Northeast Fisheries Science Center Reference Document 13-18

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by Allison G. Henry[1], Timothy V.N. Cole[1], Lanni Hall[2], Wayne Ledwell[3], David Morin[2], and Andrew Reid[4]

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ABSTRACT

The Northeast Fisheries Science Center (NEFSC) developed criteria to evaluate reports of human-caused mortality to baleen whales. The criteria minimize the likelihood of incorrectly assigning whale mortalities to human causes and provide a minimum count of human-caused events. This report describes determinations made for reports received from 2007-2011 involving North Atlantic right (*Eubalaena glacialis*), humpback (*Megaptera novaeangliae*), fin (*Balaenoptera physalus*), sei (*B. borealis*), blue (*B. musculus*), minke (*B. acutorostrata*), and Bryde's (*B. edeni*) whales observed along coastal Gulf of Mexico, the eastern seaboard of the United States, and the Atlantic Canadian provinces. We confirmed a total of 306 mortalities: 56 (18%) due to human interaction; 14 (5%) due to natural causes; and 236 (77%) which lacked sufficient evidence to determine cause of death. Of the human-caused mortalities, 28 were due to entanglement and 28 were vessel strike. Minke whales had the greatest number of entanglement mortalities (n=9) and humpback whales had the greatest number of vessel strike mortalities (n=9). These mortality numbers are minimum counts because of a low probability of detecting events and inadequate documentation for the majority of events that are detected. Despite the minimum values, the mean annual confirmed human-caused mortality rate exceeds PBR for four of the seven stocks examined, including North Atlantic right, humpback, sei, and Bryde's whales. The true level of anthropogenic mortality to these stocks is greater than these minimum values, but the amount greater is unknown.

INTRODUCTION

The NOAA National Marine Fisheries Service (NMFS) is required to estimate annual rates of human-caused mortality and serious injury to marine mammal stocks occurring regularly in US waters. The agency is also charged with developing plans to reduce the rate of human-caused mortality and serious injury to strategic stocks to levels below their Potential Biological Removal (PBR). The PBR is defined as the maximum number of animals, not including natural mortalities, which may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population size (Wade and Angliss 1997). The average rate of human-caused mortality and serious injury for the most recent five years of data is reported for each species in the annual marine mammal stock assessment report (SAR; e.g., Waring et al. 2013). This rate, when compared to a population's PBR, is used to determine the status of a stock within the relevant SAR.

This report presents the method and results of applying cause-of-death determination criteria that establish the minimum annual rates of confirmed human-caused mortality for North Atlantic right (*Eubalaena glacialis*), humpback (*Megaptera novaeangliae*), fin (*Balaenoptera physalus*), sei (*B. borealis*), blue (*B. musculus*), minke (*B. acutorostrata*), and Bryde's (*B. edeni*) whale stocks along the Gulf of Mexico, the eastern seaboard of the US, and the Atlantic Canadian provinces for the period 2007-2011. Serious injuries and their causes are reported elsewhere (Cole and Henry, *in prep*).

METHODS

Members of the US and Canadian regional stranding networks, large whale disentanglement teams, the US and Canadian Coast Guards, and the general public provided opportunistic marine mammal stranding and human interaction reports to the NMFS Northeast Regional Office (NERO), Southeast Regional Office (SERO), or the Northeast Fisheries Science Center (NEFSC). With the exception of minke whales, the incidental take of whales recorded by fisheries observer programs are also included here because the numbers of observed takes were not sufficient to calculate bycatch rate estimates. These reports were therefore treated as opportunistic. The Regional Offices obtained all available information for each report (photos, necropsy reports, etc.), which was then reviewed by NEFSC and NERO staff members. Confirmed reports were designated "events," and for each event the species involved was verified, duplicate records identified, and relevant information from each source consolidated into a single record. Information from additional sightings of a previously documented event was added to the existing record. Pre-event sighting and demographic information for whales was obtained, where available, from local population-monitoring studies. NEFSC staff reviewed each mortality event and assigned a cause of death following the confirmation criteria listed below. One staff member reviewed all determinations each year to ensure consistency in the application of determination criteria within and across years.

Events from Newfoundland and Labrador involving confirmed transboundary stocks (i.e., stocks that enter US waters during part of the year) were also included. However, humpback events from these regions were not included in tallies because the Newfoundland and Labrador humpback feeding stocks are distinct from the Gulf of Maine stock found in US waters (Palsbøll et al. 2001).

Confirmation Criteria for Species and Mortality Event
(listed in order of certainty)

The species and/or mortality event was considered confirmed if it met one of the following criteria:

1. Photographs or video allowed identification;
2. A marine mammal expert reported the mortality event and/or species as certain; or
3. The report was made by a trained observer or member of the stranding network and was then verified via interview by NMFS or stranding network staff.

The species and/or mortality event was considered confirmed in the following less certain cases:

1. Photographs or video allowed probable identification;
2. A marine mammal expert reported the mortality event and/or species as probable;
3. An inexperienced observer's report allowed probable identification; or
4. An inexperienced observer's report was verified via interview by NMFS or stranding network staff.

The species and/or mortality event was considered unconfirmed if:

1. Photographs or video were of insufficient quality to verify;
2. An inexperienced observer's report lacked photographs or video and/or detail to confirm;
3. An incomplete examination did not allow for identification; or
4. A carcass was too decomposed to identify.

Human-induced Mortality Determinations

Events were categorized as entanglement mortalities if one of the following indications were confirmed to be present on a whale carcass:

1. Fishing line constricted any body part, and subdermal hemorrhaging or extensive necrosis was present at point of attachment;
2. An extensive entanglement was evident;
3. An entanglement prevented feeding; or
4. A code 2 (fresh dead) whale was pulled up during fishing operations.

Events were categorized as vessel strike mortalities if one of the following indications was confirmed to be present on a whale carcass:

1. Large linear laceration(s) was present anywhere on body, as opposed to just dorsally as in Kraus (1990);
2. Large area(s) of subdermal hemorrhaging, hematoma, or edema was evident;
3. Extensive skeletal fracturing was evident; or
4. A code 2 (fresh dead) carcass was found on the bow of a ship.

Assignment to Country

We assigned entanglement mortalities to either the US or Canada based on the entangling gear's country of origin. Identification of gear type and country of origin was conducted by NERO, Marine Animal Response Society, or the Whale Release and Strandings Group. NERO's results are included in annual Atlantic Large Whale Take Reduction Team (TRT) reports. Identified fisheries are categorized in the List of Fisheries (LOF) according to their frequency of incidental mortality or serious injury to marine mammal stocks (50 CFR Parts 216 and 229[1]).

If gear identification was lacking, a country assignment was made if circumstances clearly indicated in whose waters the event occurred, e.g., apparent duration of the entanglement and distance from the US/Canadian border (Hague Line). If there was a reasonable chance that the event may have occurred in either country's waters, the country assignment was listed as unknown. Events placed in this category were typically mortalities either first detected near the US/Canadian border; mortalities involving severely decomposed carcasses that potentially drifted across jurisdictions; or mortalities stemming from chronic entanglement injuries.

Vessel collision mortalities were assigned to a country according to the location of the carcass. This differs from the country assignment of entanglements because vessel collision mortalities are more likely to be instantaneous (Kraus 1990; Moore et al. 2004). The country assignment was listed as unknown if there was an equal chance that the event occurred in either country's waters.

RESULTS

From 2007 through 2011, a total of 306 mortalities was documented, of which 56 (18%) were confirmed to be the result of human interactions; 14 (5%) were due to natural causes; and 236 (77%) had insufficient evidence to determine cause of death. Of the human-caused mortalities, 28 were due to entanglement and 28 were due to vessel strike. Table 1 gives the tallies of mortalities and the cause of death by stock for the period. Table 2 provides details, by stock, of each confirmed human interaction event that resulted in mortality. The LOF column indicates entanglement events to be used in categorizing the responsible fishery in the List of Fisheries.

[1] See http://www.nmfs.noaa.gov/pr/pdfs/fr/fr60-45086.pdf

Over the 5-year period, there were 17 verified mortalities of North Atlantic right whales. Of these, 4 were due to entanglements, 2 due to vessel strikes, 5 due to natural causes, and 6 for which the cause could not be determined.

With 98 confirmed mortalities, humpbacks were the species most commonly observed dead. Of these mortalities, 8 were due to entanglement, 9 due to vessel strike, 1 due to natural causes, and cause of death was undetermined for the remaining 80 events. We assumed all humpback events occurring in or near US and southeast Canadian waters involved the Gulf of Maine stock unless a whale was confirmed to be from another stock. Humpback events from Labrador and Newfoundland were assumed to not involve the Gulf of Maine stock and are therefore not included in the tallies.

There were 32 verified fin whale mortalities: 5 were due to entanglement; 7 due to vessel strikes; 4 due to natural causes; and 16 were from undetermined causes.

Of the 7 events involving sei whale mortalities, 1 was attributed to entanglement, 3 to vessel strikes, and cause of death was undetermined for the remaining 3 events.

Minke whales were involved in 87 verified mortality events, of which 9 were due to entanglements, 5 due to vessel strikes, 4 due to natural causes, and cause of death was undetermined for the remaining 69 events.

Bryde's whales had the lowest number of documented events -- one mortality -- which was a result of vessel strike.

Blue whales had two documented events. Both were mortalities where cause of death could not be determined.

In 62 of the 306 confirmed unique large whale mortality events during 2007-2011, positive species identification was not possible. In 3 of the 62 events, the similarity in body shape and size between fin and sei whales prevented us from distinguishing which of these two species were involved. In another 13 events, the whales could only be identified as balaenopteridae based on the presence of ventral pleats. The taxonomic identity of the whales involved in the remaining 46 events could not be assigned with any certainty. Of these mortalities involving unidentified species, one was attributed to entanglement and one to vessel strike. The cause of death could not be determined for the remaining 60 mortalities.

Mortality tallies by country are presented in Table 3, and include a total of 7 Canadian entanglements (3 identified by gear and 4 assigned by location of first detection) and 10 US entanglements (4 identified by gear and 6 assigned by location of first detection). The remaining 11 entanglement events that resulted in mortality could not be assigned to either country's waters with a high degree of certainty. Twenty-six of 28 confirmed collision events leading to death were first detected in US waters. One event was found close to the US and Canadian boundary so the location of the interaction could not be established. The remaining

event involved an international commercial vessel carrying a fresh, unidentified whale carcass on its bow. It could not be determined if the strike occurred in US or international waters.

DISCUSSION

Our criteria attempt to encompass all event scenarios and minimize the likelihood of incorrectly assigning whale mortalities to human causes. The resulting values provide the minimum count of confirmed human-caused mortality for baleen whale stocks along the Gulf of Mexico, US east coast and the Atlantic Canadian provinces. These values also do not consider observed serious injuries that are presumed to result in mortality. Despite the minimum values, the annual confirmed human-caused mortality rates exceed PBR for four of the seven stocks examined – including North Atlantic right, humpback, sei, and Bryde's whales – with PBRs of 0.9, 2.7, 0.5 and 0.1, respectively (Waring et al. 2013).

Differentiating injuries that cause mortalities from preexisting injuries or postmortem damage is problematic but can be accomplished through necropsy or, in many cases, parsimonious evaluation of available evidence. For example, fishing line constrictions can be considered circumstantial evidence of premortem entanglement, as these constrictions are likely the result of force applied by an active animal. Large linear (non-wrapping) lacerations can be considered an indication of a premortem vessel collision since only whales at depth would be exposed to the propellers of a ship; floating carcasses would likely be pushed aside by the ship's bow wave (Knowlton et al. 1995).

However, carcasses detected at sea often cannot be examined sufficiently for either internal or even external indications of injury. Most notably, vessel collisions frequently lack external evidence and may not be detected unless a necropsy is conducted. Necropsies frequently identify subdermal hemorrhaging or hematomas, the result of blunt trauma and the circulation of blood at the time of injury.

Given the likelihood that not all entanglement and vessel strike mortalities are detected, that the criteria applied here are designed to minimize the likelihood of incorrectly assigning whale mortalities to human causes, and that observed serious injuries are not considered here, the numbers in this report represent minimum values for confirmed human-caused mortality to baleen whale stocks along the Gulf of Mexico, the US east coast, and the Atlantic Canadian provinces. The true level of anthropogenic impact to these stocks is greater than these minimum values, but the amount greater is unknown.

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reported by mariners, investigating carcasses at sea, and assisting in disentanglement efforts. We are also grateful to the staffs of the Provincetown Center for Coastal Studies (PCCS), New England Aquarium (NEA), Whale Center of New England (WCNE), NOAA aerial survey teams, Sea to Shore Alliance, the states of Florida and Georgia, Northeast Fisheries Observer Program, Marine Animal Response Society, New Brunswick Museum, Atlantic Veterinary College, Grand Manan Whale and Seabird Research Station, Whale Release and Stranding Group, and many others for providing the sightings that have allowed this work to be conducted. Betty Lentell, Kathryn Roy, and William Greer assisted in verifying fishery observer program records. NEA, PCCS and WCNE provided sighting histories and demographic information. Members of the Atlantic Scientific Review Group have provided numerous helpful comments on the protocols described here. We also thank the anonymous reviewers of earlier drafts of this report.

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Table 1. Summary of all unique large whale mortalities observed along the Gulf of Mexico Coast, US East Coast and Atlantic Canadian Provinces, 2007-2011. Determinations of human-caused mortality follow the criteria established by the NEFSC.

Species	**Western North Atlantic right whale (***Eubalaena glacialis)*	**Gulf of Maine humpback whale** *(Megaptera novaeangliae)*	**Western North Atlantic fin whale** *(Balaenoptera physalus)*	**Nova Scotian sei whale (***B.borealis)*	**Western North Atlantic blue whale** *(B. musculus)*	**Canadian East Coast minke whale** *(B. acutorostrata)*	**Northern Gulf of Mexico Bryde's whale** *(B. edeni)*	**Unidentified fin/sei whale**	**Unidentified balaenopterid[a]**	**Unidentified whale spp.**	**Totals**
Total confirmed mortalities	**17** (3, 3, 4, 3, 4)	**98** (21, 27, 21, 18, 11)	**32** (8, 5, 5, 6, 8)	**7** (1, 3, 2, 0, 1)	**2** (0, 0, 0, 1, 1)	**87** (20, 17, 9, 15, 26)	**1** (0, 0, 1, 0, 0)	**3** (1, 0, 0, 2, 0)	**13** (2, 0, 1, 5, 5)	**46** (6, 8, 6, 11, 15)	**306**
Confirmed entanglement mortalities	**4** (1, 0, 0, 2, 1)	**8** (1, 2, 2, 3, 0)	**5** (2, 0, 0, 0, 3)	**1** (0, 1, 0, 0, 0)	**0**	**9** (1, 4, 0, 0, 4)	**0**	**0**	**0**	**1** (1, 0, 0, 0, 0)	**28**
Confirmed vessel strike mortalities	**2** (0, 0, 0, 1, 1)	**9** (3, 1, 0, 3, 2)	**7** (2, 1, 1, 2, 1)	**3** (1, 0, 1, 0, 1)	**0**	**5** (0, 0, 1, 1, 3)	**1** (0, 0, 1, 0, 0)	**0**	**0**	**1** (0, 0, 0, 1, 0)	**28**
Confirmed mortalities, NOT vessel strike or entanglement	**5** (1, 3, 1, 0, 0)	**1** (0, 0, 0, 1, 0)	**4** (0, 2, 1, 1, 0)	**0**	**0**	**4** (1, 0, 1, 1, 1)	**0**	**0**	**0**	**0**	**14**
Confirmed mortalities, IITD[b]	**6** (1, 0, 3, 0, 2)	**80** (17, 24, 19, 11, 9)	**16** (4, 2, 3, 3, 4)	**3** (0, 2, 1, 0, 0)	**2** (0, 0, 0, 1, 1)	**69** (18, 13, 7, 13, 18)	**0**	**3** (1, 0, 0, 2, 0)	**13** (2, 0, 1, 5, 5)	**44** (5, 8, 6, 10, 15)	**236**
Annual Human-Caused Mortality Rate	**1.2**	**3.4**	**2.4**	**0.8**	**0**	**2.8**	**0.2**	**0**	**0**	**0.4**	**11.2**

[a] Described as having throat grooves (rorqual pleats).

[b] IITD = insufficient information to determine cause of death or if the injury was serious and likely lethal.

Table 2. Confirmed human-caused mortality records of baleen whale stocks along the Gulf of Mexico, US East Coast and Atlantic Canadian Provinces, 2007-2011.

Date	Individual	Catalog #	General Location	Cause of Fate	Country of Origin[a]	Country Conf Code[b]	Gear Type[c]	Comments	LOF[d]
Western North Atlantic right whale (*Eubalaena glacialis*)									
31-Mar-07	U	-	Outer Banks, NC	EN	US	AE	NP	Edema associated w/ pectoral & dorsal & ventral thoracic musculature; epidermal abrasion indicated entangling body & pectoral wraps	1
27-Jun-10	Tips	1124	off Cape May, NJ	EN	XU	CE	NR	Evidence of constricting rostrum, mouth & pectoral wraps w/ associated hemorrhage & bone damage	1
02-Jul-10	U	-	off Great Wass Island, ME	VS	XU	CE	-	2 large lacerations from dorsal to ventral surface	-
12-Aug-10	U	-	Digby Neck, NS	EN	XC	CE	NP	Evidence of entanglement w/ associated hemorrhaging around right pectoral	1
16-Mar-11	U	-	Cape Romain, SC	EN	XU	CE	GU	Multiple wraps embedded in right pectoral bones; unknown rope	1
27-Mar-11	-	1308	Nags Head, NC	VS	US	AE	-	Fractured right skull	-

Table 2 Cont'd

Date	Individual	Catalog #	General Location	Cause of Fate	Country of Origin[a]	Country Conf Code[b]	Gear Type[c]	Comments	LOF[d]
Gulf of Maine humpback whale (*Megaptera novaeangliae*)									
10-May-07	U	-	off Wachapreague, VA	VS	US	AE	-	Cranium shattered, hemorrhaging on left lateral side midway between pectorals & fluke	-
13-May-07	U	-	Rockport, MA	VS	US	AE	-	Areas of hemorrhaging indicate major blunt trauma to chest, neck, & head	-
24-Jun-07	Tofu	8685	Stellwagen Bank	VS	US	AE	-	Subdermal hemorrhaging involving blubber, fascia, & muscle extending from/around the insertion of the right pectoral ventrallly to the axilla	-
21-Dec-07	U	-	Ocean Sands, Corolla, NC	EN	XU	CE	NR	Documented wrapped in gear, gear removed w/out permission prior to necropsy; external lesions at flukes, pectorals, mouth, dorsal fin, dorsal keel, & ventral pleats consistent w/ gillnet entanglement; emaciated	1
30-May-08	U	-	Georges Bank	EN	XU	CE	NR	Constricting body wraps, one wrap under lower jaw; open wound on right pectoral	1
09-Jun-08	U	-	Georges Bank	EN	US	GI	PT	Constricting body wrap	1
04-Nov-08	U	-	Assateague Island, MD	VS	US	AE	-	Cranial fractures w/ associated hemorrhaging	-
08-Feb-09	U	-	Cape Fear, NC	EN	XU	CE	NP	Evidence of entanglement at mouthline, peduncle, & pectoral w/ associated hemorrhaging; emaciated	1

Table 2 Cont'd

Date	Individual	Catalog #	General Location	Cause of Fate	Country of Origin[a]	Country Conf Code[b]	Gear Type[c]	Comments	LOF[d]
Gulf of Maine humpback whale (*Megaptera novaeangliae*) cont'd									
16-Feb-09	U	-	Nags Head, NC	EN	XU	CE	NP	Evidence of entanglement involving anchoring or heavily weighted gear w/ associated hemorrhaging	1
13-Mar-10	U	-	Ocean City, MD	VS	US	AE	-	Skull fractures w/ associated hemorrhaging	-
08-May-10	U	-	Narragansett, RI	EN	CN	GI	GN	Evidence of constricting gear w/ associated hemorrhaging; fluid filled lungs	1
28-May-10	U	-	Edgartown, MA	EN	XU	CE	GU	Evidence of entanglement w/ associated bruising & edema; 6" poly netting	1
10-Jun-10	U	-	Jones Beach State Park, NY	VS	US	AE	-	Extensive hemorrhage & edema on right dorsal lateral surface	-
04-Jul-10	U	-	off Assateague, MD	VS	US	AE	-	Extensive hemorrhage & edema to left lateral area	-
27-Nov-10	U	-	Bay of Fundy	EN	XC	CE	NR	Evidence of constricting wraps on fluke, peduncle, & pectoral	1
05-May-11	U	-	Little Compton, RI	VS	US	AE	-	Hemorrhaging at left jaw associated w/ blunt trauma; evidence of healing entanglement injuries	-
27-May-11	U	-	Barnegat Inlet, NJ	VS	US	AE	-	5 broken vertebral processess along left side w/ associated hemorrhaging	-

Table 2 Cont'd

Date	Individual	Catalog #	General Location	Cause of Fate	Country of Origin[a]	Country Conf Code[b]	Gear Type[c]	Comments	LOF[d]
Western North Atlantic fin whale (*Balaenoptera physalus*)									
25-Mar-07	U	-	Norfolk, VA	VS	US	AE	-	Extensive fracturing of ribs, skull, & vertebrae w/ associated hemorrhage & edema	-
24-May-07	U	-	Newark Bay, NJ	VS	US	AE	-	Hemorrhage & multiple fractures of ribs, vertebrae, & sternum; trailing tissue of animal marked by propellar lacerations	-
11-Aug-07	U	-	Cabot Strait, NS	EN	CN	AE	NR	Constricting body wrap around body, between head & pectorals	1
26-Sep-07	U	-	off Martha's Vineyard, MA	EN	US	AE	NR	Freshly dead, scavenged carcass w/ gear present; evidence of multiple body wraps w/ associated hemorrhaging	1
02-Jul-08	U	-	Barnegat Inlet, NJ	VS	US	AE	-	Verterbral fractures w/ associated hemorrhaging; hemorrhaging around ball joint of right pectoral	-
01-Oct-09	U	-	Port Elizabeth, NJ	VS	US	AE	-	Fresh carcass w/ broken pectoral, hematomas, & abrasions	-
18-Mar-10	U	-	off Bethany Beach, DE	VS	US	AE	-	Fractured skull w/ associated hemorrhaging; abrasion mid-dorsal consistent w/ being folded over the bow of a ship	-
03-Sep-10	U	-	Cape Henlopen State Park, DE	VS	US	AE	-	Large laceration & vertebral fractures w/ associated hemorrhaging	-
01-Jan-11	U	-	off Portland, ME	EN	XU	CE	NP	Fresh carcass w/ evidence of constricting gear	1

Table 2 Cont'd

Date	Individual	Catalog #	General Location	Cause of Fate	Country of Origin[a]	Country Conf Code[b]	Gear Type[c]	Comments	LOF[d]
Western North Atlantic fin whale (*Balaenoptera physalus*) cont'd									
05-Jun-11	U	-	off Long Beach, NJ	VS	US	AE	-	Extensive hemorrhage & soft tissue damage to the dorsal & right lateral thoracic region	-
24-Jul-11	U	-	Cheticamp, NS	EN	CN	AE	NP	Fresh carcass w/ evidence of extensive entanglement	1
21-Sep-11	U	-	off Atlantic City, NJ	EN	US	AE	NP	Fresh carcass w/ evidence of extensive entanglement	1
Nova Scotian sei whale (*Balaenoptera borealis*)									
30-May-07	U	-	off Deer Island, MA	VS	US	AE	-	Broken left pectoral, 8 vertebral processes, & 4 ribs; right pectoral sheared off; lower jaw dislocated; hemorrhaging &/or edema associated w/ lower jaw & left pectoral region	-
29-Jun-08	U	-	Slack's Cove, NB	EN	CN	AE	NP	Extensive entanglement evident	1
19-May-09	U	-	off Rehobeth Beach, DE	VS	US	AE	-	Posterior portion of skull & right mandible fractured; hemorrhaging dorsal to left pectoral	-
26-Mar-11	U	-	Virginia Beach, VA	VS	US	AE	-	Jaw, scapula, rib & vertebral fractures along right side w/ associated hemorrhaging	-

Table 2 Cont'd

Date	Individual	Catalog #	General Location	Cause of Fate	Country of Origin[a]	Country Conf Code[b]	Gear Type[c]	Comments	LOF[d]
Canadian East Coast minke whale (*Balaenoptera acutorostrata*)									
05-Aug-07	U	-	Cape Cod Bay, MA	EN	XU	CE	GU	Chronic entanglement w/ severe emaciation & dehydration & loss of protein; line lacerated blubber layer across back & at pectoral insertions; severe hemorrhage & necrosis at gear entanglement points	1
14-Jun-08	U	-	Orleans, MA	EN	US	AE	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, blood-filled lungs indicate drowning	1
23-Jul-08	U	-	Kelligrews, NL	EN	CN	AE	GU	Constricting wraps of gear on caudal peduncle	1
26-Jul-08	U	-	Conception Bay, NL	EN	CN	GI	GN	Constricting wraps of gear through mouth & around tail	1
25-Aug-08	U	-	off Richibucto Cape, NB	EN	CN	CE	NR	Evidence of constricting body wraps	1
20-May-09	U	-	off Point Pleasant, NJ	VS	US	AE	-	Large hemorrhage at right pectoral	-
09-Jul-10	U	-	Fire Island, NY	VS	US	AE	-	3-4 large dorsal lacerations associated w/ fractured ribs	-
06-May-11	U	-	off Martha's Vineyard, MA	EN	US	GI	PT	Anchored in gear; embedded line at fluke; evidence of entanglement w/ associated hemorrhaging at mouth corners & insertion of pectorals	1

Table 2 Cont'd

Date	Individual	Catalog #	General Location	Cause of Fate	Country of Origin[a]	Country Conf Code[b]	Gear Type[c]	Comments	LOF[d]
Canadian East Coast minke whale (*Balaenoptera acutorostrata*) cont'd									
04-Aug-11	U	-	off Sandy Hook, NJ	VS	US	AE	-	4 propellar lacerations across dorsal surface; fractured ribs w/ associated hemorrhaging	-
26-Aug-11	U	-	off Sandy Hook, NJ	EN	US	AE	NP	Fresh carcass w/ evidence of extensive entanglement	1
29-Aug-11	U	-	Moriches, NY	VS	US	AE	-	Extensive hemorrhage & edema along dorsal & both lateral surfaces	-
06-Oct-11	U	-	off Matinicus Island, ME	EN	US	GI	PT	Fresh carcass anchored in gear	1
07-Dec-11	U	-	Carolina Beach, NC	VS	US	AE	-	Healed deep & superficial propellar lacerations; internal lesions associated w/ deep lacerations indicative of peritonitis & infection	-
19-Dec-11	U	-	Bay of Fundy	EN	CN	GI	PT	Live entanglement; recovered dead in gear the following day; constricting peduncle wraps	1
Northern Gulf of Mexico Bryde's whale (*Balaenoptera edeni*)									
04-Oct-09	U	-	Tampa, FL	VS	US	AE	-	Vertebral separation; lung damage; subdermal contusions	-

Notes:

a. CN=Canada, US=United States, XC=Unk 1st sight in CN, XU=Unk 1st sight in US

b. GI=gear identified, AE=acute/very recent event or confirmed location, CE=chronic/prolonged event without indication of initial location

c. GN=gillnet, GU=gear unidentifiable, NP=none present, NR=none recovered/received, PT=pot/trap

d. Consider for List of Fisheries inclusion (1=yes)

Table 3. Summary of country of origin for all confirmed human-caused mortalities of large whales along the Gulf of Mexico, US East Coast and Atlantic Canadian Provinces, 2007-2011

Event Location	Event Type	Western North Atlantic right whale (*Eubalaena glacialis)*	Gulf of Maine humpback whale *(Megaptera novaeangliae)*	Western North Atlantic fin whale *(Balaenoptera physalus)*	Nova Scotian sei whale (*B.borealis)*	Western North Atlantic blue whale *(B. musculus)*	Canadian East Coast minke whale *(B. acutorostrata)*	Northern Gulf of Mexico Bryde's whale *(B. edeni)*	Unidentified fin/sei whale	Unidentified balaenopterid[a]	Unidentified whale spp.	Totals
US waters	**Entanglement**	1	2	2	0	0	4	0	0	0	1	**10**
	Vessel Strike	1	9	7	3	0	5	1	0	0	0	**26**
Canadian waters	**Entanglement**	0	0	2	1	0	4	0	0	0	0	**7**
	Vessel Strike	0	0	0	0	0	0	0	0	0	0	**0**
Unassigned waters	**Entanglement**	3	6	1	0	0	1	0	0	0	0	**11**
	Vessel Strike	1	0	0	0	0	0	0	0	0	1	**2**

[a] Described as having throat grooves (rorqual pleats).

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