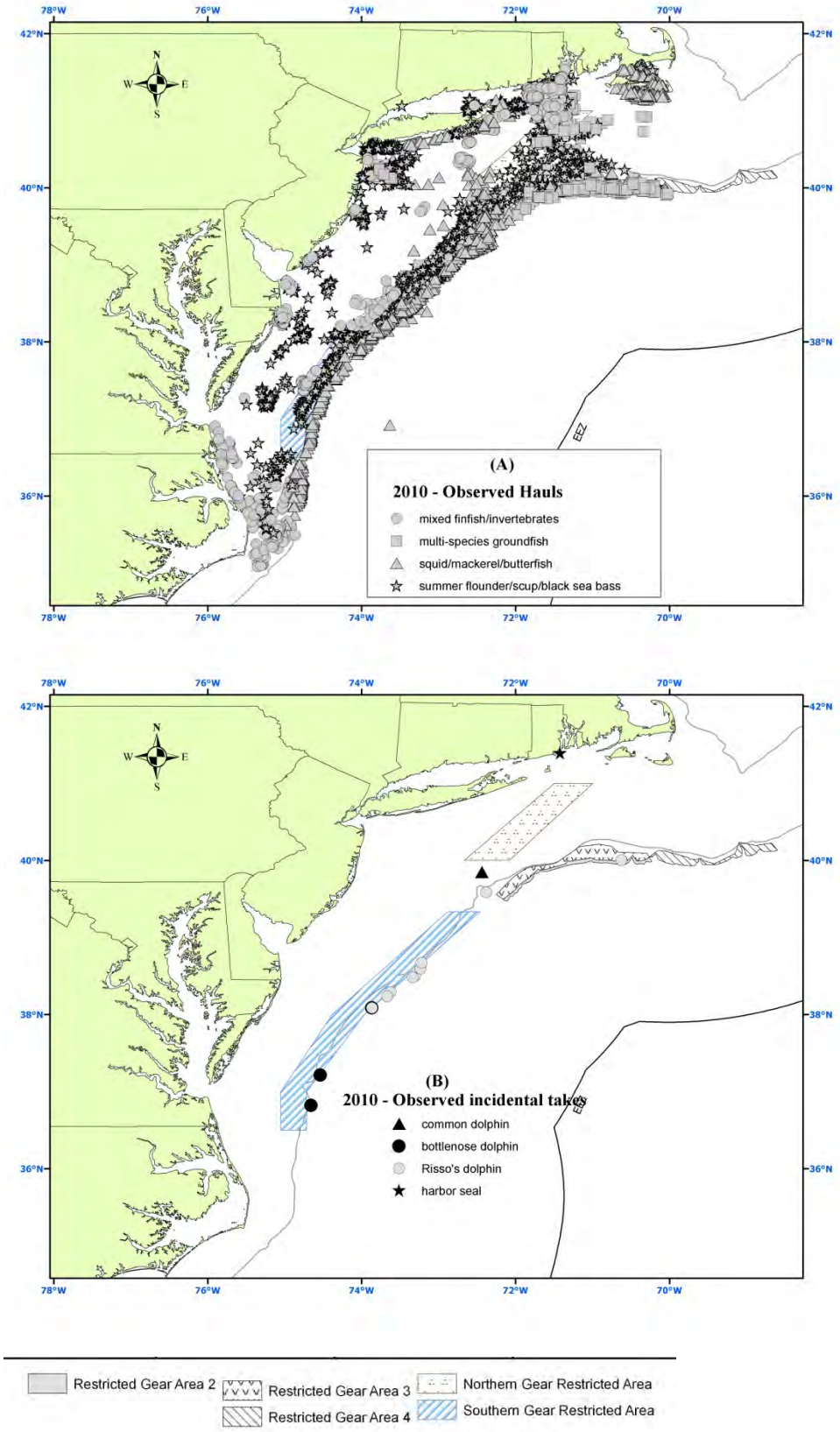


Figure 14. 2011 Mid-Atlantic bottom trawl observed tows (A) and observed takes (B).

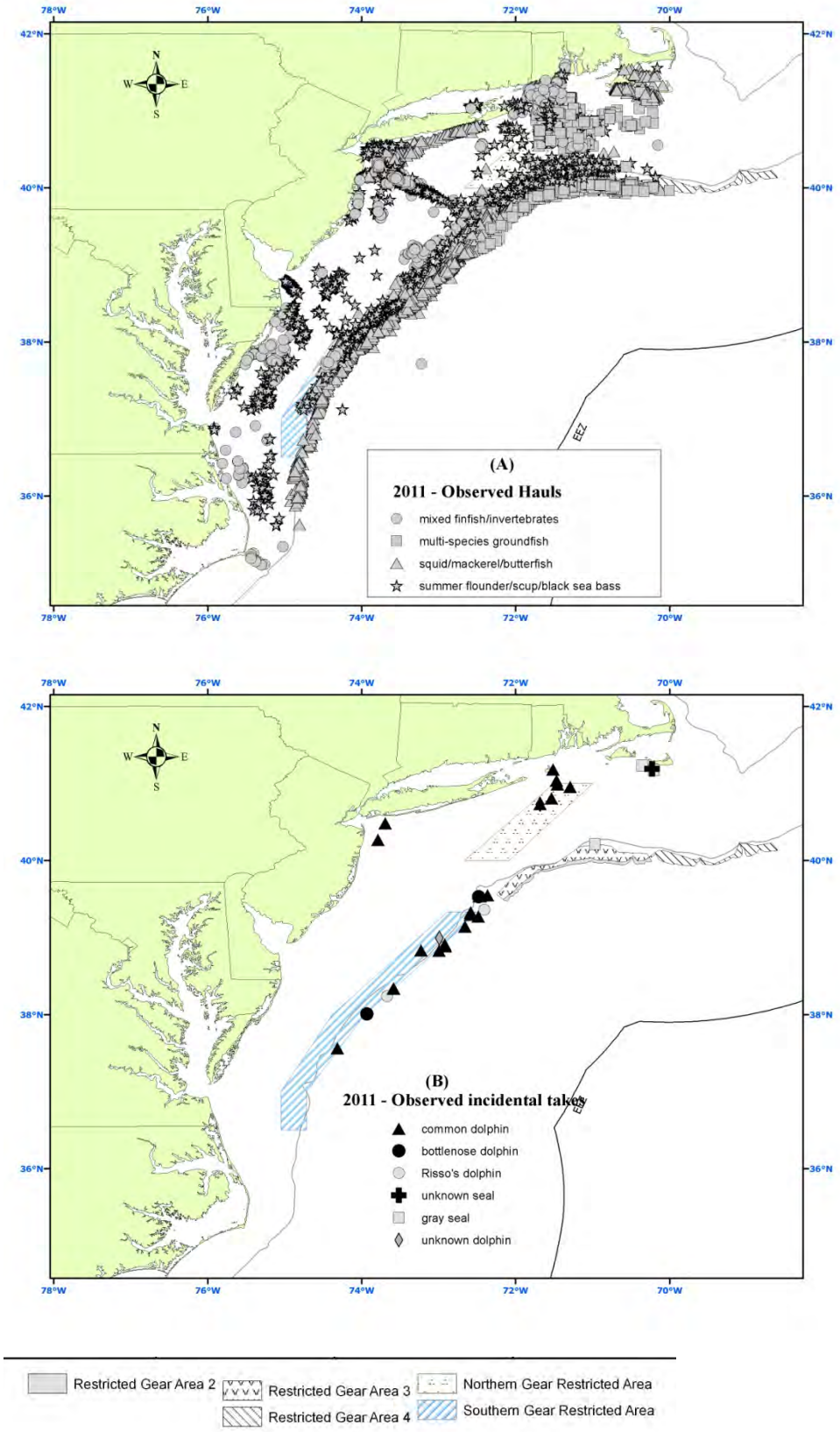


Figure 15. 2012 Mid-Atlantic bottom trawl observed tows (A) and observed takes (B).

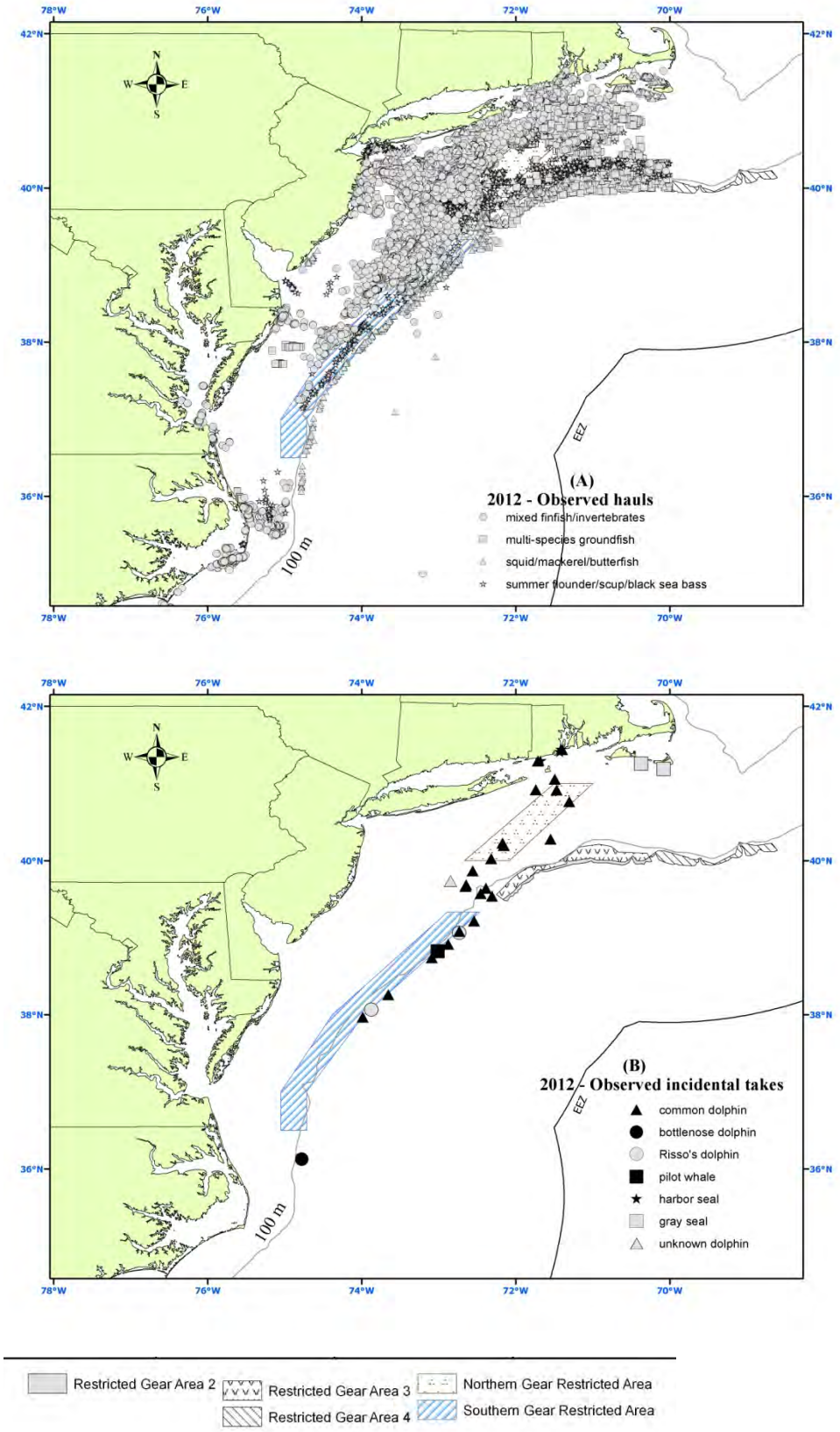


Figure 16. 2008 Northeast bottom trawl observed tows (A) and observed takes (B).

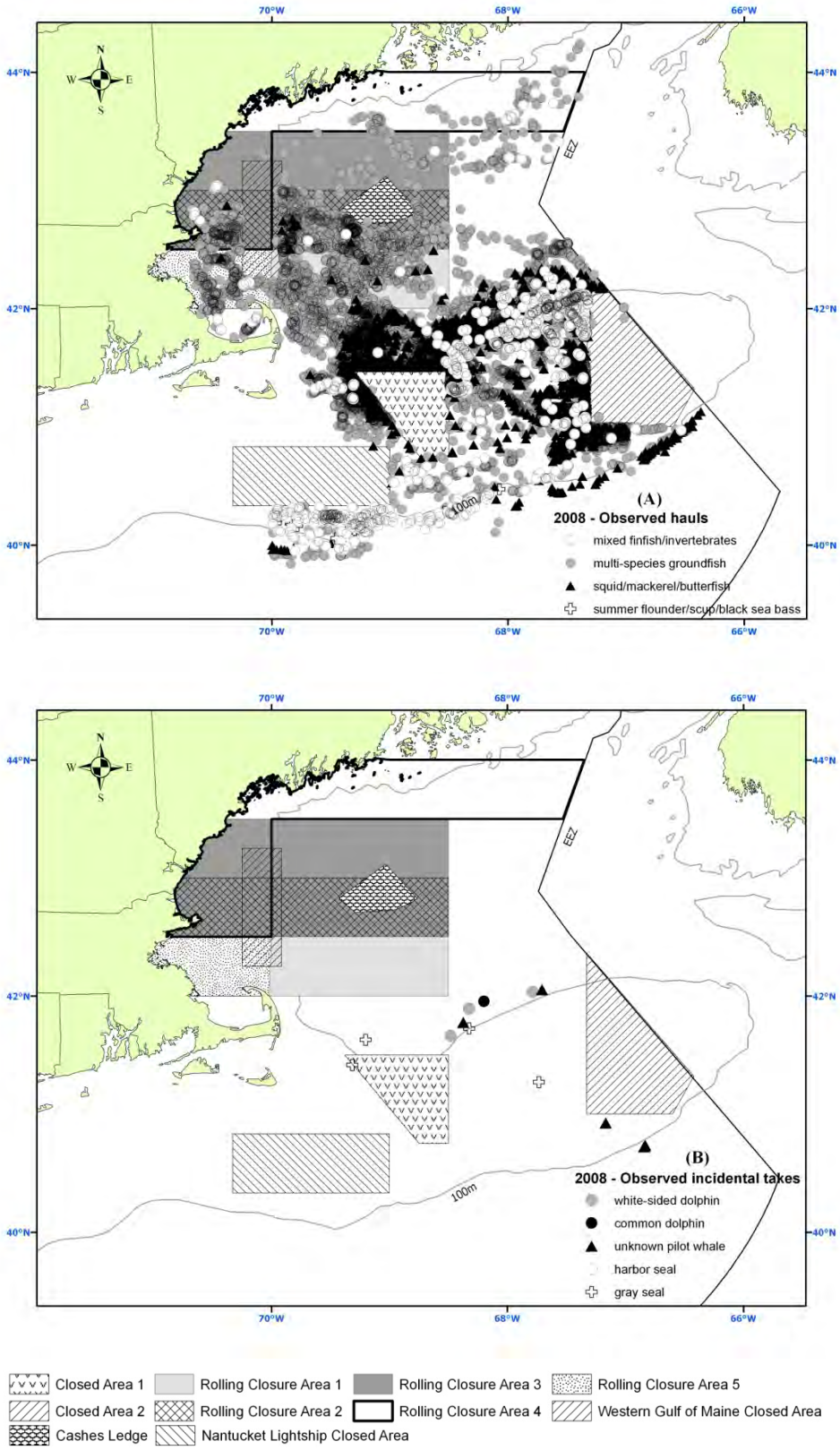


Figure 17. 2009 Northeast bottom trawl observed tows (A) and observed takes (B).

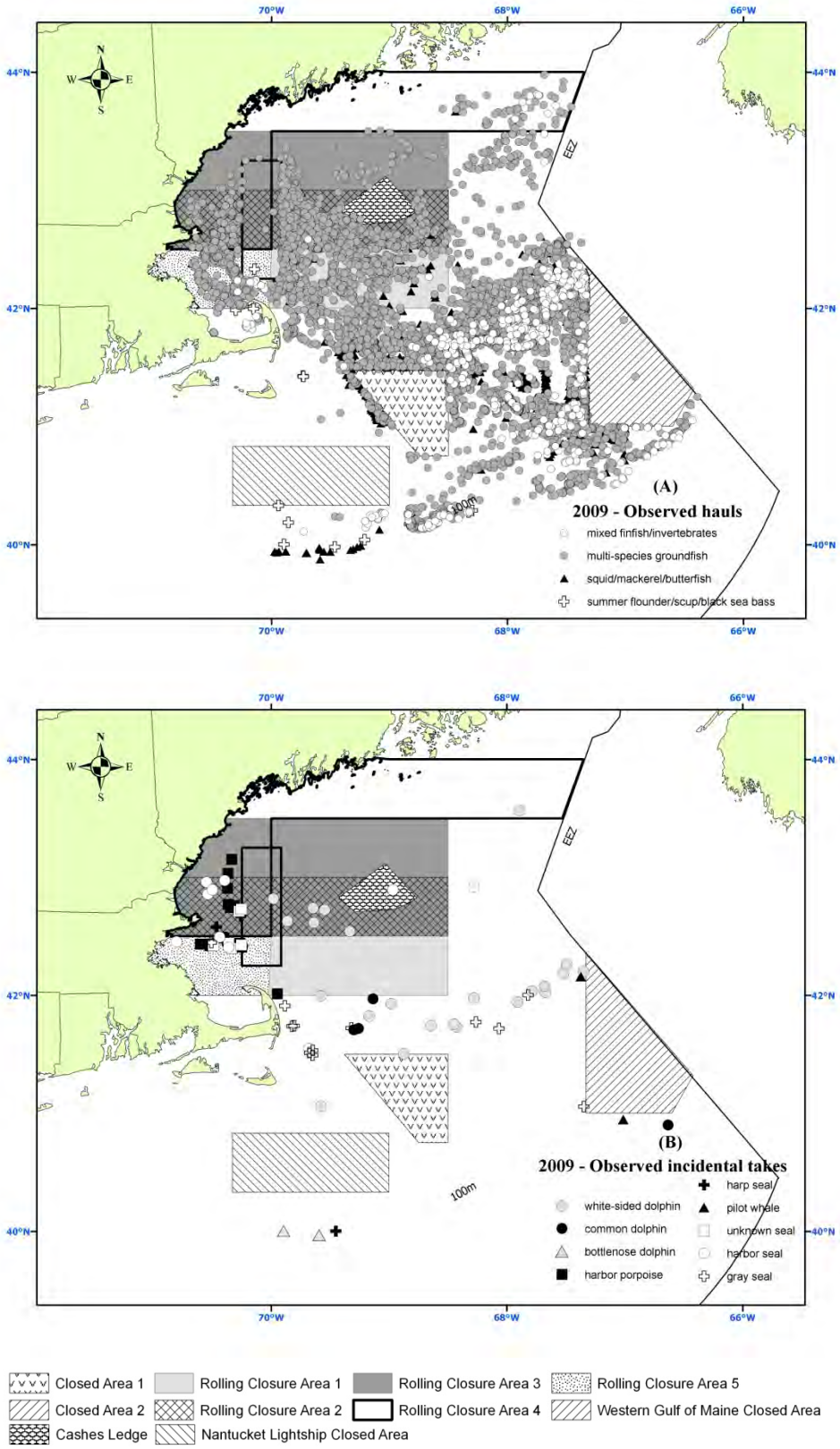


Figure 18. 2010 Northeast bottom trawl observed tows (A) and observed takes (B).

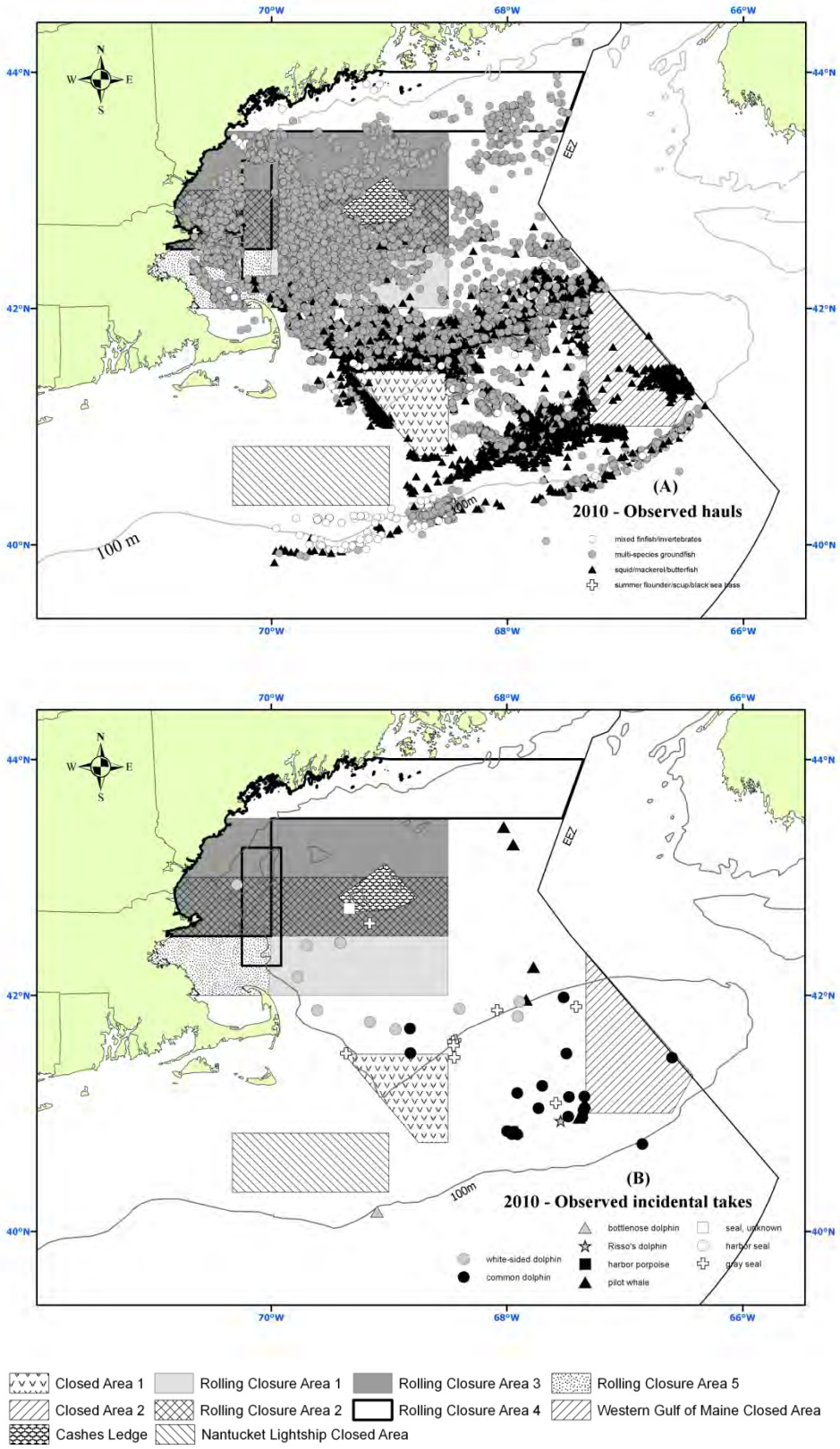


Figure 19. 2011 Northeast bottom trawl observed tows (A) and observed takes (B).

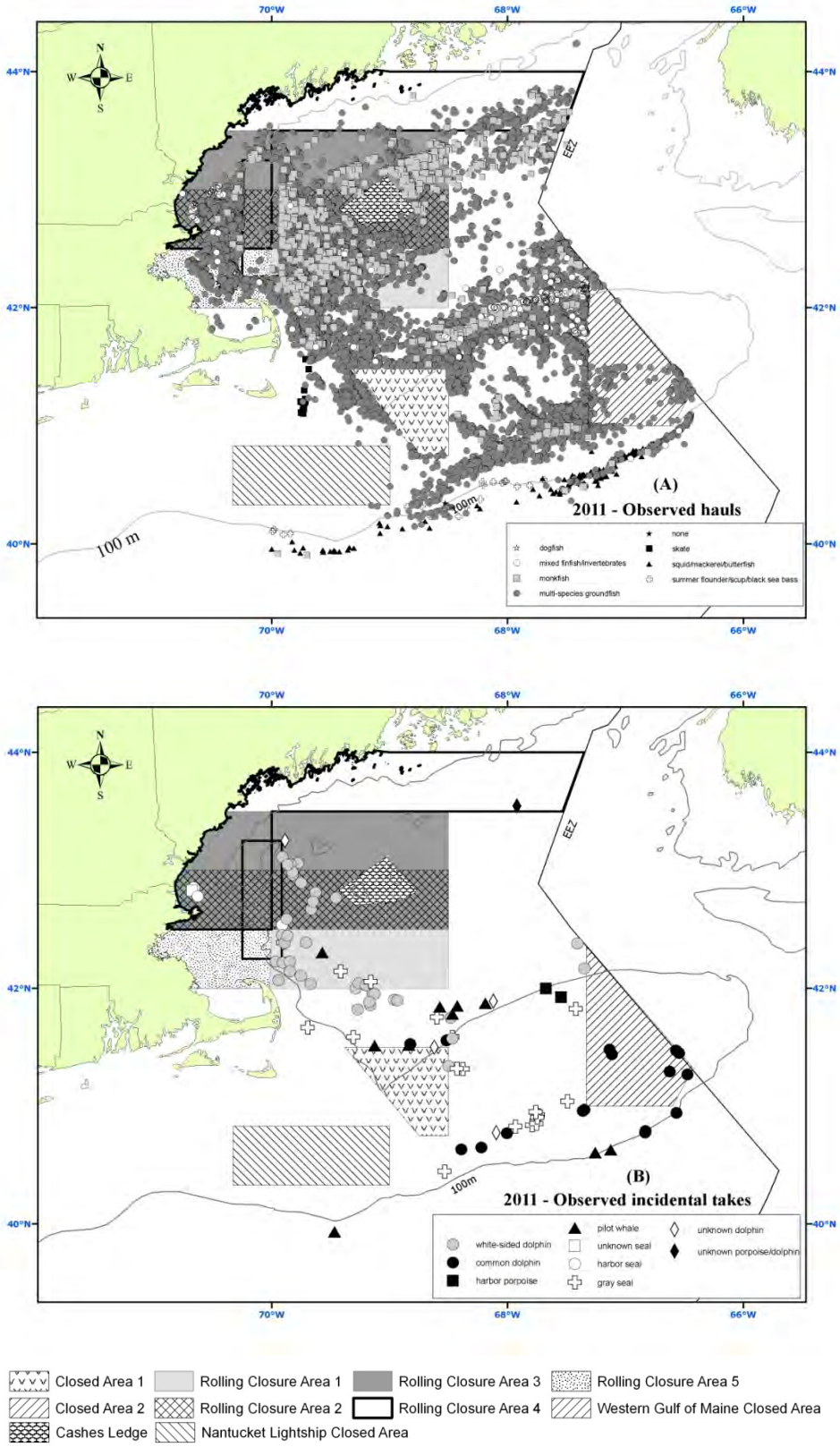


Figure 20. 2012 Northeast bottom trawl observed tows (A) and observed takes (B).

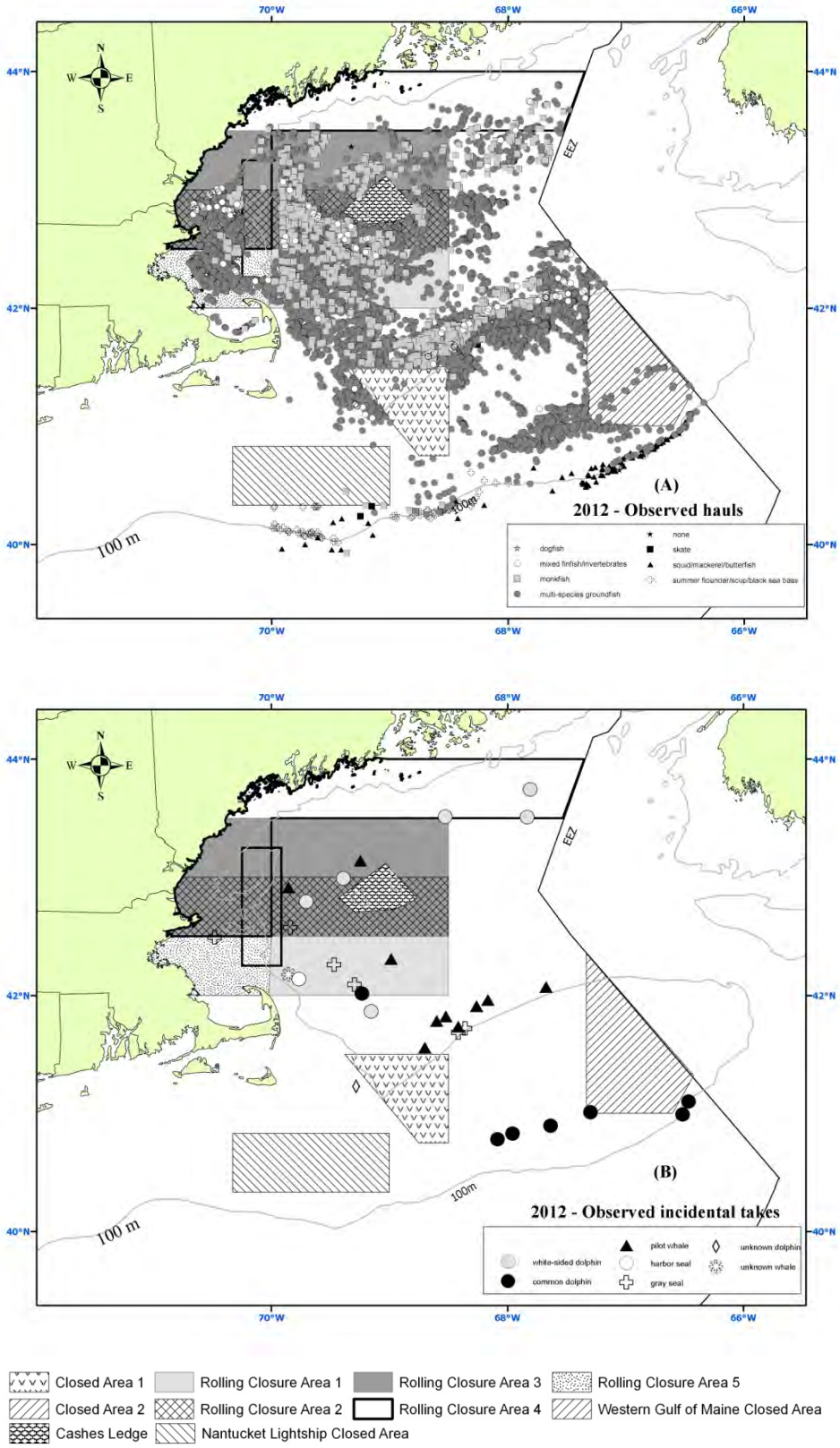


Figure 21. 2008 Northeast mid-water trawl observed tows (A) and observed takes (B).

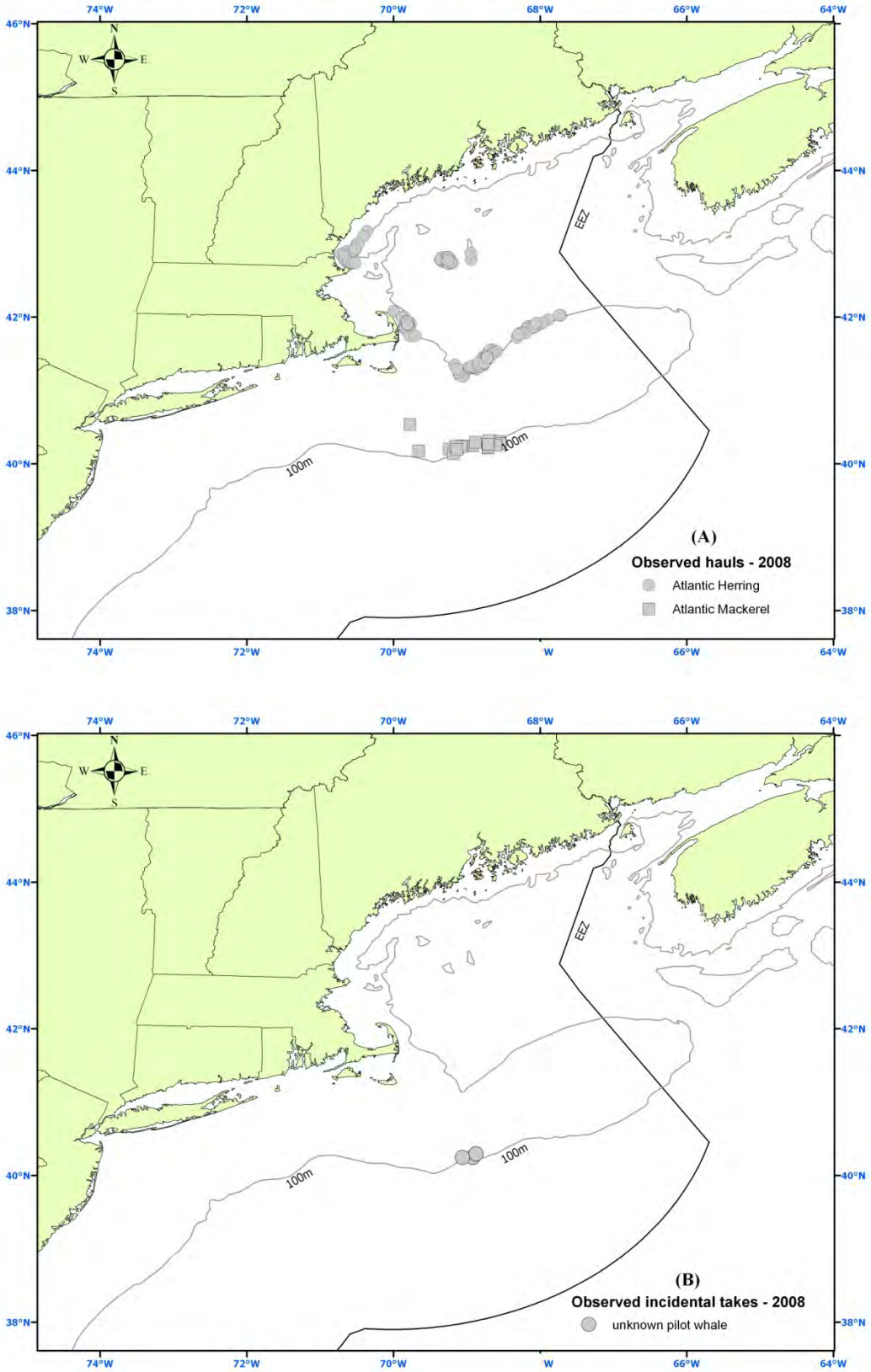


Figure 22. 2009 Northeast mid-water trawl observed tows (A) and observed takes (B).

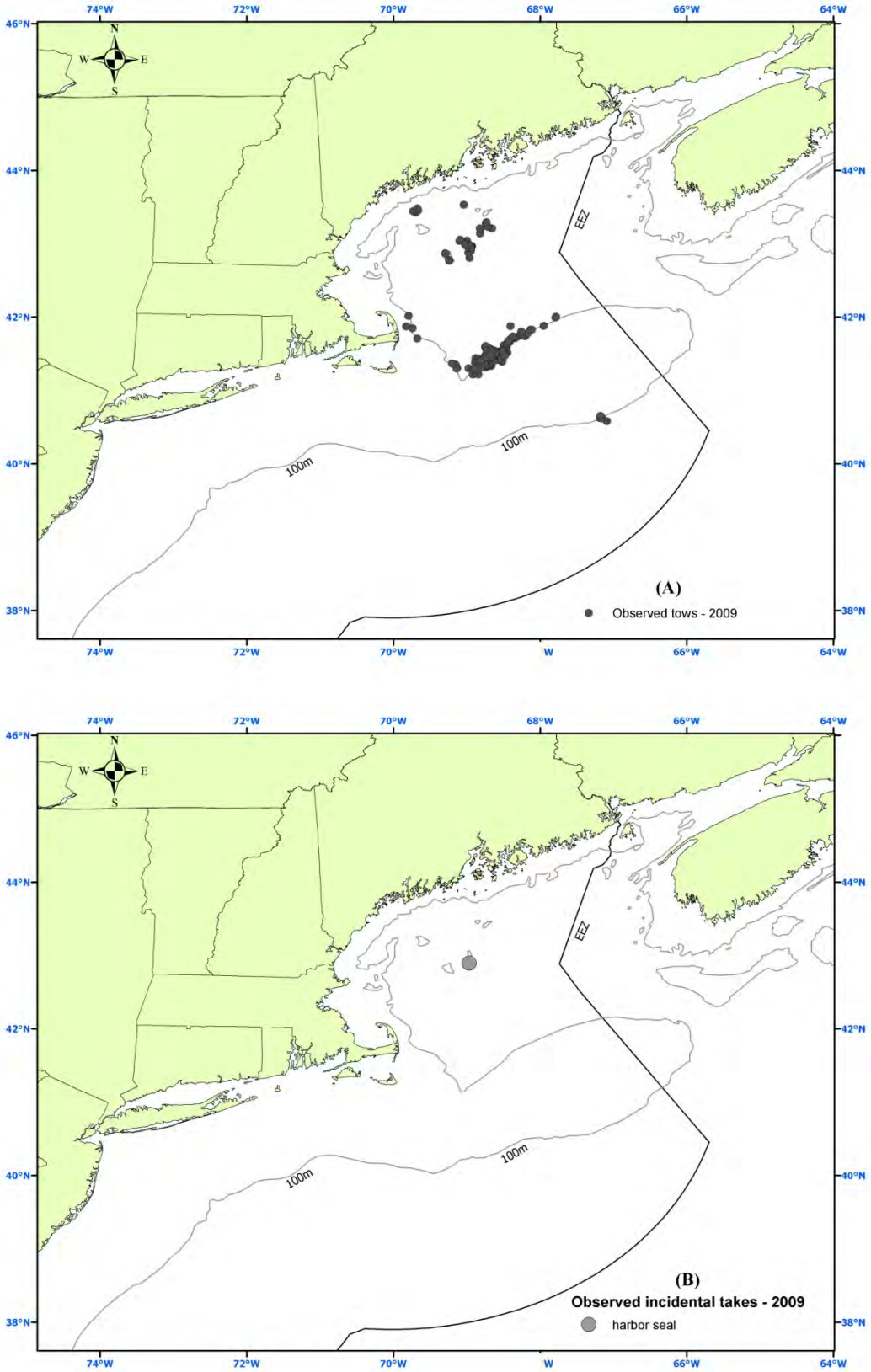


Figure 23. 2010 Northeast mid-water trawl observed tows (A) and observed takes (B).

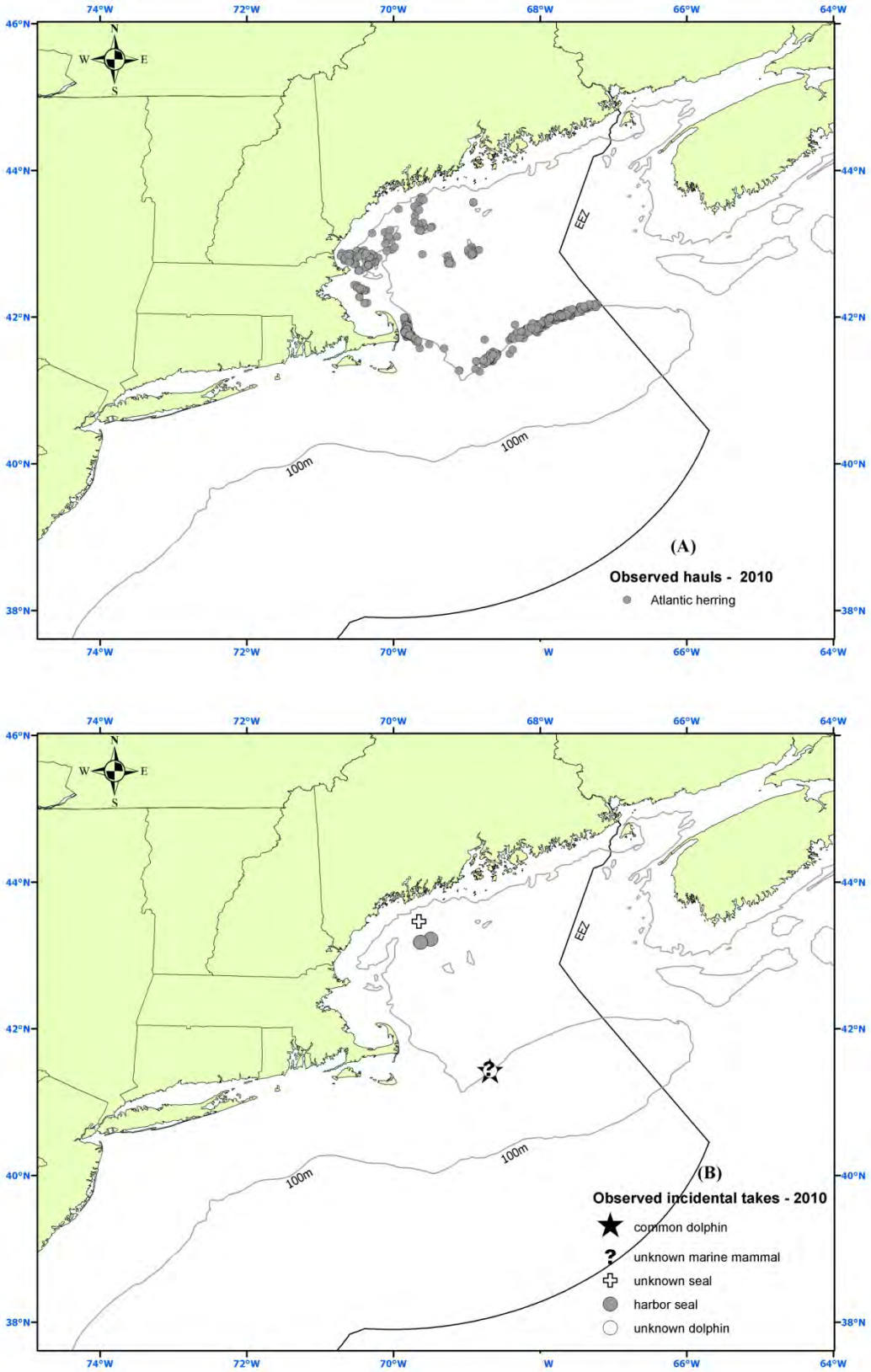


Figure 24. 2011 Northeast mid-water trawl observed tows (A) and observed takes (B).

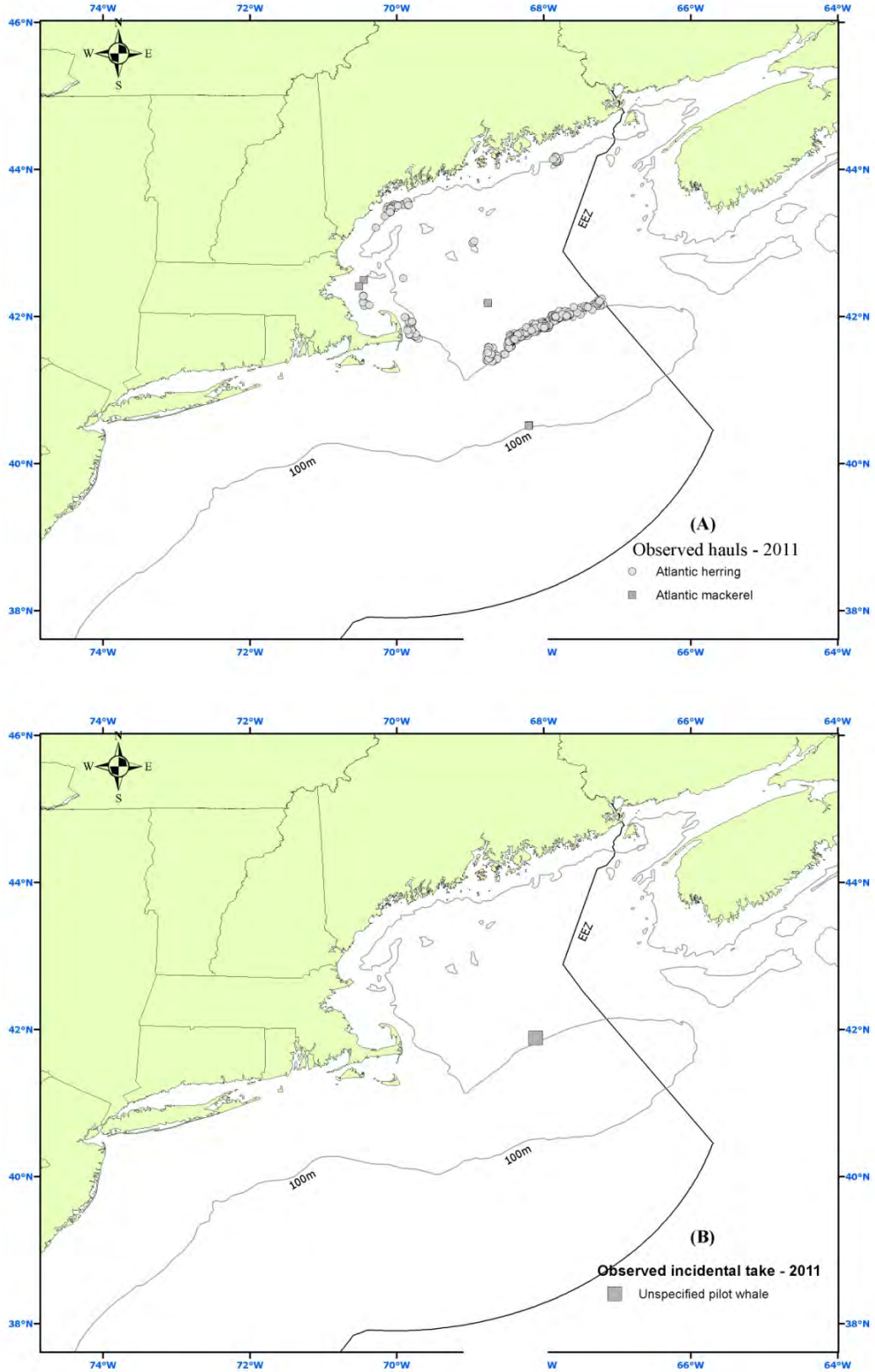


Figure 25. 2012 Northeast mid-water trawl observed tows (A) and observed takes (B).

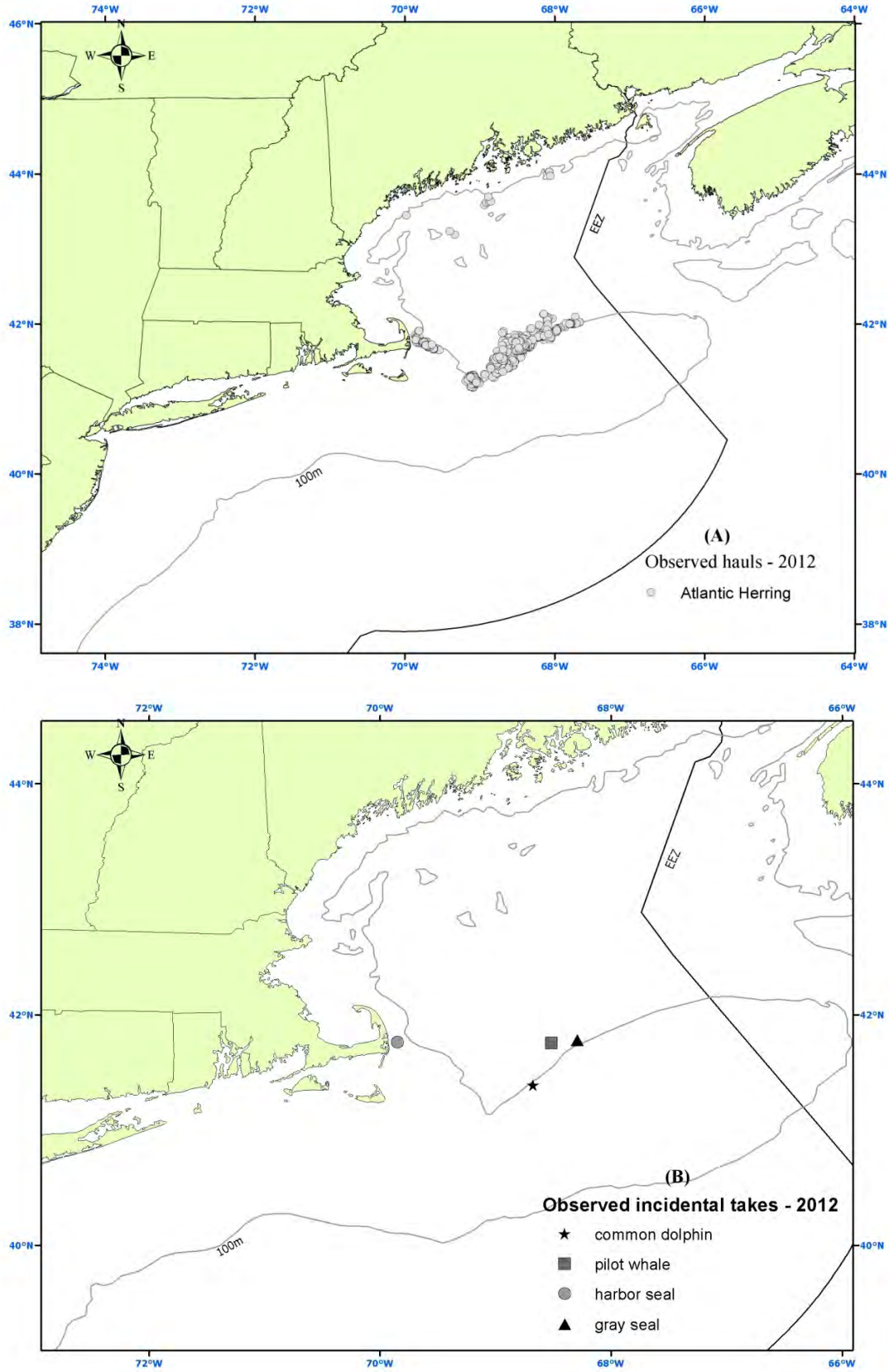


Figure 26. 2008 Mid-Atlantic mid-water trawl observed tows (A) and observed takes (B).

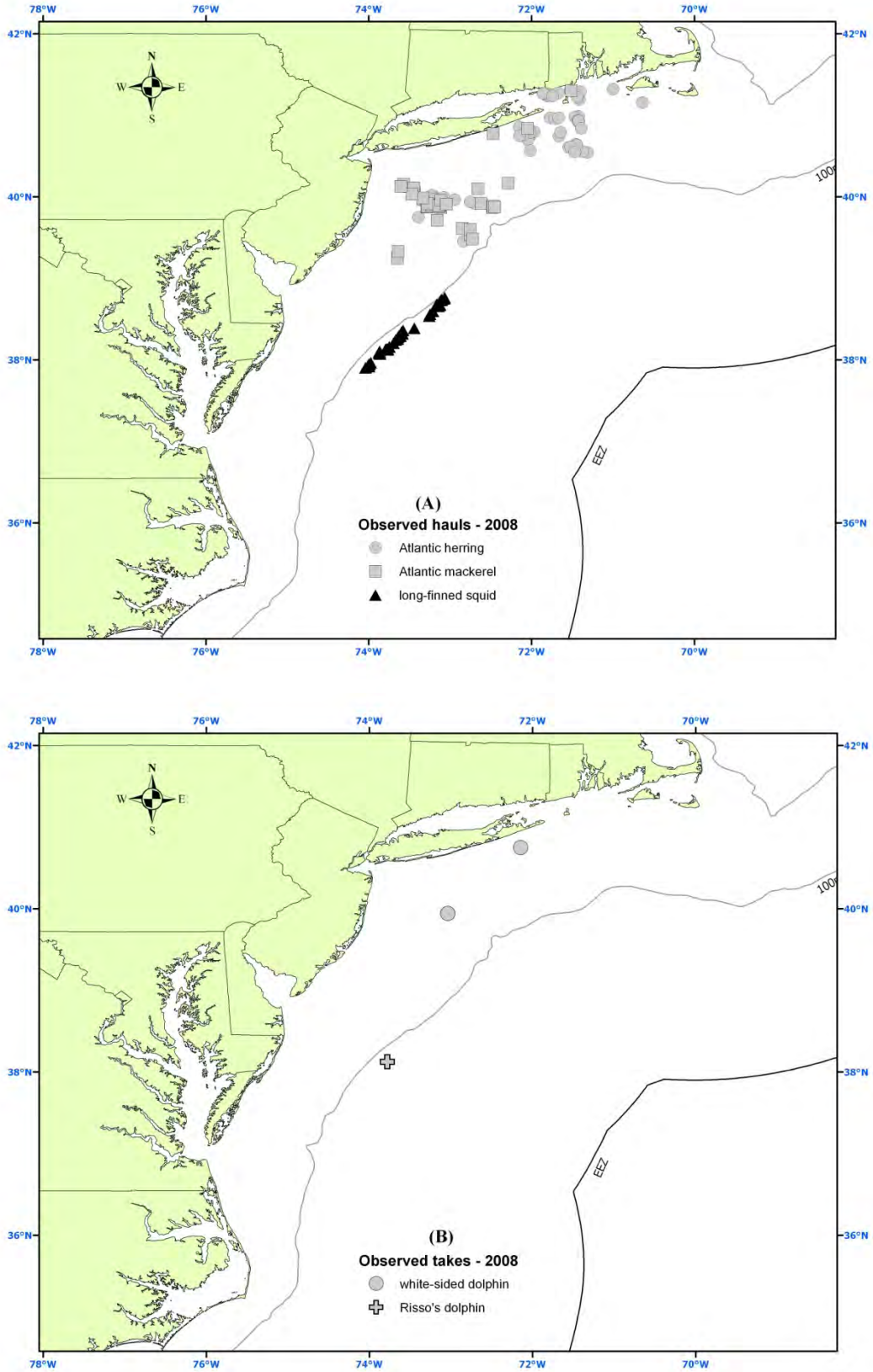


Figure 27. 2009 Mid-Atlantic mid-water trawl observed tows (A) and observed takes (B).

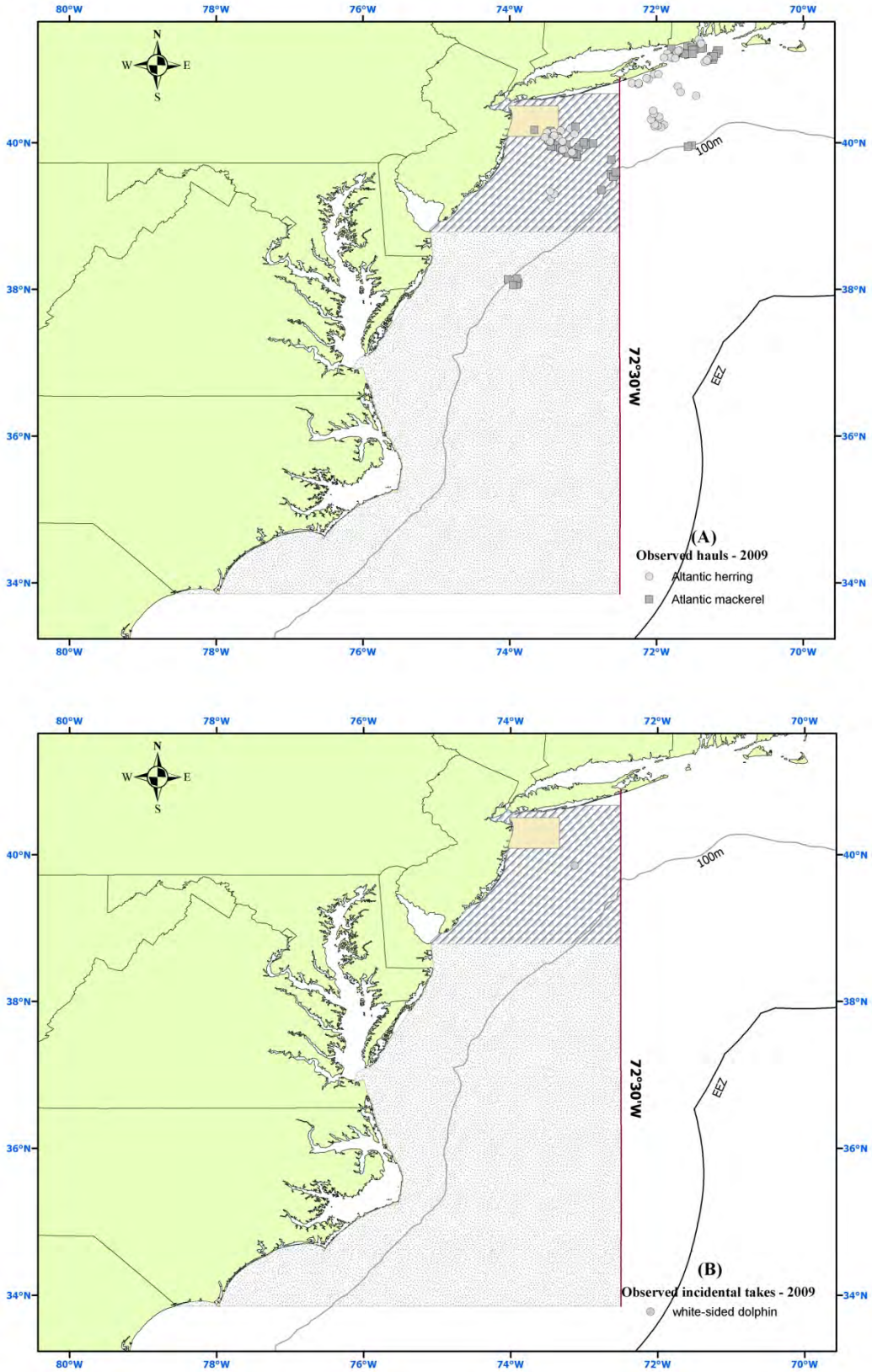


Figure 28. 2010 Mid-Atlantic mid-water trawl observed tows (A) and observed takes (B).

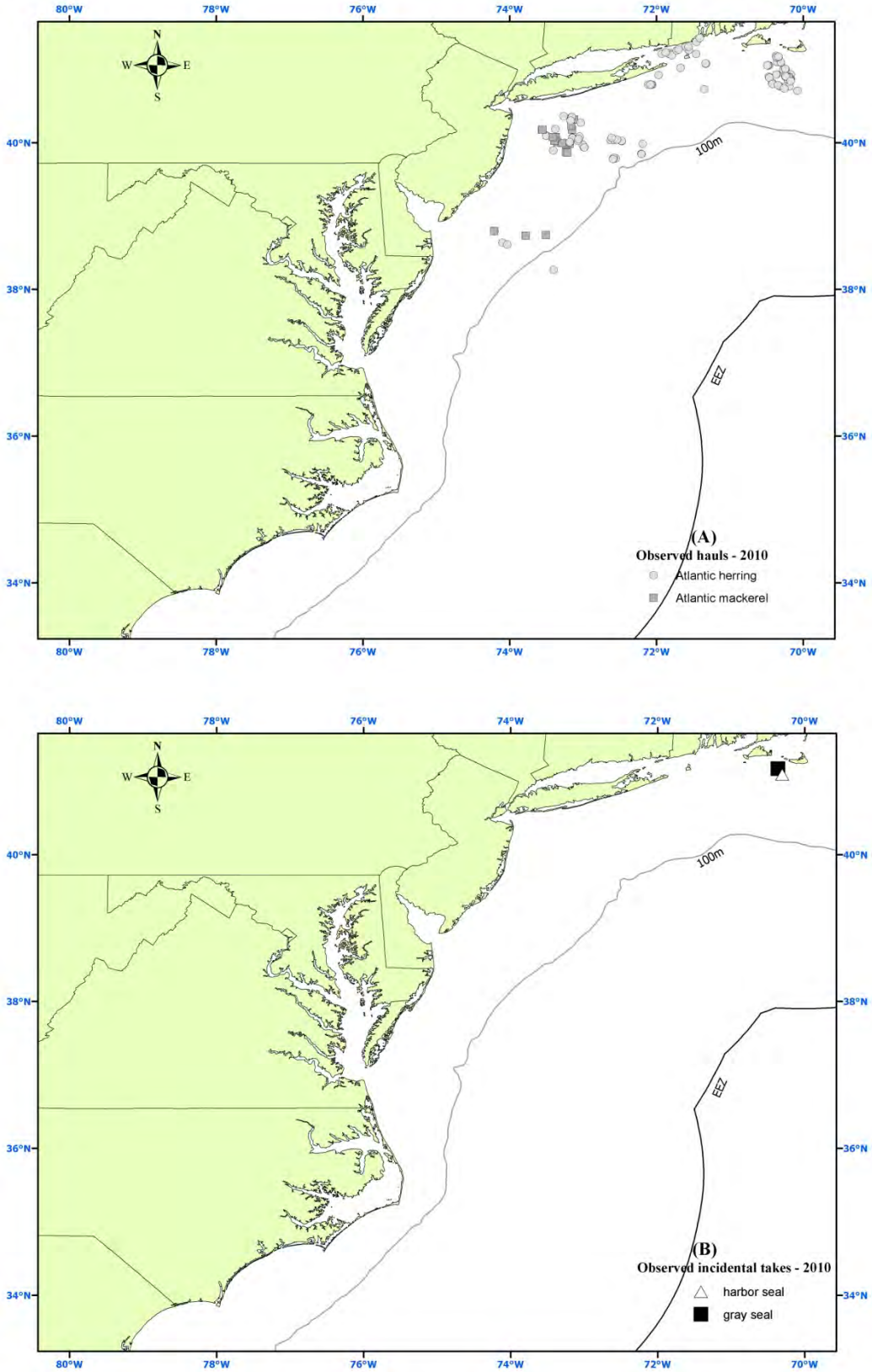


Figure 29. 2011 Mid-Atlantic mid-water trawl observed tows (A) and observed takes (B).

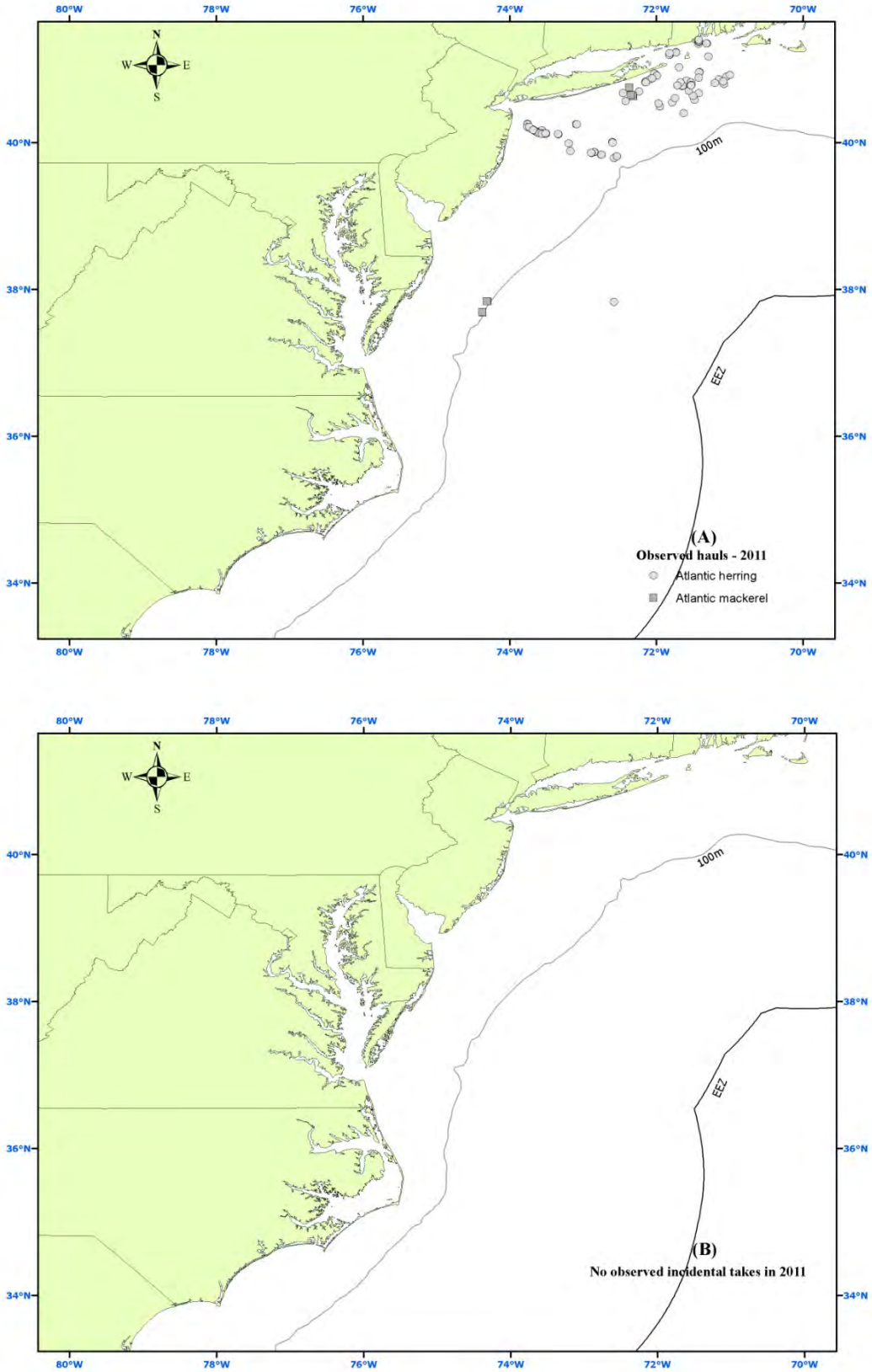


Figure 30. 2012 Mid-Atlantic mid-water trawl observed tows (A) and observed takes (B).

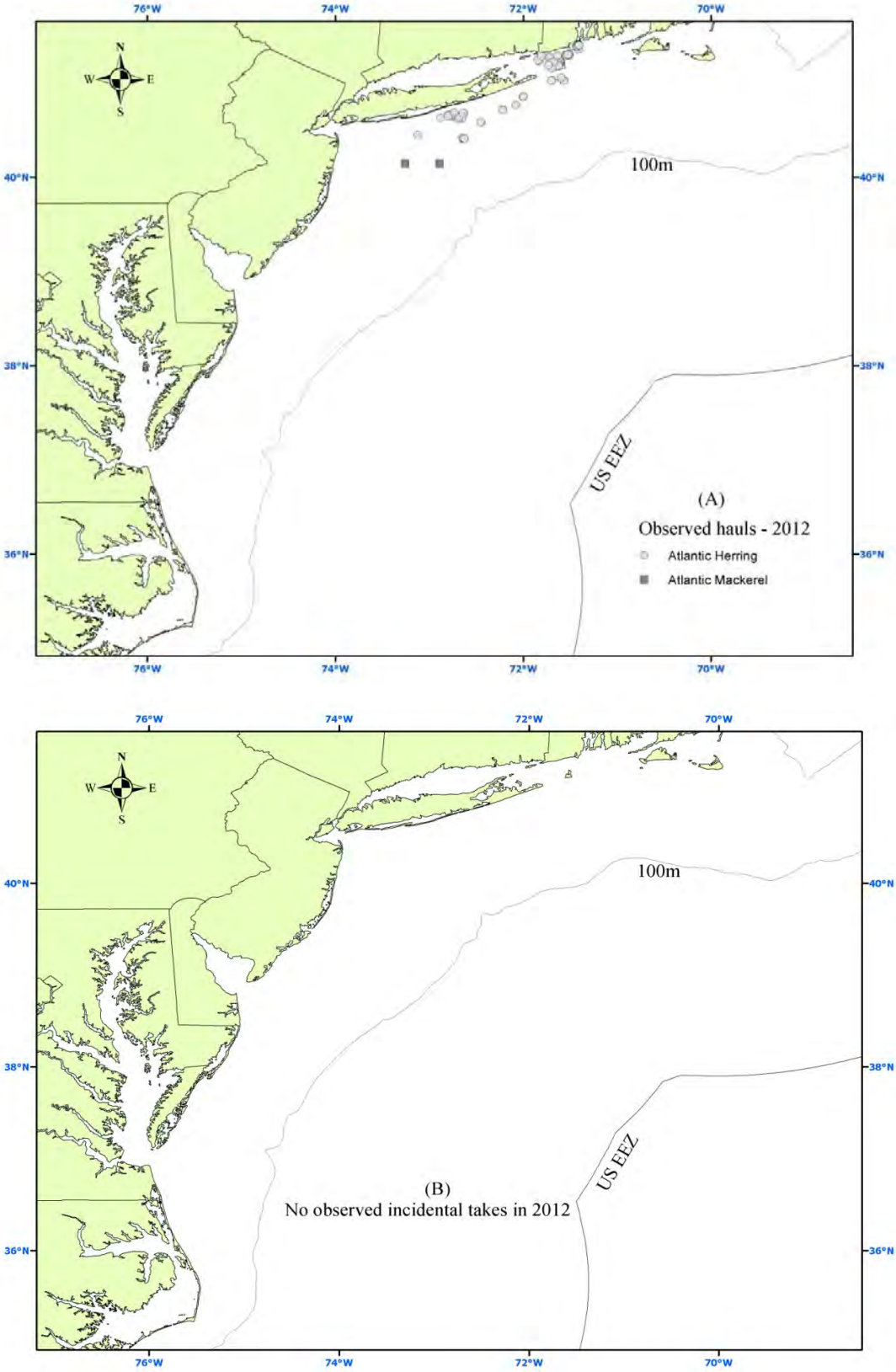


Figure 31. 2008 Herring Purse Seine observed hauls (A) and observed takes (B).

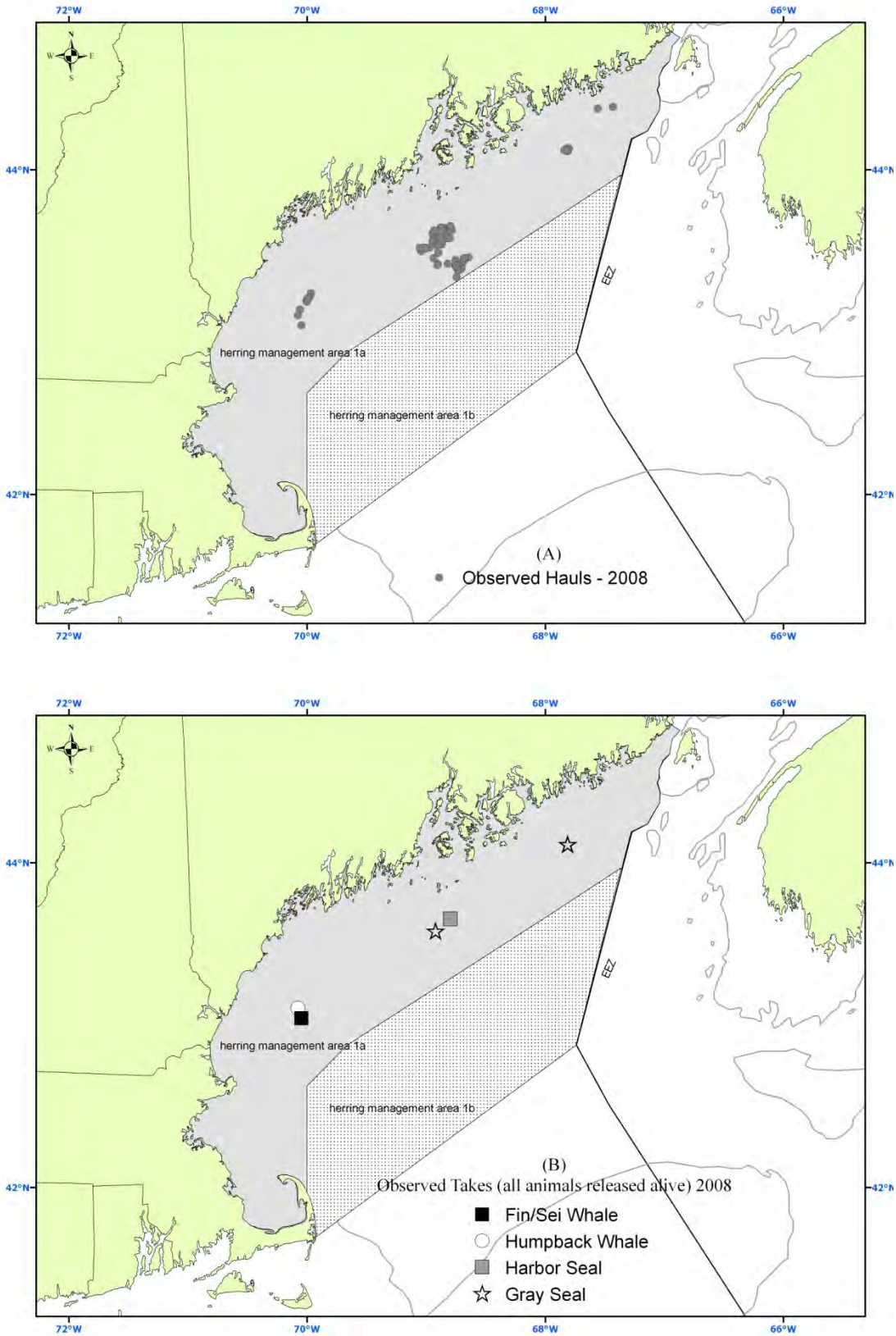


Figure 32. 2009 Herring Purse Seine observed hauls (A) and observed takes (B).

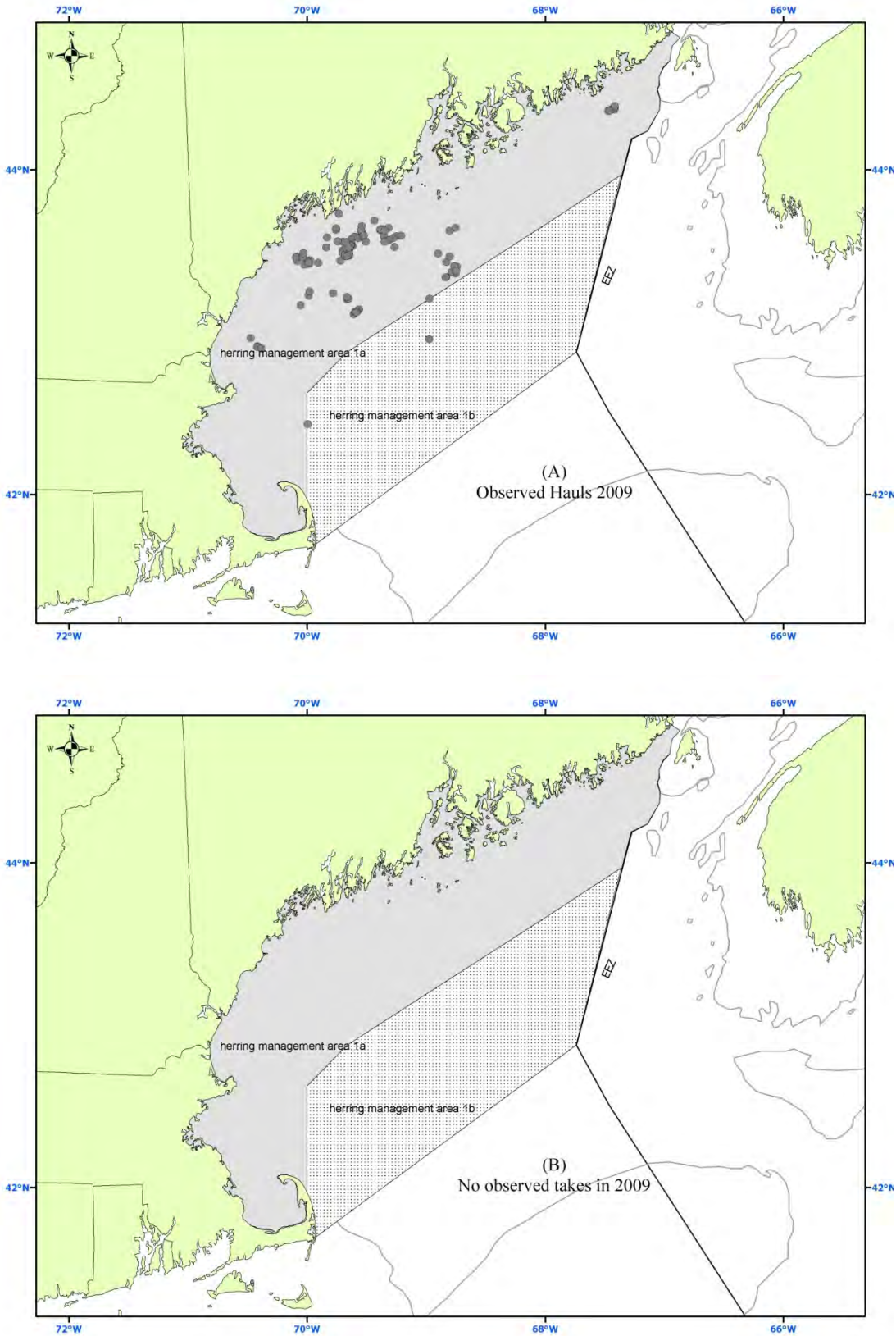


Figure 33. 2010 Herring Purse Seine observed hauls (A) and observed takes (B).

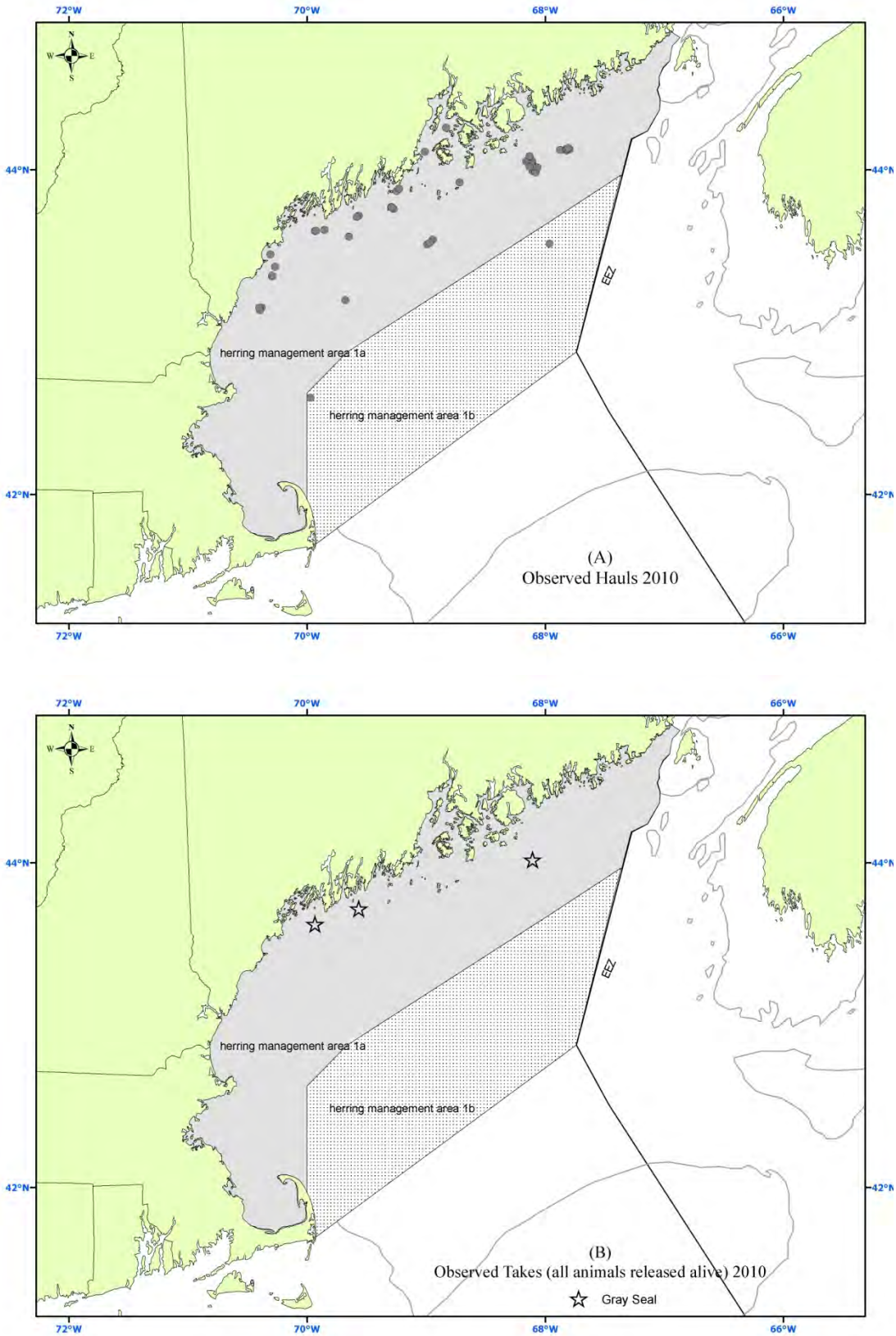


Figure 34. 2011 Herring Purse Seine observed hauls (A) and observed takes (B).

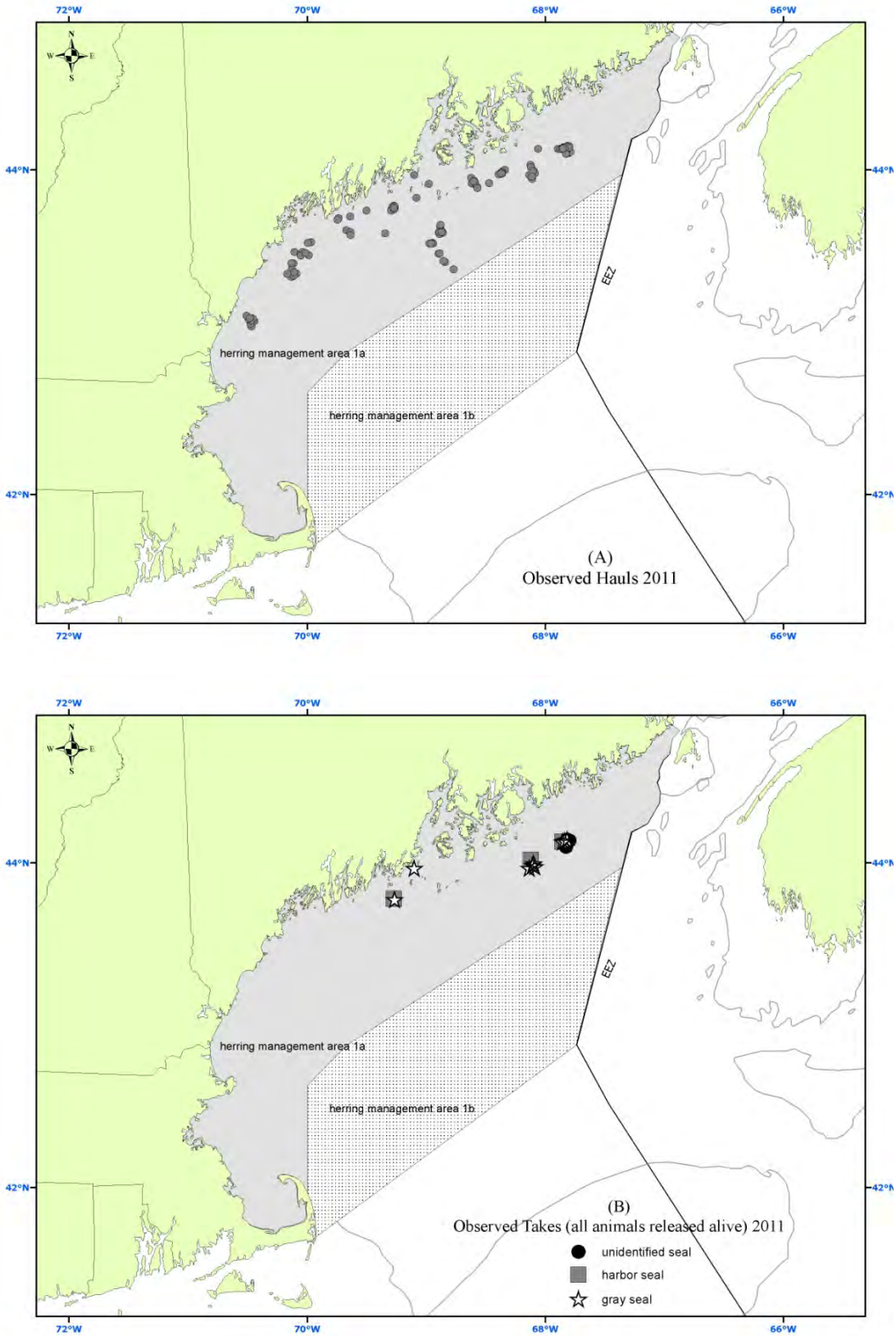


Figure 35. 2012 Herring Purse Seine observed hauls (A) and observed takes (B).

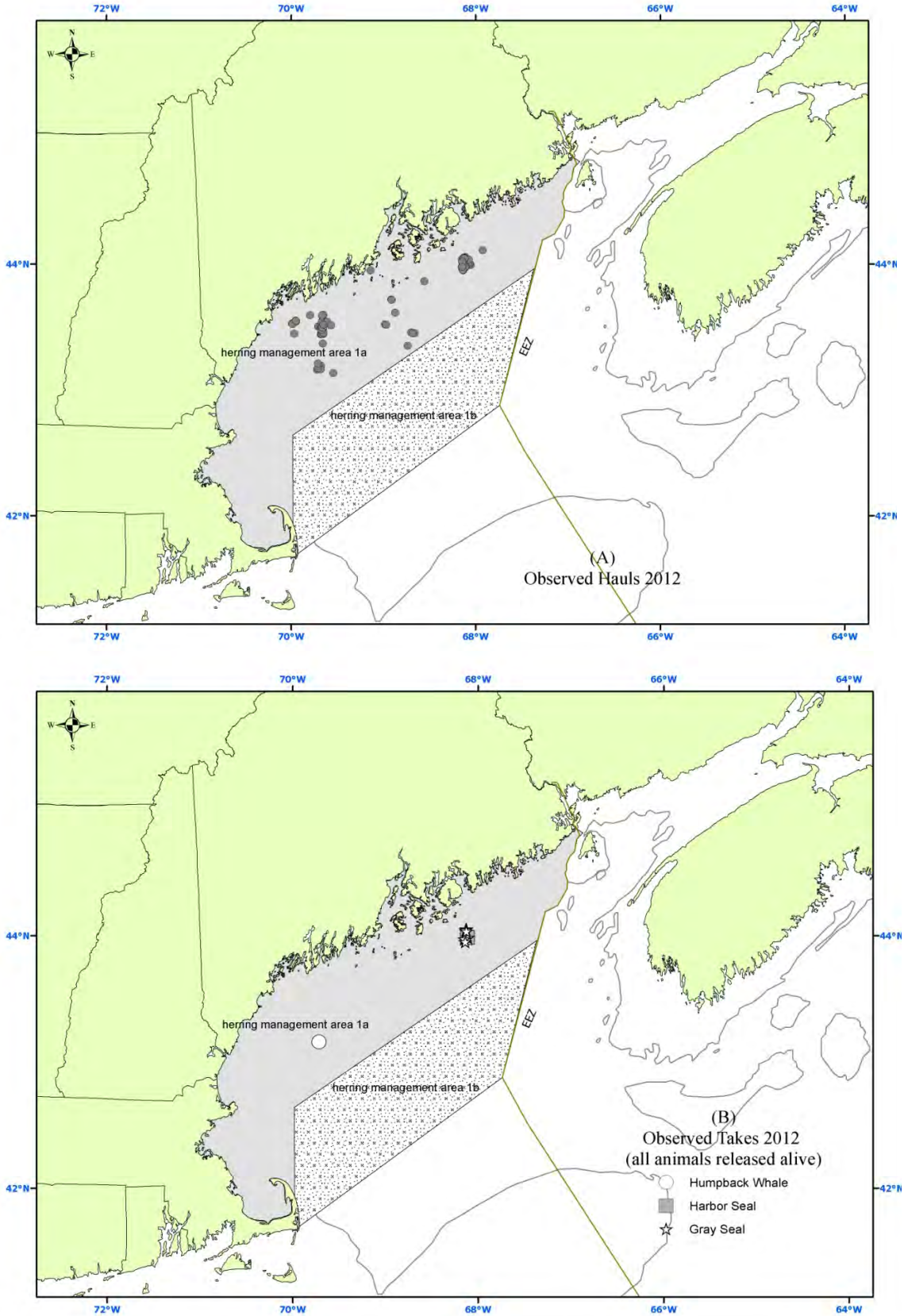


Figure 36. Observed sets and marine mammal interactions in the Pelagic longline fishery along the U.S. Atlantic coast during 2008. The boundaries of the Florida East Coast (FEC), South Atlantic Bight (SAB), Mid-Atlantic Bight (MAB), Northeast Coastal (NEC), and Sargasso Sea (SAR) fishing areas are shown. Seasonal closed areas instituted in 2001 under the HMS FMP are shown as hatched areas.

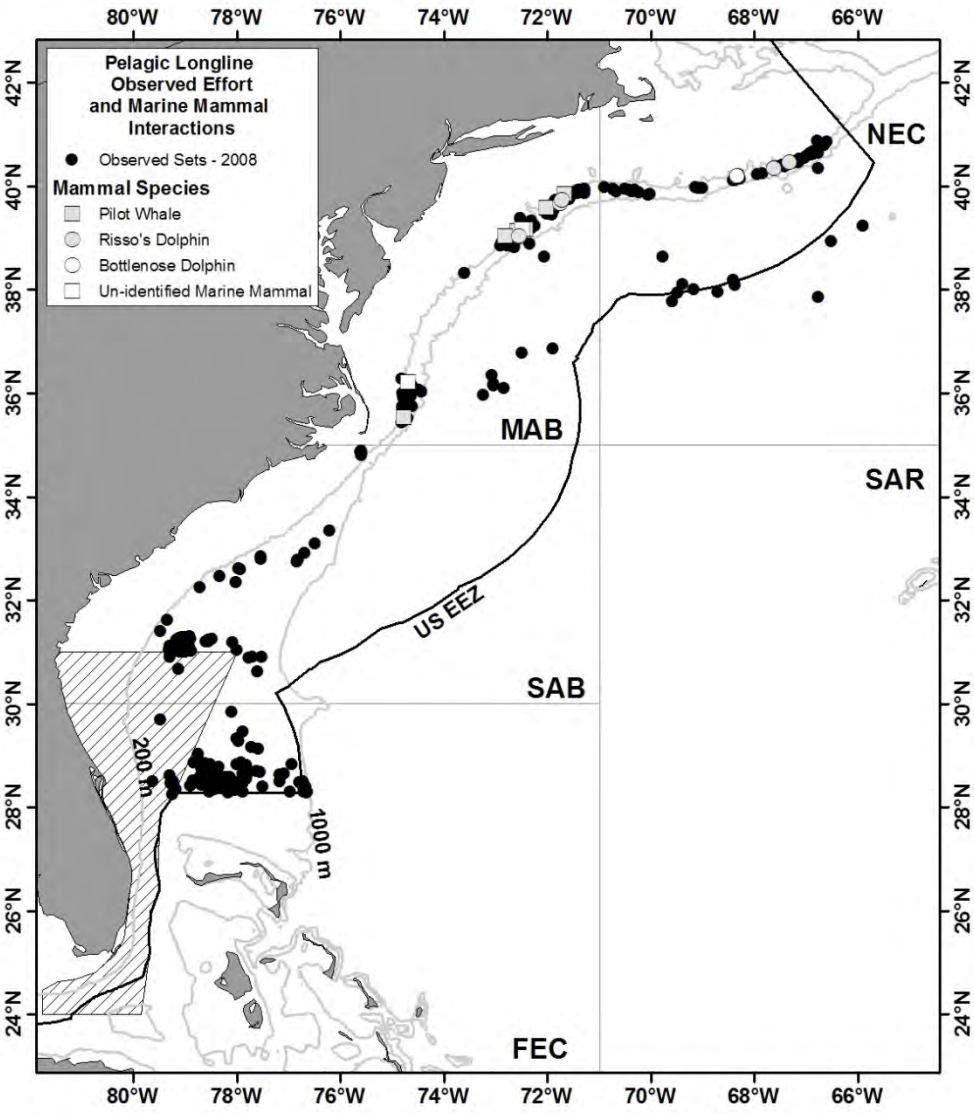


Figure 37. Observed sets and marine mammal interactions in the Pelagic longline fishery along the U.S. Atlantic coast during 2009. The boundaries of the Florida East Coast (FEC), South Atlantic Bight (SAB), Mid-Atlantic Bight (MAB), Northeast Coastal (NEC), and Sargasso Sea (SAR) fishing areas are shown. Seasonal closed areas instituted in 2001 under the HMS FMP are shown as hatched areas.

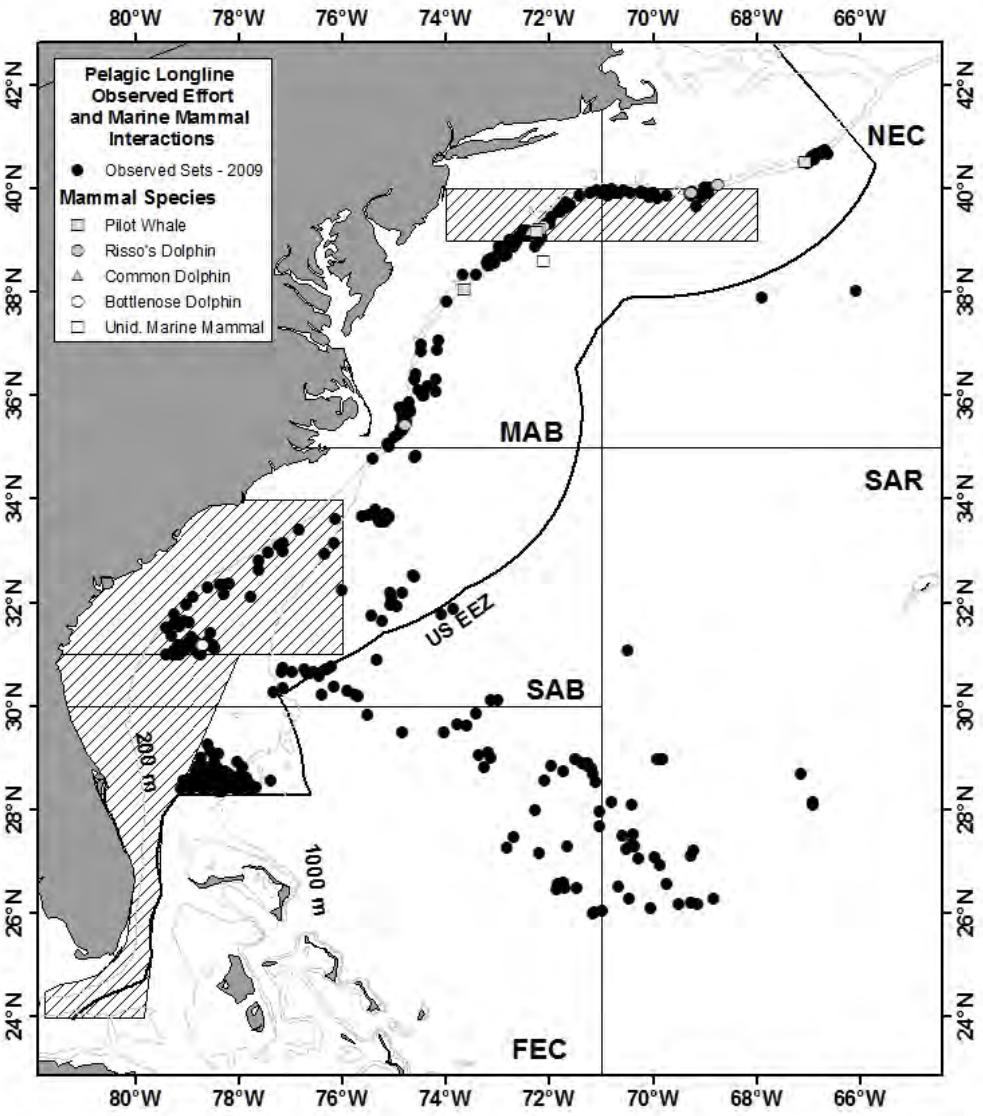


Figure 38. Observed sets and marine mammal interactions in the Pelagic longline fishery along the U.S. Atlantic coast during 2010. The boundaries of the Florida East Coast (FEC), South Atlantic Bight (SAB), Mid-Atlantic Bight (MAB), Northeast Coastal (NEC), and Sargasso Sea (SAR) fishing areas are shown. Seasonal closed areas instituted in 2001 under the HMS FMP are shown as hatched areas.

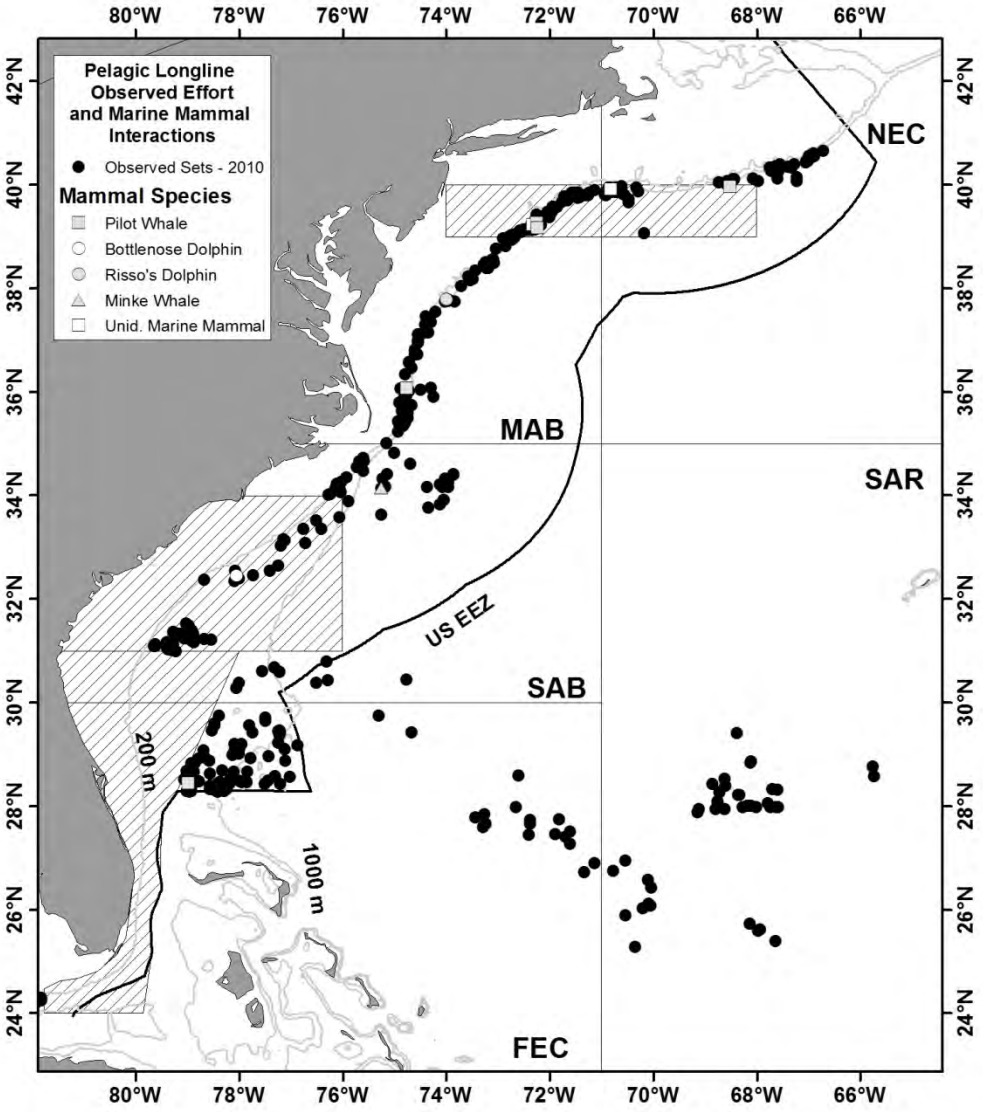


Figure 39. Observed sets and marine mammal interactions in the Pelagic longline fishery along the U.S. Atlantic coast during 2011. The boundaries of the Florida East Coast (FEC), South Atlantic Bight (SAB), Mid-Atlantic Bight (MAB), Northeast Coastal (NEC), and Sargasso Sea (SAR) fishing areas are shown. Seasonal closed areas instituted in 2001 under the HMS FMP are shown as hatched areas.

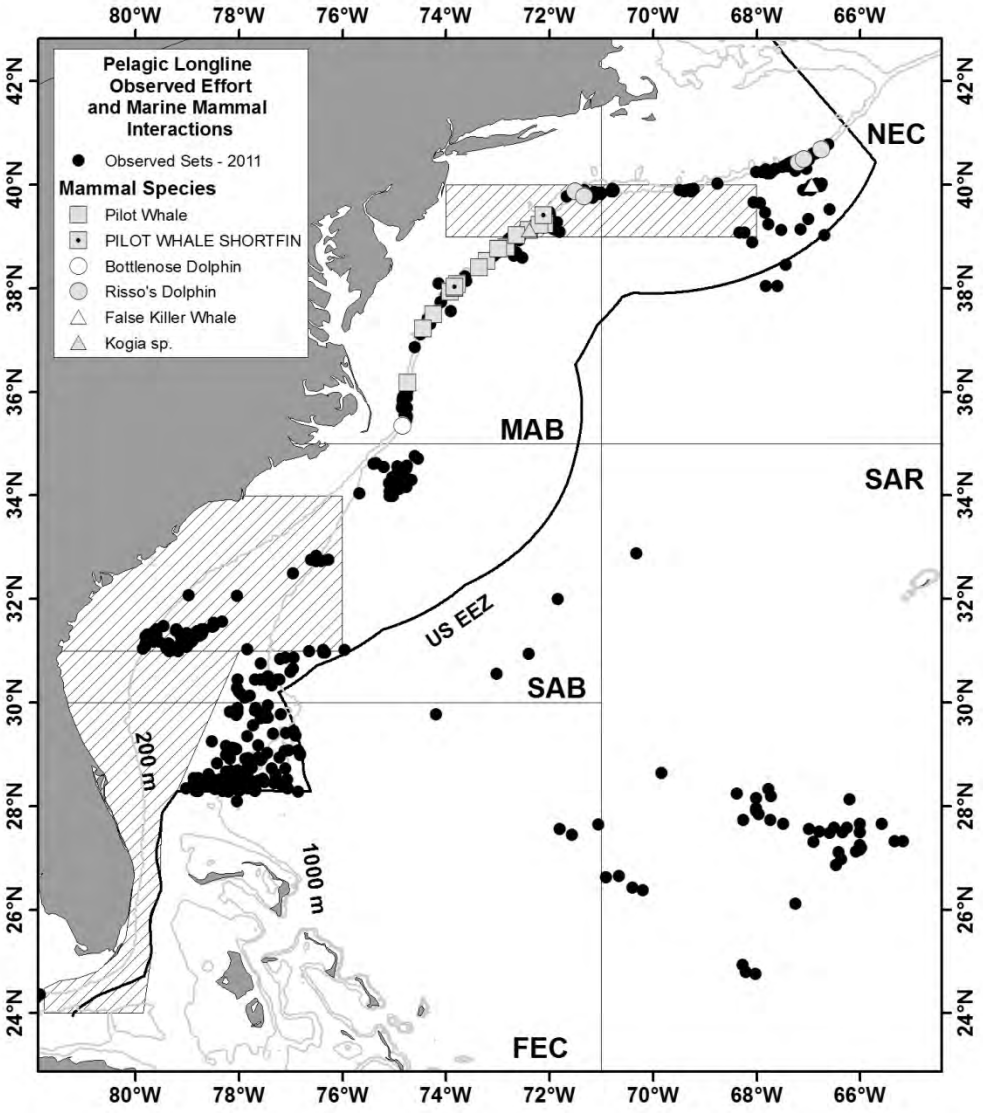


Figure 40. Observed sets and marine mammal interactions in the Pelagic longline fishery along the U.S. Atlantic coast during 2012. The boundaries of the Florida East Coast (FEC), South Atlantic Bight (SAB), Mid-Atlantic Bight (MAB), Northeast Coastal (NEC), and Sargasso Sea (SAR) fishing areas are shown. Seasonal closed areas instituted in 2001 under the HMS FMP are shown as hatched areas.

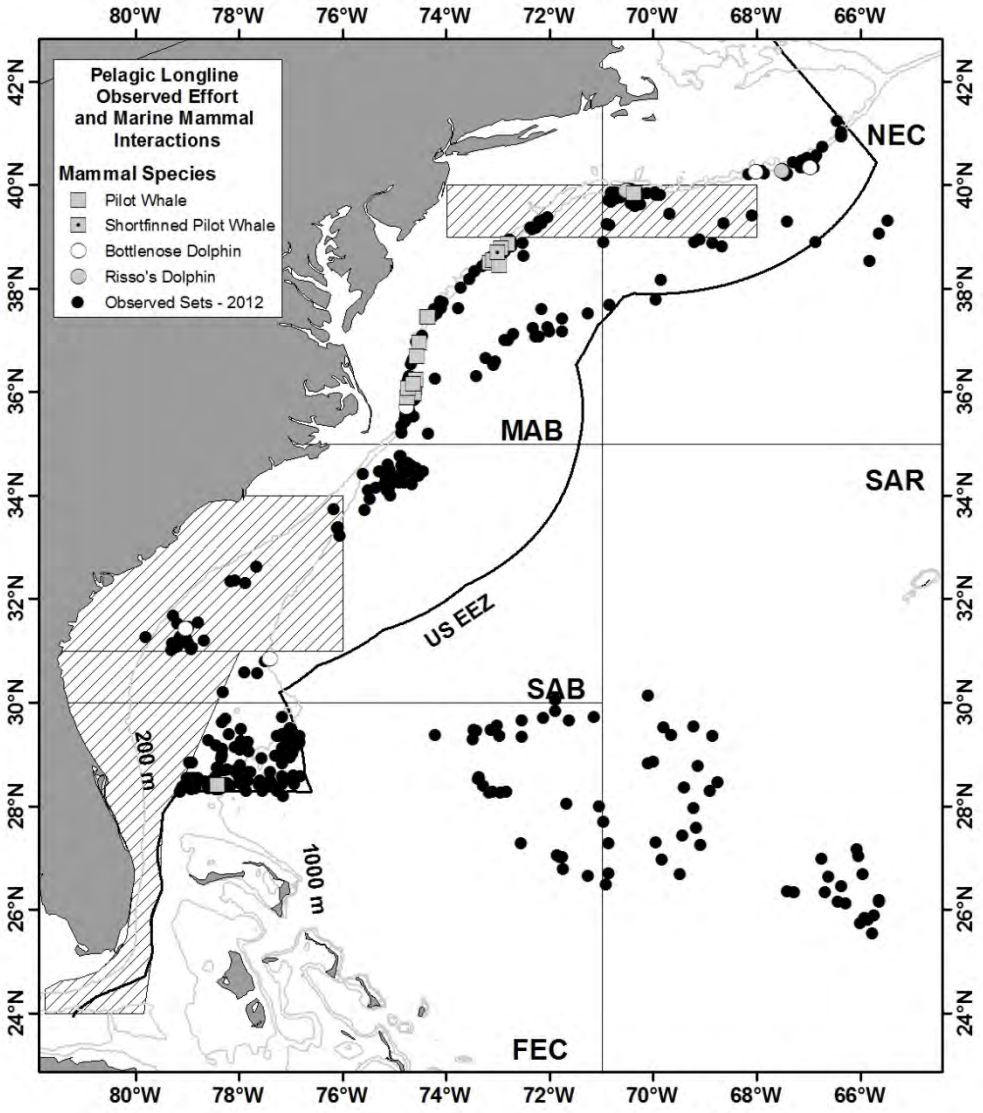


Figure 41. Observed sets in the Pelagic longline fishery in the Gulf of Mexico during 2008. Closed areas in the DeSoto canyon instituted in 2008 are shown as hatched areas.

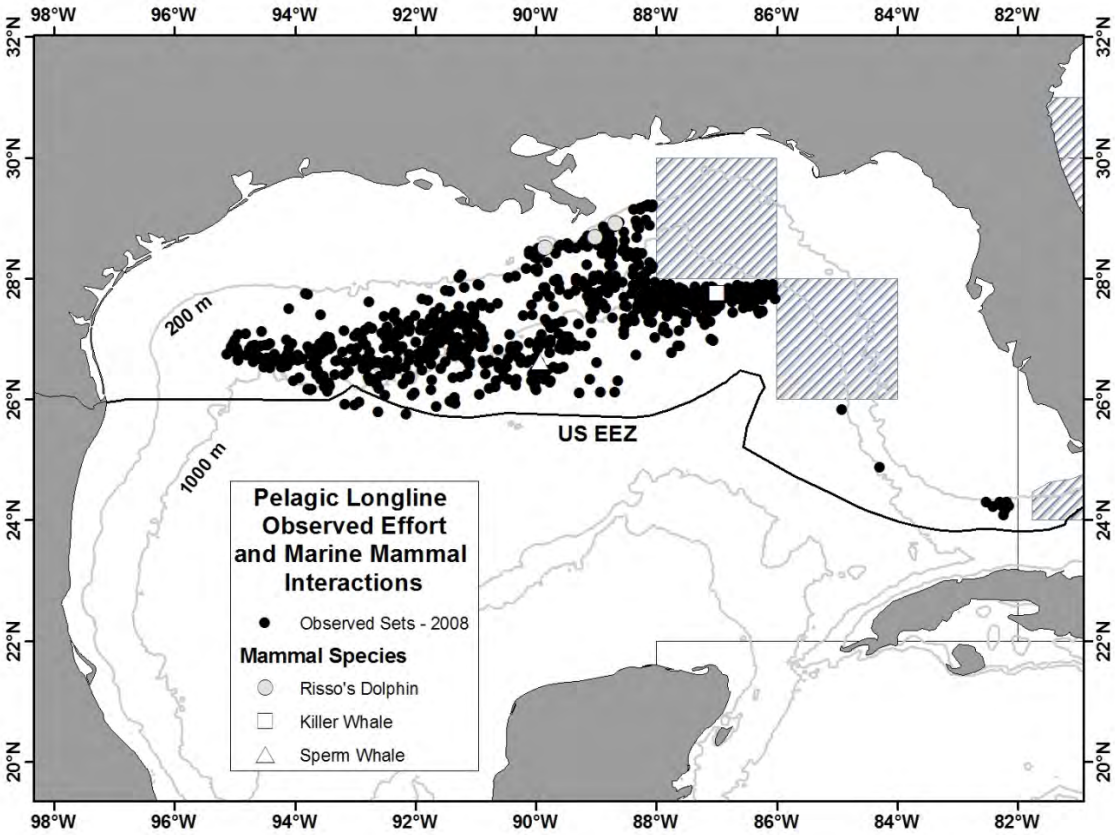


Figure 42. Observed sets in the Pelagic longline fishery in the Gulf of Mexico during 2012. Closed areas in the DeSoto canyon instituted in 2009 are shown as hatched areas.

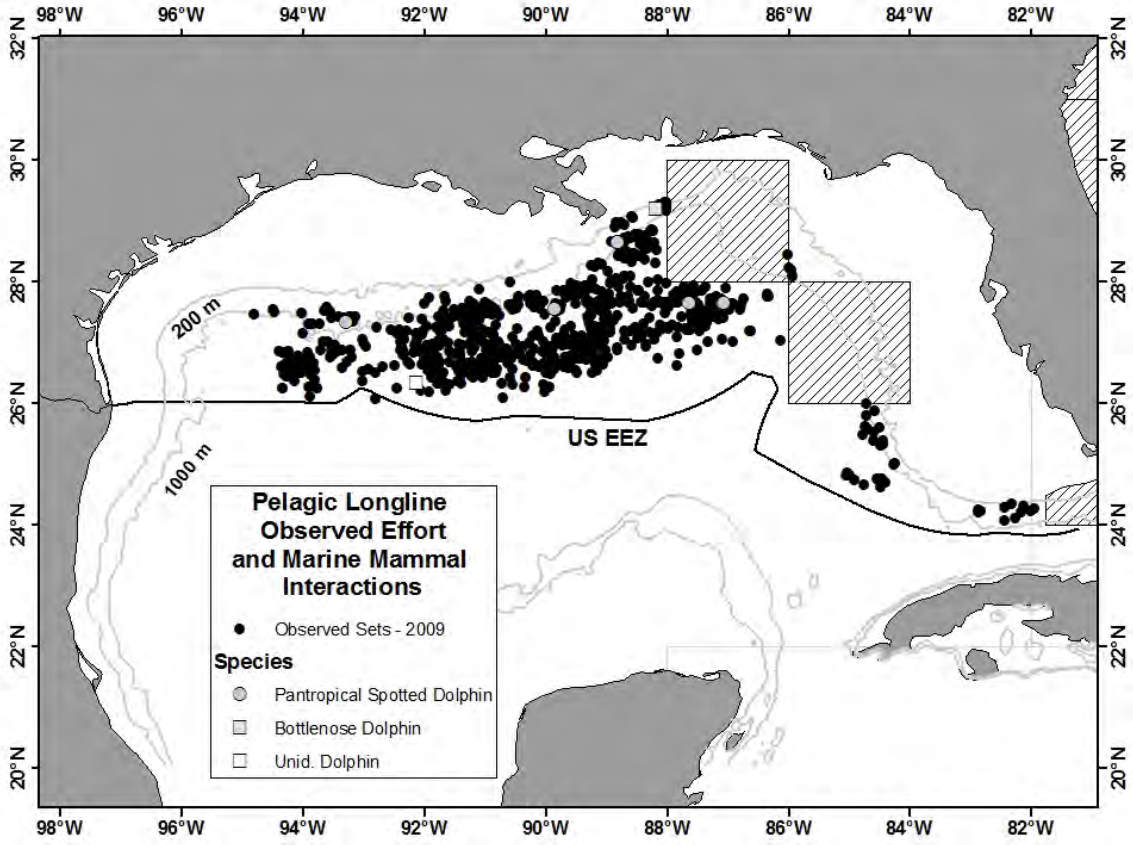


Figure 43. Observed sets in the Pelagic longline fishery in the Gulf of Mexico during 2010. Closed areas in the DeSoto canyon instituted in 2010 are shown as hatched areas.

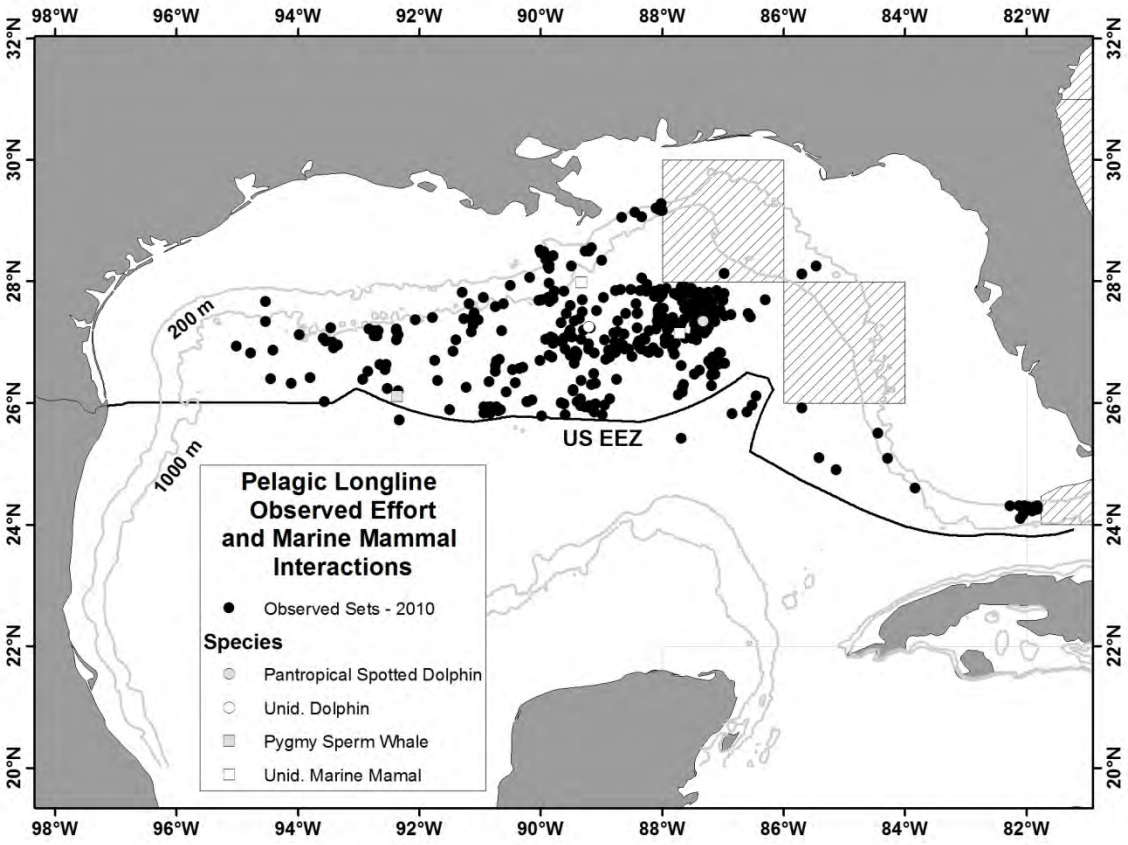


Figure 44. Observed sets in the Pelagic longline fishery in the Gulf of Mexico during 2011. Closed areas in the DeSoto canyon instituted in 2001 are shown as hatched areas.

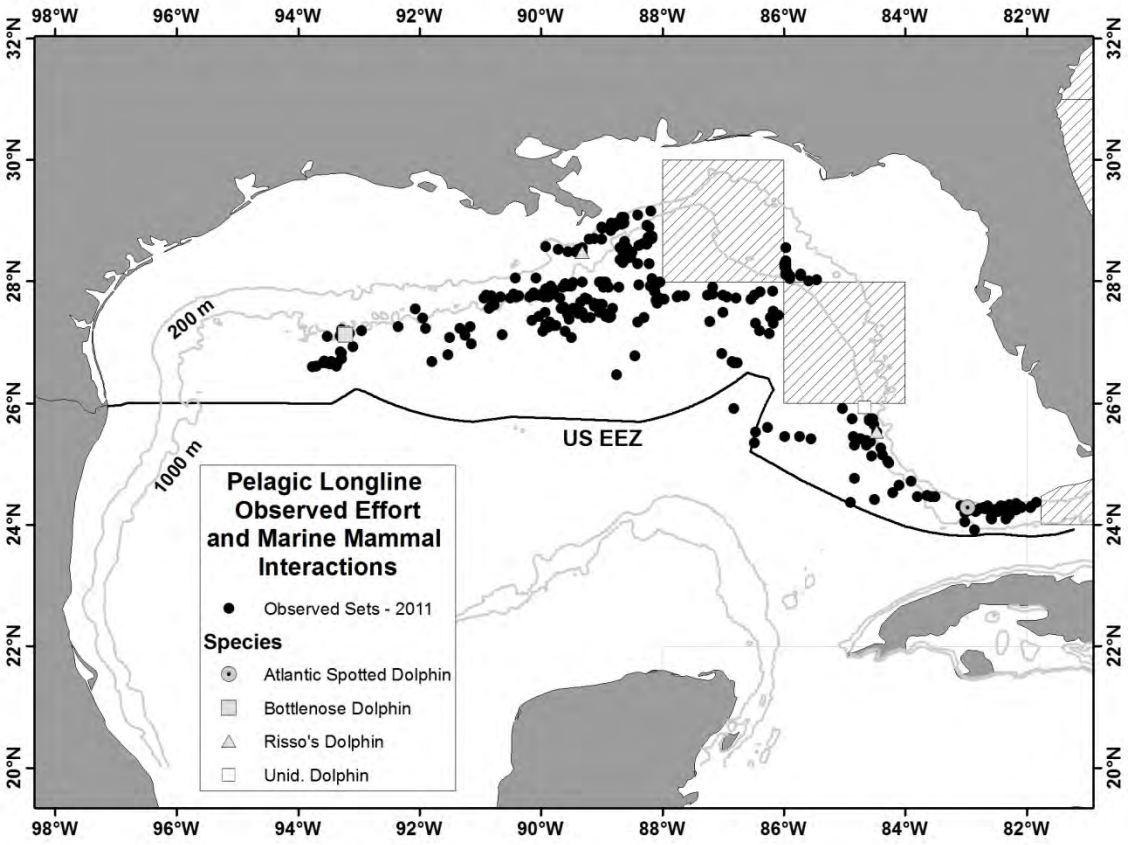
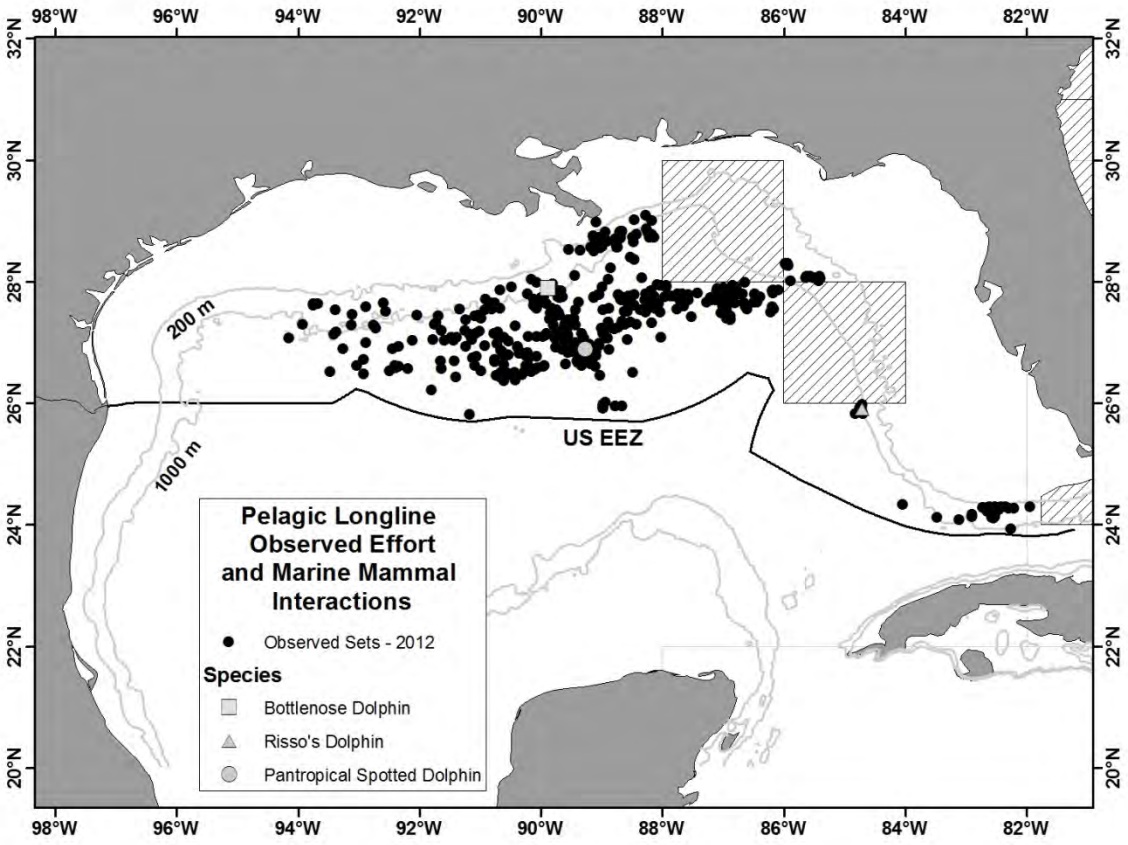


Figure 45. Observed sets in the Pelagic longline fishery in the Gulf of Mexico during 2012. Closed areas in the DeSoto canyon instituted in 2001 are shown as hatched areas.



Appendix IV

Surveys and Abundance Estimates

APPENDIX IV: Table A. Surveys

Survey Number	Year	Season	Platform	Track line length (km)	Area	Agency/ Program	Analysis	Corrected for g(0)	Reference
1	1982	year-round	plane (AT-11; 1978-1982)	211,585	Cape Hatteras, NC to Nova Scotia, continental shelf and shelf edge waters	CETAP	Line transect analyses of distance data	N	(CETAP 1982)
2	1990	Aug	ship (Chapman)	2,067	Cape Hatteras, NC to Southern New England, North wall of the Gulf Stream	NEC	One team data analyzed by DISTANCE.	N	(NMFS 1990)
3	1991	Jul–Aug	ship (Abel-J)	1,962	Gulf of Maine, lower Bay of Fundy, southern Scotian Shelf	NEC	Two independent team data analyzed with modified direct duplicate method.	Y	(Palka 1995)
4	1991	Aug	boat (Sneak Attack)	640	inshore bays of Maine	NEC	One team data analyzed by DISTANCE.	Y	(Palka 1995)
5	1991	Aug–Sep	plane 1(AT-11)	9,663	Cape Hatteras, NC to Nova Scotia, continental shelf and shelf edge waters	NEC/SEC	One team data analyzed by DISTANCE.	N	(NMFS 1991)
6	1991	Aug–Sep	plane 2 (Twin Otter)		Cape Hatteras, NC to Nova Scotia, continental shelf and shelf edge waters	NEC/SEC	One team data analyzed by DISTANCE.	N	(NMFS 1991)
7	1991	Jun–Jul	ship (Chapman)	4,032	Cape Hatteras to Georges Bank, between 200 and 2,000m isobaths	NEC	One team data analyzed by DISTANCE.	N	(Waring *et al*. 1992; Waring 1998)
8	1992	Jul–Sep	ship (Abel-J)	3,710	N. Gulf of Maine and lower Bay of Fundy	NEC	Two independent team data analyzed with modified direct duplicate method.	Y	(Smith *et al*. 1993)

9	1993	Jun–Jul	ship (Delaware II)	1,874	S. edge of Georges Bank, across the Northeast Channel, to the SE. edge of the Scotian Shelf	NEC	One team data analyzed by DISTANCE.		(NMFS 1993)
10	1994	Aug–Sep	ship (Relentless)	534	shelf edge and slope waters of Georges Bank	NEC	One team data analyzed by DISTANCE.	N	(NMFS 1994)
11	1995	Aug–Sep	plane (Skymaster)	8,427	Gulf of St. Lawrence	DFO	One team data analyzed using quenouille's jackknife bias reduction procedure that modeled the left truncated sighting curve	N	(Kingsley and Reeves 1998)
12	1995	Jul–Sep	2 ships (Abel-J and Pelican) and plane (Twin Otter)	32,600	Virginia to the mouth of the Gulf of St. Lawrence	NEC	Ship: two independent team data analyzed with modified direct duplicate method. Plane: one team data analyzed by DISTANCE.	Ship: Y. Plane: Y (only harbor porpoise) N (rest of species)	(Palka 1996)
13	1996	Jul–Aug	plane	3,993	Northern Gulf of St. Lawrence	DFO	Quenouille's jackknife bias reduction procedure on line transect methods that modeled the left truncated sighting curve	N	(Kingsley and Reeves 1998)
14	1998	Jul–Aug	ship	4,163	south of Maryland	SEC	One team data analyzed by DISTANCE.	N	(Mullin and Fulling 2003)
15	1998	Aug–Sep	plane (1995 and 1998)		Gulf of St. Lawrence	DFO			(Kingsley and Reeves 1998)
16	1998	Jul–Sep	ship (Abel-J) and plane (Twin Otter)	15,900	north of Maryland	NEC	Ship: two independent team data analyzed with the modifed direct duplicate or Palka & Hammond analysis methods, depending on the presence of responsive movement. Plane: one team data analyzed by DISTANCE.	Y	

17	1999	Jul–Aug	ship (Abel-J) and plane (Twin Otter)	6,123	south of Cape Cod to mouth of Gulf of St. Lawrence	NEC	Ship: two independent team data analyzed with modified direct duplicate or Palka & Hammond analysis methods, depending on the presence of responsive movement. Plane: circle-back data pooled with aerial data collected in 1999, 2002, 2004, 2006, 2007, and 2008 to calculate pooled g(0)'s and year-species specific abundance estimates for all years except 2008.	Y	
18	2002	Jul–Aug	plane (Twin Otter)	7,465	Georges Bank to Maine	NEC	Same as for plane in survey 17.	Y	(Palka 2006)
19	2002	Feb–Apr	ship (Gunter)	4,592	SE US continental shelf Delaware - Florida	SEC	One team data analyzed by DISTANCE.	N	(Garrison *et al.* 2003)
20	2002	Jun–Jul	plane	6,734	Florida to New Jersey	SEC	Two independent team data analyzed with modified direct duplicate method.	Y	(Garrison 2003)
21	2004	Jun–Aug	ship (Gunter)	5,659	Florida to Maryland	SEC	Two independent team data analyzed with modified direct duplicate method.	Y	(Garrison et al. in prep)
22	2004	Jun-Aug	ship (Endeavor) and plane (Twin Otter)	10,761	Maryland to Bay of Fundy	NEC	Same methods used in survey 17.	Y	(Palka 2006)
23	2006	Aug	plane (Twin Otter)	10,676	Georges Bank to Bay of Fundy	NEC	Same as for plane in survey 17.	Y	Palka (in prep)
24	2007	Aug	ship (Bigelow) and plane (Twin Otter)	8,195	Georges Bank to Bay of Fundy	NEC	Ship: Tracker data analyzed by DISTANCE. Plane: same as for plane in survey 17.	Y	Palka (in prep)
25	2007	July–Aug	plane	46,804	Canadian waters from Nova Scotia to Newfoundland	DFO	uncorrected counts	N	(Lawson and Gosselin 2009)
26	2008	Aug	plane (Twin Otter)	6,267	NY to Maine in US waters	NEC	Same as for plane in survey 17.	Y	Palka (in prep)
27	2001	May–June	plane	na	Maine coast	NEC/UM	corrected counts	N	(Gilbert *et al.* 2005)
28	1999	March	plane	na	Cape Cod	NEC	uncorrected counts	N	(Barlas 1999)
29	1983 - 1986	1983 (Fall) 1984	plane (Beechcraft D-18S	103,490 total 25,627	northern Gulf of Mexico bays	SEC	One team data analyzed with Line-transect theory	N	(Scott *et al.* 1989)

		(Winter, Spring, Summer) 1985 (Summer, Fall) 1986 (Winter)	modified with a bubblenose)	(bays and sounds) 36,685 (coastal) 41,178 (outer continental shelf, OCS)	and sounds, coastal waters from shoreline to 18-m isobath, and OCS waters from 18-m isobath to 9.3 km past the 18-m isobath				
30	1991-1994	Apr–June	ship (Oregon II)	22,041	northern Gulf of Mexico from 200 m to U.S. EEZ	SEC	One team data analyzed by DISTANCE	N	(Hansen *et al.* 1995)
31	1992-1993	Sep–Oct	plane (Twin Otter)	5,578 (bays and sounds) 4,806 (coastal) 7,678 (outer continental shelf, OCS)	northern Gulf of Mexico bays and sounds, coastal waters from shoreline to 18-m isobath, and OCS waters from 18-m isobath to 9.3 km past the 18-m isobath	GOMEX92 GOMEX93	One team data analyzed by DISTANCE	N	(Blaylock and Hoggard 1994)
32	1994	Sep–Nov	plane (Twin Otter)	1,155 (bays and sounds) 1,953 (coastal) 1,879 (outer continental shelf, OCS)	northern Gulf of Mexico bays and sounds, coastal waters from shoreline to 18-m isobath, and OCS waters from 18-m isobath to 9.3 km past the 18-m isobath	GOMEX94	One team data analyzed by DISTANCE	N	NMFS unpub. data
33	1996-1997, 1999-2001	Apr–June	ship (Oregon II and Gunter)	12,162	northern Gulf of Mexico from 200 m to U.S. EEZ	SEC	One team data analyzed by DISTANCE	N	(Mullin and Fulling 2004)
34	1998-2001	end Aug–early Oct	ship (Gunter and Oregon II)	2,196	northern Gulf of Mexico outer continental shelf (OCS, 20-200 m)	SEC	One team data analyzed by DISTANCE	N	(Fulling *et al.* 2003)
35	2003-2004	Jun–Aug (2003) Apr–Jun (2004)	ship (Gunter)	10,933	northern Gulf of Mexico from 200 m to U.S. EEZ	SEC	One team data analyzed by DISTANCE	N	(Mullin 2007)
36	2004	12–13 Jan	helicopter		Sable Island	DFO	Pup count	na	(Bowen *et al.* 2007)

37	2004		plane		Gulf of St Lawrence and Nova Scotia Eastern Shore	DFO	Pup count		(Hammill 2005)
38	2009	10 June–13 August	ship	4,600	northern Gulf of Mexico from 200m to U.S. EEZ	SEC	One team data analyzed by DISTANCE	N	
39	2007	17 July–8 August	plane		northern Gulf of Mexico from shore to 200m (majority of effort 0-20m)	SEC	One team data analyzed by DISTANCE	N	
40	2011	4 June–1 August	ship (Bigelow)	3,107	Virginia to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the US EEZ)	NEC	Two-independent teams, both using big-eyes. Analyzed using DISTANCE, the independent observer option assuming point independence.	Y	(Palka 2012)
41	2011	7–26 August	Plane (Twin Otter)	5,313	Massachusetts to New Brunswick, Canada (waters north of New Jersey and shallower than the 100-m depth contour, through the US and Canadian Gulf of Maine and up to and including the lower Bay of Fundy)	NEC	Two-independent teams, both using naked eye in the same plane. Analyzed using DISTANCE, the independent observer option assuming point independence.	Y	(Palka 2012)
42	2011	19 June–1 August	Ship (Gunther)	4,445	Florida to Virginia	SEC	Two-independent teams, both using big-eyes. Analyzed using DISTANCE, the independent observer option assuming point independence.	Y	
43	2012	May–June	plane	na	Maine coast	NEC	corrected counts	N	(Waring *et al.* in press)
44	2011	March-April	plane	13,500-15,600	U.S. Gulf of Mexico coast	SEC	Two-independent teams, analyzed using DISTANCE		
45	2011	July-August	plane	13,500-15,600	U.S. Gulf of Mexico coast	SEC	Two-independent teams, analyzed using DISTANCE		

46	2011	October-Nov	plane	13,500-15,600	U.S. Gulf of Mexico coast	SEC	Two-independent teams, analyzed using DISTANCE		
47	2012	January-Febr	plane	13,500-15,600	U.S. Gulf of Mexico coast	SEC	Two-independent teams, analyzed using DISTANCE		

APPENDIX IV: Table B. Abundance estimates – "Survey Number" refers to surveys described in Table A. "Best" estimate for each species in bold font.

Species	Stock	Year	Nbest	CV	Survey Number	Notes
Humpback Whale	Gulf of Maine	1992	501			minimum pop'n size estimated from photo-ID data
		1993	652	0.29		YONAH sampling (Clapham *et al.* 2003)
		1997	497			minimum pop'n size estimated from photo-ID data
		1999	902	0.45	17	
		2002	521	0.67	18	
		2004	359	0.75	22	
		2006	847	0.55	23	
		2008	**823**			Mark-recapture estimate Robbins 2010
		2011	335	0.42	40+41	
Fin Whale	Western North Atlantic	1995	2,200	0.24	12	
		1999	2,814	0.21	18	
		2002	2,933	0.49	18	
		2004	1,925	0.55	22	
		2006	2,269	0.37	23	
		2007	**3,522**	**0.27**	**25**	
		2011	1,595	0.33	40+41	
		2011	23	0.87	42	
Sei Whale	Nova Scotia	1977	1,393-2248			based on tag-recapture data (Mitchell and Chapman 1977)
		1977	870			based on census data (Mitchell and Chapman 1977)
		1982	280		1	
		2002	71	1.01	21	
		2004	386	0.85	23	
		2006	207	0.62	24	
		2011	**357**	**0.52**	**40+41**	
Minke	Canadian	1982	320	0.23	1	

Whale	East Coast	1992	2,650	0.31	3+8	
		1993	330	0.66	9	
		1995	2,790	0.32	12	
		1995	1,020	0.27	11	
		1996	620	0.52	13	
		1999	2,998	0.19	17	
		2002	756	0.9	18	
		2004	600	0.61	22	
		2006	3,312	0.74	23	
		2007	**20,741**	**0.3**	**25**	
		2011	2,591	0.81	40+41	
Sperm Whale	North Atlantic	1982	219	0.36	1	
		1990	338	0.31	2	
		1991	736	0.33	7	
		1991	705	0.66	6	
		1991	337	0.5	5	
		1993	116	0.4	9	
		1994	623	0.52	10	
		1995	2,698	0.67	12	
		1998	2,848	0.49	16	
		1998	1,181	0.51	14	
		2004	2,607	0.57	22	
		2004	2,197	0.47	21	
		2004	4,804	0.38	21+22	Estimate summed from north and south surveys
		2011	1,593	0.36	40+41	
		2011	695	0.39	42	
		2011	**2,288**	**0.28**	**40+41+42**	Estimate summed from north and south surveys
Kogia spp.	Western North Atlantic	1998	115	0.61	16	
		1998	580	0.57	14	
		2004	358	0.44	22	
		2004	37	0.75	21	
		2004	395	0.4	21+22	Estimate summed from north and south surveys
		2011	1,783	0.62	40+41	
		2011	2,002	0.69	42	
		2011	**3,785**	**0.47**	**40+41+42**	Estimate summed from north and south surveys
Beaked Whales	Western North Atlantic	1982	120	0.71	1	
		1990	442	0.51	2	

		1991	262	0.99	7	
		1991	370	0.65	6	
		1991	612	0.73	5	
		1993	330	0.66	9	
		1994	99	0.64	10	
		1995	1,519	0.69	12	
		1998	2,600	0.4	16	
		1998	541	0.55	14	
		2004	2,839	0.78	22	
		2004	674	0.36	21	
		2004	3,513	0.63	21+22	Estimate summed from north and south surveys
		2006	922	1.47	23	
		2011	5,500	0.67	40+41	2011 estimates are for *Mesoplodon* spp. beaked whales alone (not including *Ziphias*)
		2011	1,592	0.67	42	2011 estimates are for *Mesoplodon* spp. beaked whales alone (not including *Ziphias*)
		2011	**7,092**	**0.54**	**40+41+42**	2011 estimates are for *Mesoplodon* spp. beaked whales alone (not including *Ziphias*); Estimate summed from north and south surveys
Cuvier's Beaked Whale	Western North Atlantic	2011	4,962	0.37	40+41	
		2011	1,570	0.65	42	
		2011	**6,532**	**0.32**	**40+41+42**	Estimate summed from north and south surveys
Risso's Dolphin	Western North Atlantic	1982	4,980	0.34	1	
		1991	11,017	0.58	7	
		1991	6,496	0.74	5	
		1991	16,818	0.52	6	
		1993	212	0.62	9	
		1995	5,587	1.16	12	
		1998	18,631	0.35	17	
		1998	9,533	0.5	15	
		1998	28,164	0.29	15+17	Estimate summed from north and south surveys
		2002	69,311	0.76	18	
		2004	15,053	0.78	21	
		2004	5,426	0.54	22	
		2004	20,479	0.59	21+22	Estimate summed from north and south surveys
		2006	14,408	0.38	23	
		2011	15,197	0.55	40+41	
		2011	3,053	0.44	42	
		2011	**18,250**	**0.46**	**40+41+42**	Estimate summed from north and south surveys

Pilot Whale	Western North Atlantic	1951	50,000			Derived from catch data from 1951-1961 drive fishery (Mitchell 1974)
		1975	43,000-96000			Derived from population models (Mercer 1975)
		1982	11,120	0.29	1	
		1991	3,636	0.36	7	
		1991	3,368	0.28	5	
		1991	5,377	0.53	6	
		1993	668	0.55	9	
		1995	8,176	0.65	12	
		1995	9,776	0.55	12+16	Sum of US (#12) and Canadian (#16) surveys
		1998	1,600	0.65	16	
		1998	9,800	0.34	17	
		1998	5,109	0.41	15	
		2002	5,408	0.56	18	
		2004	15,728	0.34	22	
		2004	15,411	0.43	21	
		2004	31,139	0.27	21+22	Estimate summed from north and south surveys
		2006	**26,535**	**0.35**	**23**	**Best estimate for long-finned pilot whales alone; Estimate summed from north and south surveys**
		2007	6,134	0.28	25	long-finned pilot whales
		2011	5,636	0.63	40+41	long-finned pilot whales
		2011	4,569	0.57	40+41	short-finned pilot whales
		2011	16,946	0.43	42	short-finned pilot whales
		2011	**21,515**	**0.37**	**40+41+42**	**Best estimate for short-finned pilot whales alone; Estimate summed from north and south surveys**
Atlantic white-sided Dolphin	Western North Atlantic	1982	28,600	0.21	1	
		1992	20,400	0.63	2+7	
		1993	729	0.47	9	
		1995	27,200	0.43	12	
		1995	11,750	0.47	11	
		1996	560	0.89	13	
		1999	51,640	0.38	17	
		2002	109,141	0.3	18	
		2004	2,330	0.8	22	
		2006	17,594	0.3	23	
		2006	63,368	0.27	(18+23)/2	average of #18 and #23

		2007	5,796	0.43	25	
		2011	**48,819**	**0.61**	**40+41**	
White-beaked Dolphin	Western North Atlantic	1982	573	0.69	1	
			5,500			(Alling and Whitehead 1987)
		1982	3,486	0.22		(Alling and Whitehead 1987)
		2006	**2,003**	**0.94**	**23**	
		2007	11,842		25	
		2008			26	
Common Dolphin	Western North Atlantic	1982	29,610	0.39	1	
		1991	22,215	0.4	7	
		1993	1,645	0.47	9	
		1995	6,741	0.69	12	
		1998	30,768	0.32	17	
		1998	0		15	
		2002	6,460	0.74	21	
		2004	90,547	0.24	22	
		2004	30,196	0.54	21	
		2004	120,743	0.23	21+22	Estimate summed from north and south surveys
		2006	84,000	0.36	24	
		2007	53,625	0.22	25	
		2011	67,191	0.29	40+41	
		2011	2,993	0.87	42	
		2011	**70,184**	**0.28**	**40+41+42**	Estimate summed from north and south surveys
Atlantic Spotted Dolphin	Western North Atlantic	1982	6,107	0.27	1	
		1995	4,772	1.27	12	
		1998	32,043	1.39	16	
		1998	14,438	0.63	14	
		2004	3,578	0.48	22	
		2004	47,400	0.45	21	
		2004	50,978	0.42	21+22	Estimate summed from north and south surveys
		2011	26,798	0.66	40+41	
		2011	17,917	0.42	42	
		2011	**44,715**	**0.43**	**40+41+42**	Estimate summed from north and south surveys
Pantropical Spotted Dolphin	Western North Atlantic	1982	6,107	0.27	1	
		1995	4,772	1.27	12	
		1998	343	1.03	16	
		1998	12,747	0.56	14	
		2004	0		22	

		2004	4,439	0.49	21	
		2004	4,439	0.49	21+22	Estimate summed from north and south surveys
		2011	0	0	40+41	
		2011	3,333	0.91	42	
		2011	**3,333**	**0.91**	**40+41+42**	**Estimate summed from north and south surveys**
Striped Dolphin	Western North Atlantic	1982	36,780	0.27	1	
		1995	31,669	0.73	12	
		1998	39,720	0.45	16	
		1998	10,225	0.91	14	
		2004	52,055	0.57	22	
		2004	42,407	0.53	21	
		2004	94,462	0.4	21+22	Estimate summed from north and south surveys
		2011	46,882	0.33	40+41	
		2011	7,925	0.66	42	
		2011	**54,807**	**0.3**	**40+41+42**	**Estimate summed from north and south surveys**
Rough-toothed Dolphin	Western North Atlantic	2011	0	0	40+41	
		2011	271	1	42	
		2011	**271**	**1**	**40+41+42**	**Estimate summed from north and south surveys**
Bottlenose Dolphin	Western North Atlantic Offshore	1998	16,689	0.32	16	
		1998	13,085	0.4	14	
		2002	26,849	0.19	20	
		2002	5,100	0.41	18	
		2004	9,786	0.56	22	
		2004	44,953	0.26	21	
		2006	2,989	1.11	23	
		2011	26,766	0.52	40+41	
		2011	50,766	0.55	42	
		2011	77,532	0.4	**40+41+42**	**Estimate summed from north and south surveys**
Harbor Porpoise	Gulf of Maine/Bay of Fundy	1991	37,500	0.29	3	
		1992	67,500	0.23	8	
		1995	74,000	0.2	12	
		1995	12,100	0.26	11	
		1996	21,700	0.38	14	
		1999	89,700	0.22	18	survey discovered portions of the range not previously surveyed
		2002	64,047	0.48	21	
		2004	51,520	0.65	23	

		2006	89,054	0.47	24	
		2007	4,862	0.31	25	
		2011	**79,883**	**0.32**	**40+41**	
Harbor Seal	Western North Atlantic	2001	99,340	0.097	27	
		2012	75,834	**0.15**	**43**	Waring *et al.* in press
Gray Seal	Western North Atlantic	1999	5,611		28	
		2001	1,731		27	
		2004	52,500	0.15	37	Gulf of St Lawrence and Nova Scotia Eastern Shore
		2004	208,720 216,490 223,220	0.14 0.11 0.08	36	Sable Island
		2012	331,000	95% CI 263,000- 458,000		DFO 2013
Bryde's Whale	Northern Gulf of Mexico	1991-1994	35	1.1	30	
		1996-2001	40	0.61	33	
		2003-2004	15	1.98	35	
		2009	**33**	**1.07**	**38**	
Sperm Whale	Northern Gulf of Mexico	1991-1994	530	0.31	30	
		1996-2001	1,349	0.23	33	
		2003-2004	1,665	0.2	35	
		2009	**763**	**0.38**	**38**	
Kogia spp.	Northern Gulf of Mexico	1991-1994	547	0.28	30	
		1996-2001	742	0.29	33	
		2003-2004	453	0.35	35	
		2009	**186**	**1.04**	**38**	
Cuvier's Beaked Whale	Northern Gulf of Mexico	1991-1994	30	0.5	30	
		1996-2001	95	0.47	33	
		2003-2004	65	0.67	35	
		2009	**74**	**1.04**	**38**	
Mesoplodon spp.	Northern Gulf of Mexico	1996-2001	106	0.41	33	
		2003-2004	57	1.4	35	
		2009	**149**	**0.91**	**38**	
Killer Whale	Northern Gulf of Mexico	1991-1994	277	0.42	30	
		1996-2001	133	0.49	33	

		2003-2004	49	0.77	35	
		2009	**28**	**1.02**	**38**	
False killer Whale	Northern Gulf of Mexico	1991-1994	381	0.62	30	
		1996-2001	1,038	0.71	33	
		2003-2004	777	0.56	35	
Short-finned Pilot Whale	Northern Gulf of Mexico	1991-1994	353	0.89	30	
		1996-2001	2,388	0.48	33	
		2003-2004	716	0.34	35	
		2009	**2,415**	**0.66**	**38**	
Melon-headed Whale	Northern Gulf of Mexico	1991-1994	3,965	0.39	30	
		1996-2001	3,451	0.55	33	
		2003-2004	2,283	0.76	35	
		2009	**2,235**	**0.75**	**38**	
Pygmy Killer Whale	Northern Gulf of Mexico	1991-1994	518	0.81	30	
		1996-2001	408	0.6	33	
		2003-2004	323	0.6	35	
		2009	**152**	**1.02**	**38**	
Risso's Dolphin	Northern Gulf of Mexico	1991-1994	2,749	0.27	30	
		1996-2001	2,169	0.32	33	
		2003-2004	1,589	0.27	35	
		2009	**2,442**	**0.57**	**38**	
Pantropical Spotted Dolphin	Northern Gulf of Mexico	1991-1994	31,320	0.2	30	
		1996-2001	91,321	0.16	33	
		2003-2004	34,067	0.18	35	
		2009	**50,880**	**0.27**	**38**	
Striped Dolphin	Northern Gulf of Mexico	1991-1994	4,858	0.44	30	
		1996-2001	6,505	0.43	33	
		2003-2004	3,325	0.48	35	
		2009	**1,849**	**0.77**	**38**	
Spinner Dolphin	Northern Gulf of Mexico	1991-1994	6,316	0.43	30	
		1996-2001	11,971	0.71	33	
		2003-2004	1,989	0.48	35	
		2009	**11,441**	**0.83**	**38**	
Clymene	Northern	1991-1994	5,571	0.37	30	

Dolphin	Gulf of Mexico	1996-2001	17,355	0.65	33	
		2003-2004	6,575	0.36	35	
		2009	**129**	**1**	**38**	
Atlantic Spotted Dolphin	Northern Gulf of Mexico	1991-1994 oceanic	3,213	0.44	30	
		1996-2001 oceanic	175	0.84	33	
		1998-2001 OCS	37,611	0.28	34	This abundance estimate is from 2000-2001 surveys only. Current best population size estimate is unknown because data from the continental shelf portion of this species' range are more than 8 years old.
		2003-2004 oceanic	0	-	35	
		2009	2968	0.67	38	
Fraser's Dolphin	Northern Gulf of Mexico	1991-1994	127	0.9	30	
		1996-2001	726	0.7	33	
		2003-2004	0	-	35	
		2009	0	-	38	Current best population size estimate is unknown.
Rough-toothed Dolphin	Northern Gulf of Mexico	1991-1994 oceanic	852	0.31	30	
		1996-2001 oceanic	985	0.44	33	
		1998-2001 OCS	1,145	0.83	34	This abundance estimate is from 2000-2001 surveys only. Current best population size estimate is unknown because data from the continental shelf portion of this species' range are more than 8 years old.
		2003-2004 oceanic	1,508	0.39	35	
		2009	624	0.99	0.05	
Bottlenose Dolphin	Northern Gulf of Mexico Oceanic	1996-2001	2,239	0.41	33	
		2003-2004	3,708	0.42	35	
		2009	**5,806**	**0.39**	**38**	
Bottlenose Dolphin	Northern Gulf of Mexico Continental Shelf	1998-2001	17,777	0.32	34	This abundance estimate is from 2000-2001 surveys only.
		2011-2012	**51,192**	**0.1**	**44-47**	
Bottlenose Dolphin	Northern Gulf of Mexico	Eastern 1994	9,912	0.12	32	

	Coastal (3 stocks)	Eastern 2007	7,702	0.19	39	
		Eastern 2011/2012	**12,388**	**0.13**	**44-47**	
		Northern 1993	4,191	0.21	31	
		Northern 2007	2,473	0.25	39	
		Northern 2011/2012	**7,185**	**0.21**	**44-47**	
		Western 1992	3,499	0.21	31	
		Western 2011/2012	**20,161**	**0.17**	**44-47**	
Bottlenose Dolphin	Northern Gulf of Mexico Bay, Sound and Estuarine (31 stocks)	Choctawhatchee Bay, 2007	179	0.04		(Conn *et al.* 2011)
		St. Joseph Bay, 2005-2007	146	0.18		(Balmer *et al.* 2008)
		St. Vincent Sound, Apalachicola Bay, St. George Sound, 2008	439	0.14		(Tyson *et al.* 2011)
		Sarasota Bay, Little Sarasota Bay, 2007	160	-		Direct count; Wells, R.S. 2009.
		Mississippi River Delta, 2011-12	332	0.93		
		Mississippi Sound/ Lake Borgne, Bay Boudreau	901	0.63		
		Pine Island Sound, Charlotte Harbor, Gasparilla Sound, Lemon Bay (2006)	826	0.09		Bassos-Hull *et al.* 2013
		Remaining 27 stocks	unknown	undetermined	31	Current best population size estimate for each of these 27 stocks is unknown because data are more than 8 years old.

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APPENDIX V: Reports not updated in 2014

Species	Stock	Updated
Blue whale	Western North Atlantic	2010
Dwarf sperm whale	Western North Atlantic	2013
Pygmy sperm whale	Western North Atlantic	2013
Pygmy killer whale	Western North Atlantic	2007
Cuvier's beaked whale	Western North Atlantic	2013
Blainville's beaked whale	Western North Atlantic	2013
Gervais' beaked whale	Western North Atlantic	2013
True's beaked whale	Western North Atlantic	2013
Melon-headed whale	Western North Atlantic	2007
White-beaked dolphin	Western North Atlantic	2007
Atlantic spotted dolphin	Western North Atlantic	2013
Pantropical spotted dolphin	Western North Atlantic	2013
Striped dolphin	Western North Atlantic	2013
Fraser's dolphin	Western North Atlantic	2007
Rough-toothed dolphin	Western North Atlantic	2013
Clymene dolphin	Western North Atlantic	2013
Spinner dolphin	Western North Atlantic	2013
Common bottlenose dolphin	Biscayne Bay	2013
Common bottlenose dolphin	Florida Bay	2013
Harp seal	Western North Atlantic	2013
Hooded seal	Western North Atlantic	2007
Cuvier's beaked whale	Gulf of Mexico Oceanic	2012
Blainville's beaked whale	Gulf of Mexico Oceanic	2012
Gervais' beaked whale	Gulf of Mexico Oceanic	2012
Striped dolphin	Gulf of Mexico Oceanic	2012
Spinner dolphin	Gulf of Mexico Oceanic	2012
Rough-toothed dolphin	Gulf of Mexico (Outer continental shelf and Oceanic)	2012
Clymene dolphin	Gulf of Mexico Oceanic	2012
Fraser's dolphin	Gulf of Mexico Oceanic	2012
Killer whale	Gulf of Mexico Oceanic	2012
False killer whale	Gulf of Mexico Oceanic	2012
Pygmy killer whale	Gulf of Mexico Oceanic	2012
Dwarf sperm whale	Gulf of Mexico Oceanic	2012
Pygmy sperm whale	Gulf of Mexico Oceanic	2012
Melon-headed whale	Gulf of Mexico Oceanic	2012
Sperm Whale	Puerto Rico and US Virgin Islands stock	2010
Common bottlenose dolphin	Puerto Rico and US Virgin Islands stock	2011
Cuvier's beaked whale	Puerto Rico and US Virgin Islands stock	2011
Pilot whale, short-finned	Puerto Rico and US Virgin Islands stock	2011
Spinner dolphin	Puerto Rico and US Virgin Islands stock	2011
Atlantic spotted dolphin	Puerto Rico and US Virgin Islands stock	2011

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