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associated with the Gulf Stream wall and thermal fronts along the continental shelf edge (Waring *et al.* 1992; NMFS unpublished data).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the mid-Atlantic shelf break between New Jersey and the southern flank of Georges Bank (Payne and Heinemann 1993; NMFS unpublished data).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).

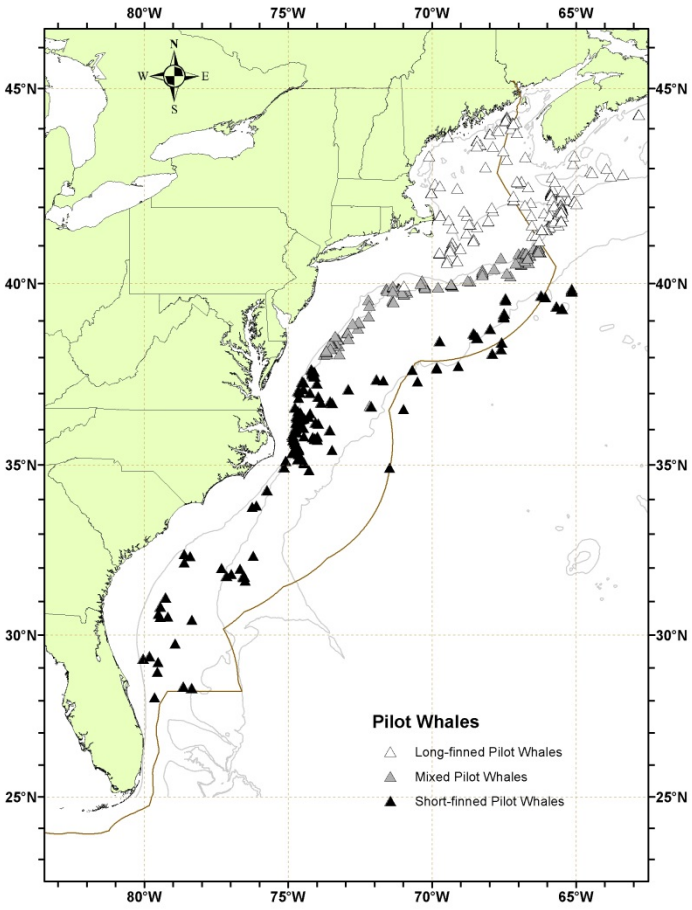

Figure 1. *Distribution of long-finned (open symbols), short-finned (black symbols), and possible mixed (gray symbols; could be either species) pilot whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1998, 1999, 2002, 2004, 2006, 2007 and 2011. The inferred distribution 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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