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.

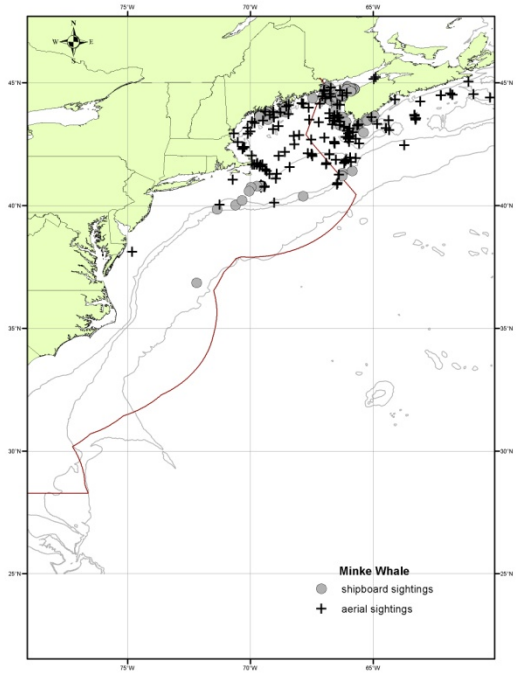

Figure 1. *Distribution of minke whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008, 2010 and 2011. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

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 and summer are times of relatively widespread and common occurrence, and when the whales are most abundant in New England waters. In New England waters during fall there are fewer minke whales, while during winter the species appears to be largely absent. Like most other baleen whales, minke whales generally occupy the continental shelf proper, 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 600 (CV=0.61) minke whales was obtained from a line-transect sighting survey

conducted during 12 June to 4 August 2004 by a ship and plane that surveyed 6,180 km of trackline from the 100-m depth contour on southern Georges Bank to the lower Bay of Fundy. The Scotian Shelf south of Nova Scotia was not surveyed (Table 1; Palka 2006). Shipboard data were collected using the two-independent-team line-transect method and analyzed using the modified direct-duplicate method (Palka 1995), accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*, the probability of detecting a group on the trackline. Aerial 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)* used for this estimation was derived from the pooled 2002, 2004 and 2006 aerial survey data.

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; J. Lawson, DFO, pers. comm.) 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 (MRDS), and correcting for availability bias using dive/surface times, as reported in the literature, and the Laake (2007) 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 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. 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 US 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). 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). An abundance survey was conducted concurrently in the southern U.S. waters (from North Carolina to Florida). The abundance estimates from this southern survey are being calculated and are not available at this time.

Table 1. Summary of abundance estimates for the Canadian east coast stock of minke 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
Jun-Jul 2004	Gulf of Maine to lower Bay of Fundy	600	0.61
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	North Carolina 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 minke whales is 20,741animals (CV= 0.30). The minimum population estimate for the Canadian East Coast minke whale is 16,199 animals.

Current Population Trend

A population trend analysis for this species has not been conducted.

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 INJURY

During 2006 to 2010, the average annual minimum detected human-caused mortality and serious injury was 5.0 minke whales per year (2.6 (0.46) minke whales per year from observed U.S. fisheries, 1.0 minke whales per year (unknown CV) from U.S. fisheries using strandings and entanglement data, 1.0 (unknown CV) from Canadian fisheries using strandings and entanglement data, and 0.4 per year from U.S. ship strikes (Henry *et al.* 2012)).

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, only those unobserved strandings and entanglement records considered confirmed human-caused mortalities or serious injuries are shown in Table 2, while mortalities and serious injuries recorded by the Observer or At-Sea Monitor Programs are recorded in Table 3.

Detected mortalities 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.

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. The 28 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 2010.

U.S.

Northeast Bottom Trawl

The fishery is active in New England waters in all seasons. Detailed fishery information is reported in Appendix III. One freshly dead minke whale was caught in 2004 on the northeastern tip of Georges Bank in US waters. Two dead minkes were reported by observers in 2008. Fisheries observer data from the years 2005 through 2009 were pooled and bycatch rates for minke whales were estimated using a stratified ratio-estimator. Estimated bycatch rates from the pooled fisheries observer data were expanded by annual (2006-2010) fisheries data collected from mandatory vessel trip reports. The estimated annual mortality (CV in parentheses) attributed to this fishery was 3.71 (0.73) for 2006, 3.28 (0.72) for 2007, 2.86 (0.73) for 2008, 2.86 (0.75) for 2009 and 0 for 2010. Annual average

estimated minke whale mortality and serious injury from the Northeast bottom trawl fishery during 2006 to 2010 was 2.6 (CV=0.46)(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).

Unknown 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. Mortalities (and serious injuries) that were likely a result of a U.S. fishery interaction with an unknown fishery include 3 (0) in 1997, 3 (0) in 1999, 1 (1) in 2000, 2 (0) in 2001, 1 (0) in 2002, 5 (0) in 2003, 2 (0) in 2004, 0 (0) in 2005, 0 (0) in 2006, 1 (1) in 2007, 1 (0) in 2008, 0 (1) in 2009, and 0 (1) in 2010 (Table 2). During 2006 to 2010, as determined from strandings and entanglement records, the minimum detected average annual mortality and serious injury is 1.0 minke whales per year in unknown U.S. fisheries (Table 2).

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 minkes were reported released alive from Gran Manan herring weirs in 2009 (H. Koopman pers. comm.).

Other Fisheries

Six minke whales were reported entangled during 1989 in the groundfish gillnet fishery in Newfoundland and Labrador (Read 1994). One of these animals escaped and was still towing gear, the remaining five animals died.

Salmon gillnets in Canada, now no longer used, had taken a few minke whales. In Newfoundland in 1979, one minke whale died in a salmon net. In Newfoundland and Labrador, between 1979 and 1990, it was estimated that 15% of the Canadian minke whale takes were in salmon gillnets. A total of 124 minke whale interactions were documented in cod traps, groundfish gillnets, salmon gillnets, other gillnets, and other traps. The salmon gillnet fishery ended in 1993 as a result of an agreement between the fishermen and North Atlantic Salmon Fund (Read 1994).

Five minke whales were entrapped and died in Newfoundland cod traps during 1989. The cod trap fishery closed in Newfoundland in 1993 due to the depleted groundfish resources (Read 1994).

In 2004, two minke whales were reported dead in entangled fishing gear off Newfoundland and Labrador, one in a blackback flounder net, and one in crab gear (Ledwell and Huntington 2004). Only the flounder net animal had enough information to include it as a human-caused mortality. In 2005, four minke whales were reported entangled in fishing gear in Newfoundland and Labrador. Two (entangled in salmon net and mackerel trap gear) were released alive and two (involved with whelk pot and toad crab pot fisheries) were dead (Ledwell and Huntington 2006). The whelk pot mortality could not be conclusively attributed to human causes. In 2006, one minke whale was reported dead in a mackerel trap off Newfoundland (Ledwell and Huntington 2007). In 2007, four minke whales in Newfoundland and Labrador were reported entangled, but released alive (Ledwell and Huntington 2008). In 2008, four minkes were reported entangled in Newfoundland and Labrador. Two of these were dead and two were released alive, though one of the live releases was listed as “condition uncertain” (Ledwell and Huntington 2009). In 2008, one minke was reported dead in an unknown fishery off New Brunswick. In 2009, one minke whale was determined to have been seriously injured off Quebec. In 2010, a minke whale was released alive from a mackerel seine in La

Poile Bay, Newfoundland (Ledwell and Huntington 2011). Mortalities (and serious injuries) that were likely a result of an interaction with an unknown Canadian fishery include 1(0) in 2005, 1(0) in 2006, 0(0) in 2007, 3(0) in 2008, 0 (1) in 2009, and 0(0) in 2010 (Table 2). During 2006 to 2010, as determined from Canadian strandings and entanglement records, the minimum detected average annual mortality and serious injury was 1.0 minke whales per year in fisheries.

Table 2. Confirmed human-caused mortality and serious injury records of Canadian East Coast minke whales *(Balaenoptera acutorostrata)*, 2006 - 2010.

Date[a]	**Report Type**	**Age, Sex, Length**	**Location**[a]	**Assigned Cause: P=primary, S=secondary**		**Notes/Observations**
				Ship strike	**Entanglement/ Fishery interaction**	
09/22/06[b]	mortality	age & sex unknown	Woods Cove, Great Northern Peninsula, NL		P	Anchored by tail in doorways of the gear; mackerel trap
7/16/2007	serious injury	age & sex unknown 10m (est)	Trescott, ME		P	Wrapped in gear and anchored; no gear recovered
8/5/2007	mortality	Juvenile Female 4.3m	Cape Cod Bay, MA		P	Chronic entanglement with severe emaciation and dehydration and loss of protein; line lacerated blubber layer across back and at flipper insertions; severe hemorrhage and necrosis of blubber at gear entanglement points; gear consists of 11/16” diameter floating rope

6/14/2008	mortality	Juvenile Female 4.7m	Orleans, MA		P	Braided line impressions wrapped the body in 3 places and left a deep, hemorrhaged laceration across the rostrum and blowholes; hemorrhaged abrasions present on roof of mouth; wet, blood-filled lungs indicate drowning; no gear present
7/23/2008	mortality	age & sex unknown 7m (est)	Kelligrews, NL		P	Constricting wraps of gear on caudal peduncle; 5/8" polypropylene rope
7/26/2008	mortality	age & sex unknown	Conception Bay, NL		P	Constricting wraps of gear through mouth and around tail; blackback flounder nets
8/25/2008	mortality	age & sex unknown 8m (est)	off Richibucto Cape, NB		P	Evidence of constricting body wraps; gear not recovered
5/20/2009	mortality	Adult sex unknown 8m (est)	off Point Pleasant, NJ	P		Large hemorrhage at right pectoral
6/3/2009	serious injury	age & sex unknown	off Tadoussac, Quebec		P	Free-swimming with tight rostrum wrap; no gear recovered
8/11/2009	serious injury	age & sex unknown	off Plymouth, MA		P	Constricting wrap on rostrum & poor skin condition; no gear recovered
7/9/2010	mortality	Juvenile Male 5.7m	Fire Island, NY	P		3-4 large dorsal lacerations associated with fractured ribs
8/21/2010	serious injury	Adult sex unknown	Plymouth Harbor, MA		P	Embedded rostrum wrap; no gear recovered

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. Additional record which was not included in previous reports.

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 (Years), 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 [a]	Years	Data Type	Observer Coverage [b]	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Annual Mortality
Northeast Bottom Trawl	06-10	Obs. Data Dealer Data VTR Data	.06, .06, .08, .09, .16	0, 0, 0, 0, 0	0, 0, 2, 0, 0	0, 0, 0, 0, 0	3.7, 3.3, 2.9, 2.9, 0	3.7, 3.3, 2.9, 2.9, 0	.73, .72, .73, .75, 0	2.6 (.46)
TOTAL										2.6 (.46)

a. Bycatch rates were estimated from fisheries observer data pooled over years 2005-2009. A new five year time period will begin in 2010. Fisheries observer data from the years 2010-2014 will be pooled to estimate bycatch rates for minke whales for the same five year time period. No takes of minke whales were observed or monitored in 2010. As a result the estimated mortality is zero.

b. Total observer coverage reported for bottom trawl gear in the year 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). In the Northeast region, 437 and 658 trips were sampled by observers and monitors, respectively. In the mid-Atlantic region, 661 and 75 trips were sampled by observers and monitors, respectively.

Other Mortality

Minke whales have been and continue to be hunted in the North Atlantic. 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 still being harvested.

U.S.

Minke whales inhabit coastal waters during much of the year and are thus subject 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 (Table 2). 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 and in 2010 a juvenile male minke was discovered killed by ship strike off Fire Island, New York. Thus, during 2006 to 2010, as determined from stranding and entanglement records, the minimum detected annual average was 0.4 minke whales per year struck by ships.

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. Stranding mortalities and serious injuries that have been determined to be human-caused are included in Table 2 (Henry *et al.* 2012).

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.

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.

Whales and dolphins stranded between 1997 and 2009 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 (including the entangled animal listed in Table 2) in 2008, and 5 in 2009 (including one minke released alive from a weir).

The Whale Release and Strandings program has reported 8 minke whale stranding mortalities in Newfoundland and Labrador between 2006 and 2010; 1 in 2006, 2 in 2007, 3 in 2008, 1 in 2009 and 1 in 2010. Three of these records are included in Table 2 (Ledwell and Huntington 2004; 2006; 2007; 2008; 2009; 2010, 2011).

STATUS OF STOCK

This is not a strategic stock because estimated human-related mortality and serious injury does not exceed PBR and the minke whale is not listed as a threatened or endangered species under the Endangered Species Act (ESA). 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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