Northeast Fisheries Science Center Reference Document 09-04

Mortality and Serious Injury Determinations for Baleen Whale Stocks along the United States Eastern Seaboard and Adjacent Canadian Maritimes, 2003-2007 (Second Edition)

by Allison H. Glass, Timothy V.N. Cole, and Mendy Garron

May 2009

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TABLE OF CONTENTS

List of Tables

ABSTRACT

The Northeast Fisheries Science Center (NEFSC) has developed criteria to evaluate reports of human-caused injury and mortality to large whales. The criteria minimize the identification of false positive human-caused mortalities and serious injuries, and therefore provide a minimum value of human impact to whale stocks. Serious injury is defined as an injury that is likely to lead to death. This report describes determinations made for reports received from 2003 through 2007 involving 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 the eastern seaboard of the United States and adjacent Canadian Maritimes. A total of 537 unique large whale events were verified during the period, including carcasses (both beached and at-sea) and live whales. We confirmed 153 unique entanglement, 52 ship strike, and 349 mortality events. Twenty-one (14%) of the entanglements and 30 (58%) of the ship strikes were fatal. Serious injury was sustained in 16 (10%) of the entanglement events and in 2 (4%) of the confirmed ship strikes. Twenty-four (16%) of the entanglements and five (10%) of the ship strike events did not have adequate documentation to determine if serious injury occurred. Seventy-six (50%) of the entanglement events and 13 (25%) of the ship strike events did not cause serious injury or death. Of the 349 confirmed mortalities, 280 (80%) lacked sufficient evidence to determine cause of death. Minke whales had the greatest number of entanglement mortalities (n=9); humpback whales had the highest number of serious injury events resulting from entanglements (n=10); and right whales had the greatest number of ship strike mortalities (n=9) and serious injuries (n=2) from ship strikes. These mortality and serious injury numbers are minimum counts due to poor detection probabilities and inadequate documentation. Thus, the true level of human impact to these stocks is assumed to be greater than that reported here, however the amount greater is unknown.

INTRODUCTION

As part of the 1994 amendments to the Marine Mammal Protection Act (MMPA), the NOAA National Marine Fisheries Service (NMFS) is mandated to establish monitoring programs to estimate incidental mortality and serious injury of marine mammals taken during commercial fishing operations. The Agency is also charged with developing Take Reduction Plans (TRPs) such that within six months of the implementation of the TRP, commercial takes of strategic stocks of marine mammals are reduced to levels below the Potential Biological Removal (PBR) level of the stocks. The longer-term goal of all the TRPs is to reduce--within 5 years of implementation--commercial takes of marine mammals to insignificant levels approaching zero mortality and serious injury rates, which has been defined as 10% of PBR (69 FR 43338; July 20, 2004).

The most current five years' average rate of human-caused serious injury and mortality is reported for each species in the annual marine mammal stock assessment reports (SAR). This rate when compared to a population's PBR can be used as an index of the success of a recovery plan. 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 (Wade and Angliss 1997). The PBR is the product of the following factors:

1. The minimum population estimate of the stock;
2. One-half the maximum theoretical or estimated net productivity rate of the stock at a small population size; and
3. A recovery factor of between 0.1 and 1.0.

This report presents the protocols and determinations for events involving 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 US eastern seaboard for the period 2003 through 2007.

METHODS

Members of the National Stranding Network, large whale disentanglement teams, the US Coast Guard, and civilians recorded and submitted marine mammal strandings and human-induced interaction reports to the NMFS Northeast Regional Office (NERO) and Southeast Regional Office (SERO). The Regional Offices obtained all available information for each report (photos, necropsy reports, etc.), which was then reviewed by NEFSC, NERO, and Northeast Fisheries Observer Program (NEFOP) staff members. Confirmed reports were designated "events" and 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. If an identified whale was involved in a second interaction, a new event record was assigned. NEFSC staff reviewed each mortality event and assigned a cause of death following the confirmation criteria listed below. Each injury event was similarly examined for indications of cause, and identified as a serious injury if it was likely to lead to the whale's death. One staff member

(TVC) reviewed all determinations each year to ensure consistency in the application of determination criteria within and across years. Criteria indicated by an asterisk (*) are new this year and were applied to the 2007 events only. Application of the revised criteria to events prior to 2007 will be completed in a separate document.

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

Species/Event was considered confirmed if it met one of the following criteria:

1. Photographs or video allowed identification;
2. Marine mammal expert reported as certain;
3. Reported by trained observer or member of the Disentanglement Network verified via interview by NMFS, disentanglement or stranding network staff; or
4. A fisherman reported a whale entangled in gear or a shipper reported colliding with a whale.

Species/Event was considered confirmed in the following less certain cases:

1. Photographs or video allowed probable identification;
2. Marine mammal expert reported as possible;
3. Inexperienced observer's report allowed probable identification; or
4. Inexperienced observer's report verified via interview by NMFS, disentanglement or stranding network staff.

Species/Event was considered unconfirmed if:

1. Photographs or video were of insufficient quality to verify;
2. Inexperienced observer report lacked photographs or video and/or detail to confirm;
3. Incomplete examination for identification; or
4. Carcass 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. Extensive entanglement evident*;
3. Entanglement prevented feeding*; or
4. A code 2 (fresh dead) whale was pulled up during fishing operations*.

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

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

Serious Injury Determinations

Events were categorized as entanglement serious injuries if one of the following indications was confirmed on a living whale:

1. Fishing line constricted any body part, or was likely to become constricting as the whale grew;
2. It was uncertain if the line was constricting, but appendages near the entanglement's point of attachment were discolored and likely compromised;
3. The whale showed a marked decline in appearance following entanglement, including skin discoloration, lesions near the nares, fat loss, or increased cyamid loads;
4. Entanglement prevented feeding*;
5. Whale was anchored; or
6. Entanglement was extensive*.

A whale was typically not considered seriously injured if all constricting lines were removed or shed.

Events were categorized as ship-strike serious injuries if, following the appearance of a linear laceration or large gouge, a living whale exhibited a marked decline in appearance, including skin discoloration, lesions near the nares, fat loss, or increased cyamid loads.

No forecasts were made as to how an entanglement or injury might increase the whale's susceptibility to further injury (e.g., from additional entanglements or collisions with vessels).

RESULTS

A total of 537 unique events occurred during 2003 - 2007, involving both live and dead whales (Table 1). Of these, we confirmed 153 entanglement events and 52 ship strike events. We were able to verify 349 mortalities, of which 21 were due to entanglements and 30 were the result of ship strikes. The cause of death could not be confirmed for 280 (80%) of the mortalities. Entanglement caused serious injury in 16 events, and 2 ship strike events resulted in serious injury. There were 76 entanglement events which were not serious injuries (this includes cases where the animal was freed by a disentanglement team or shed gear on its own), and 24 which lacked sufficient evidence to determine if a serious injury had occurred. Thirteen ship strike events occurred which did not result in serious injury, and five events lacked sufficient evidence to make a determination. Table 2 presents a summary of mortalities attributed to causes other than entanglement or ship strike, confirmed entanglement and ship strike events not

resulting in serious injury or mortality, and confirmed events for which insufficient information was available for determination. Annual human-caused mortality and serious injury rates for 2003 - 2007 are presented for each large whale stock in Table 3. Tables 4 to 9 provide details of each confirmed serious injury or mortality event.

Over the five-year period, right whales had the highest proportion of entanglements and ship strikes relative to the number of events for a species: of 58 events involving right whales, 20 were confirmed entanglements and 17 were confirmed ship strikes (Table 1). Of the 20 verified right whale mortalities, 3 were due to entanglements, 9 due to ship strikes, and the cause of the remaining 12 could not be determined. Serious injury was documented for one entanglement event and two ship strikes (details in Table 4).

Humpbacks were involved in 198 events, were the most commonly observed entangled whale species, and the most commonly observed dead whale (109 confirmed mortalities; Table 1). Of the 76 confirmed entanglements, four resulted in mortality and ten in serious injury. Ship strikes were relatively uncommon with only eleven verified events, eight of which were fatal (Table 5). We assumed all humpback events were from the Gulf of Maine stock unless a whale was confirmed to be from another stock. At the time of this writing, all available information indicated the humpbacks were from the Gulf of Maine stock (Table 3).

Few fin whales had documented entanglements. Of 61 fin whale events, 13 were confirmed entanglements; three of these were fatal and three resulted in serious injury. Eleven ship strike events were documented and eight proved fatal (Table 6).

Mortalities accounted for seven of the eight sei whale events. Three of these mortalities were attributed to ship strike. In one additional ship strike event, it could not be determined whether the strike occurred pre or post-mortem. There was one confirmed entanglement event which resulted in serious injury (Table 7).

Minke whales were involved in 115 events, of which 32 were confirmed entanglements. Nine of the entanglement events were fatal, the highest percentage for any of the whale species. There were only two verified ship strike events, both of which resulted in mortality (Table 8).

Bryde's whales had the lowest number of events--two. One was a confirmed entanglement which resulted in the death of the whale (Table 9).

There were no events involving blue whales.

In 95 of the 537 large whale events during 2003 - 2007, positive species identification was not possible. In 13 of the 95 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 21 events, the whales could only be identified as balaenopterids based on the presence of ventral pleats. The taxonomic identity of the whales involved in the remaining 61 events could not be assigned with any certainty. Entanglement was confirmed in 11 of these 95 events. Seventy-three of the 95 events involving unidentified whales were confirmed mortalities (see Table 1).

DISCUSSION

The criteria employed in this report evolved from recommendations of serious injury workshops (see Andersen *et al.* 2008 and Angliss and DeMaster 1998) and our experience examining large whale reports since 1990. The criteria attempt to encompass all event scenarios

and minimize the identification of false positive human-caused mortalities and serious injuries. The resulting values provide a minimum value of human impact to whale stocks.

Differentiating causal injuries from pre-existing ones or post-mortem damage is problematic, but can be accomplished through examination of necropsy data or parsimonious evaluation of available evidence. In our determinations, fishing line constrictions were considered circumstantial evidence of pre-mortem entanglement, as these constrictions were likely the result of force applied by an active animal. Vessel collisions frequently lack external evidence, and may not be detected unless a necropsy is conducted; necropsies frequently identified subdermal hemorrhaging or hematomas, indicating that blood was still circulating at the time of injury. Large lacerations were considered an indication of a pre-mortem vessel collision since only whales at depth would be exposed to the propellers of a ship; floating carcasses would be pushed aside by the ship's bow wave (Knowlton *et al.* 1995).

Our assessment of serious injury was guided by regulation 50 *CFR* 229.2, which defines serious injury as "any injury that will likely result in mortality." Evidence of the whale's deteriorating health was used as confirmation of serious injury. A whale's physiological response to tissue damage includes increased secretion of glucocorticoids, which suppresses lymphocytes, and if sustained (due to chronic destruction of tissue by gear or hydrodynamic forces) compromises the ability of an animal to fight other infections. External indications of poor health, including skin discoloration, lesions near the nares, fat loss, or increased cyamid loads are part of a cascade of immunological disorders. Cases of constricting entanglements invariably follow this sequence.

Removal of constricting gear typically reversed the decline in appearance, and disentanglement was generally considered to prevent serious injury. Whales only loosely entangled in line typically did not have external indications of poor health; some whales carried loose wraps for years.

Over the five-year period, 280 of 349 confirmed mortalities (80%) lacked sufficient evidence to determine cause of death (Table 2). Carcasses floating at sea often cannot be examined sufficiently for either internal or external indications, and generate false negatives if they are not towed ashore and necropsied. Likewise, insufficient documentation precluded determination in 24 of 153 confirmed entanglement events (16%) and 5 of 52 ship strike events (10%).

However, perhaps of greater concern is the number of animals never observed. Humpback whale scar evidence suggests that only 3-10% of entanglements are witnessed and reported (Robbins and Mattila 2000, 2004). Thus, whales may succumb to entanglement before the event can be detected. Negatively buoyant species are less likely to be detected after death, and positively buoyant species, such as right whales, may become negatively buoyant if an injury precludes effective feeding for an extended period (Moore *et al*. 2004). The numbers in this report therefore represent the minimum values for human-caused serious injury and mortality to large whale stocks along the U.S. eastern seaboard.

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Table 1. Summary of all reported baleen and unidentified whale events along the Gulf of Mexico coast, U.S. East coast and adjacent Canadian Maritimes, 2003 -2007.

Species	Western North Atlantic right whale	Northwest Atlantic humpback whale[b]	Western North Atlantic fin whale	Nova Scotian sei whale	Western North Atlantic blue whale	Canadian East Coast minke whale	Western North Atlantic Bryde's whale	Unidentified fin/sei whale	Unidentified balaenopterid[c]	Unidentified whale spp.	TOTALS
Total events[a] (2003, 2004, 2005, 2006, 2007)	**58** (9, 12, 15, 13, 9)	**198** (55, 23, 31, 50, 39)	**61** (14, 10, 10 14, 13)	**8** (1, 2, 0, 4, 1)	**0**	**115** (27, 26, 18, 22, 22)	**2** (1, 0, 0, 1, 0)	**13** (4, 2, 4, 2, 1)	**21** (8, 6, 3, 1, 3)	**61** (19, 5, 10, 18, 9)	**537**
Confirmed entanglement events	**20** (6, 4, 2, 5, 3	**75** (18, 10, 13, 19, 15	**13** (1, 4, 0, 2, 6)	**1** (0, 0, 0, 1, 0	**0**	**32** (9, 7, 3, 6, 7)	**1** (1, 0, 0, 0, 0)	**2** (0, 0, 1, 1, 0)	**1** (0, 1, 0, 0, 0)	**8** (0, 2, 2, 3, 1)	**153**
Confirmed ship strike events	**17** (2, 2, 7, 5, 1)	**11** (2, 1, 1, 3, 4)	**11** (0, 2, 6, 0, 3)	**4** (1, 1, 0, 1, 1)	**0**	**2** (0, 1, 1, 0, 0)	**0**	**0**	**0**	**7** (0, 0, 2, 3, 2)	**52**
Total confirmed mortalities	**20** (2, 5, 4, 6, 3)	**109** (29, 12, 13, 33, 22)	**42** (12, 7, 8, 7, 8)	**7** (1, 2, 0, 3, 1)	**0**	**96** (25, 22, 16, 15, 18)	**2** (1, 0, 0, 1, 0)	**10** (4, 2, 2, 1, 1)	**19** (8, 5, 3, 1, 2)	**44** (18, 3, 5, 12, 6)	**349**
Confirmed entanglement mortalities	**3** (0, 1, 0, 1, 1)	**4** (1, 1, 0, 1, 1)	**3** (0, 1, 0, 0, 2)	**0**	**0**	**9** (5, 3, 0, 0, 1)	**1** (1, 0, 0, 0, 0)	**0**	**0**	**1** (0, 0, 0, 0, 1)	**21**
Confirmed ship strike mortalities	**9** (1, 2, 2, 4, 0)	**8** (1, 1, 0, 3, 3)	**8** (0, 2, 4, 0, 2)	**3** (1, 0, 0, 1, 1)	**0**	**2** (0, 1, 1, 0, 0)	**0**	**0**	**0**	**0**	**30**
Confirmed entanglement serious injuries	**1** (1, 0, 0, 0, 0)	**10** (4, 1, 0, 3, 2)	**3** (0, 1, 0, 1, 1)	**1** (0, 0, 0, 1, 0)	**0**	**1** (0, 0, 0, 0, 1)	**0**	**0**	**0**	**0**	**16**
Confirmed ship strike serious injuries	**2** (0, 0, 1, 1, 0)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**

[a] Excludes resights of previously entangled individuals unless a new entanglement was documented.
[b] Includes all humpback reports, whether confirmed as members of the Gulf of Maine feeding stock or not.
[c] Described as having throat grooves (rorqual pleats).

Table 2. Summary of large whale events not resulting in serious injury or mortality, and events lacking sufficient evidence for determination, 2003 -2007.

Species	Western North Atlantic right whale	Northwest Atlantic humpback whale	Western North Atlantic fin whale	Nova Scotian sei whale	Western North Atlantic blue whale	Canadian East Coast minke whale	Western North Atlantic Bryde's whale	Unidentified fin/sei whale	Unidentified balaenopterid	Unidentified whale spp.	TOTALS
Confirmed mortalities, NOT SS or EN	**2** 1%	**3** 3%	**2** 5%	**1** 14%	**0**	**6** 6%	**1** 50%	**0**	**0**	**0**	**15** 4%
Confirmed mortalities, IITD*	**6** 30%	**94** 86%	**27** 64%	**3** 43%	**0**	**78** 81%	**0**	**10** 100%	**19** 100%	**43** 98%	**280** 80%
Confirmed entanglement events, NOT SI/MT**	**13** 60%	**49** 65%	**4** 31%	**0**	**0**	**9** 28%	**0**	**0**	**0**	**1** 13%	**76** 49%
Confirmed entanglement events, IITD*	**4** 7%	**9** 12%	**4** 31%	**0**	**0**	**2** 6%	**0**	**2** 100%	**1** 100%	**2** 25%	**24** 16%
Confirmed ship strike events, NOT SI/MT	**6** 35%	**3** 27%	**2** 18%	**0**	**0**	**0**	**0**	**0**	**0**	**2** 29%	**13** 25%
Confirmed ship strike events, IITD*	**1** 6%	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4** 57%	**5** 10%

* IITD = insufficient information to determine cause of death or if the injury likely to lead to mortality.
** Includes cases where animal was disentangled or shed gear.

NOTE: This table has been revised/corrected from the previous (March 2009) edition.

Table 3. Summary of the confirmed human-caused mortality and serious injury (SI) events involving baleen whale stocks along the Gulf of Mexico coast, U.S. East coast and adjacent Canadian Maritimes, 2003 - 2007, with number of events attributed to entanglements or vessel collisions by year.

Stock	Mean annual mortality and SI rate (PBR for reference)	Entanglements			Vessel Collisions		
		Annual rate (US waters / Canadian waters)	Confirmed mortalities (2003, 2004, 2005, 2006, 2007)	Confirmed SI's (2003, 2004, 2005, 2006, 2007)	Annual rate (US waters / Canadian waters)	Confirmed mortalities (2003, 2004, 2005, 2006, 2007)	Confirmed SI's (2003, 2004, 2005, 2006, 2007)
Western North Atlantic right whale	**3.2** (0)	**1.0** (0.8 / 0.2)	**3** (0, 1, 0, 1, 1)	**1** (1, 0, 0, 0, 0)	**2.2** (1.6 / 0.6)	**9** (1, 2, 2, 4, 0)	**2** (0, 0, 1, 1, 0)
Gulf of Maine humpback whale[1]	**4.4** (1.1)	**2.8** (2.4 / 0.4)	**4** (1, 1, 0, 1, 1)	**10** (4, 1, 0, 3, 2)	**1.6** (1.6 / 0)	**8** (1, 1, 0, 3, 3)	**0**
Western North Atlantic fin whale	**2.8** (3.4)	**1.2** (0.8 / 0.4)	**3** (0, 1, 0, 0, 2)	**3** (0, 1, 0, 1, 1)	**1.6** (1.2 / 0.4)	**8** (0, 2, 4, 0, 2)	**0**
Nova Scotian sei whale	**0.8** (0.3)	**0.2** (0.2 / 0)	**0**	**1** (0, 0, 0, 1, 0)	**0.6** (0.6 / 0)	**3** (1, 0, 0, 1, 1)	**0**
Western North Atlantic blue whale[2]	**0** (–)	**0**	**0**	**0**	**0**	**0**	**0**
Canadian East Coast minke whale	**2.4** (19)	**2.0** (2.0 / 0)	**9** (5, 3, 0, 0, 1)	**1** (0, 0, 0, 0, 1)	**0.4** (0.4 / 0)	**2** (0, 1, 1, 0, 0)	**0**
Western North Atlantic Bryde's whale	**0.2** (0.1)	**0.2** (0.2 / 0)	**1** (1, 0, 0, 0, 0)	**0**	**0**	**0**	**0**

[1] Excludes events involving confirmed members of a stock other than the Gulf of Maine feeding stock.

[2] Stock abundance estimates outdated; no PBR established for this stock.

Table 4. Confirmed human-caused mortality and serious injury records of Western North Atlantic right whales, 2003 - 2007.

Date[a]	Report Type	Age, Sex, ID, Length	Location[a]	Assigned Cause: P=primary, S=secondary		Notes/Observations
				Ship strike	Entang./ Fsh. Inter.	
01/14/03	serious injury	Adult Female #2240 12m (est.)	Jacksonville, FL		P	Body condition poor; no gear recovered
10/02/03	mortality	Adult Female #2150 15m (est.)	Digby, NS	P		Large fracture in skull; subdermal hemorrhage
02/07/04	mortality	Adult Female #1004 16.0m	Virginia Beach, VA	P		Severe subdermal bruising; complete fracture of rostrum and laceration of oral rete
09/06/04	mortality	Adult Female #2301 15m (est.)	Roseway Basin, NS		P	Extensive constricting line on head and left flipper; found dead March 3, 2005 on Ship Shoal Island, VA; gear recovered consists of 10 fathoms of 3/8" & 7/16" rope
11/24/04	mortality	Adult Female #1909 14.9m	Ocean Sands, NC	P		Left fluke lobe severed and large bore blood vessels exposed
01/12/05	mortality	Adult Female #2143 13.1m	Cumberland Island, GA	P		Healed propeller wounds from strike as a calf re-opened as a result of pregnancy
03/10/05	serious injury	Adult Female #2425	Cumberland Island, GA	P		43 ft power yacht partially severed left fluke; resighted 9/4/05 in extremely poor condition
04/28/05	mortality	Adult Female #2617 14.7m	Monomoy Island, MA	P		Significant bruising and multiple vertebral fractures
01/10/06	mortality	Calf Male 5.4m w/out fluke	Jacksonville, FL	P		Propeller lacerations associated with hemorrhaging and edema; flukes completely severed
01/22/06	mortality	Calf Female 5.6m	off Ponte Vedra Beach, FL		P	Significant pre-mortem lesions from entanglement in apparent monofilament netting; no gear present
03/11/06	serious injury	Yearling Male #3522	Off Cumberland Island, GA	P		11 propeller lacerations across dorsal surface

Date[a]	Report Type	Age, Sex, ID, Length	Location[a]	Assigned Cause: P=primary, S=secondary		Notes/Observations
				Ship strike	Entang./ Fsh. Inter.	
07/24/06	mortality	age unknown Female 9.6m	Campobello Island, NB	P		Propeller lacerations through blubber, into muscle and ribs
08/24/06	mortality	Adult Female 14.7m	Roseway Basin, NS	P		16 fractured vertebrae; dorsal blubber bruise from head to genital region
12/30/06	mortality	Yearling Male #3508 12.6m	off Brunswick, GA	P		20 propeller lacerations along right side of head and back with associated hemorrhaging
03/31/07	mortality	Calf Male 7.7m	Outer Banks, NC		P	Edema associated with flipper and dorsal & ventral thoracic musculature; epidermal abrasion indicated entangling body and flipper wraps; 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.

Table 5. Confirmed human-caused mortality and serious injury records of Northwest Atlantic humpback whales, 2003 - 2007. All records were assumed to involve members of the Gulf of Maine humpback whale stock unless a whale was confirmed to be a member of another stock.

Date[a]	Report Type	Age, Sex, ID, Length	Location[a]	Assigned Cause: P=primary, S=secondary		Notes/Observations
				Ship strike	Entang./ Fsh. Inter.	
06/06/03	mortality	Juvenile Female 8.3m	Chesapeake Bay mouth, VA	P		Major trauma to right side of head; hematoma
07/09/03	serious injury	Calf of Shockwave sex unknown	Bay of Fundy, NS		P	Constricting entanglement on a young whale; no gear recovered
07/12/03	serious injury	age & sex unknown	Oregon Inlet, NC		P	Entangled in substantial amount of gear; no gear recovered
08/15/03	mortality	Calf sex unknown 7.3m (est.)	Petit Manan Island, ME		P	Floating offshore wrapped in line; gear recovered consists of a small portion of gillnet
08/16/03	serious injury	age & sex unknown	Cape Cod, MA		P	Poor body condition; line deeply embedded; gear recovered included sink gillnet, vessel anchoring system, surface buoy system and endline
08/18/03	serious injury	age & sex unknown	Cape Cod, MA		P	Extensive entanglement; no gear recovered
07/11/04	serious injury	Juvenile sex unknown "Lucky"	Briar Island, NS		P	Entanglement on a young whale; no gear recovered
10/03/04	mortality	age unknown Male 15m (est.)	Georges Bank		P	Fresh carcass with entangling line and high flyer; no gear recovered
12/19/04	mortality	Calf Female 8.0m	Bethany Beach, DE	P		Hematoma and skeletal fracturing

Date[a]	Report Type	Age, Sex, ID, Length	Location[a]	Assigned Cause: P=primary, S=secondary		Notes/Observations
				Ship strike	Entang./ Fsh. Inter.	
01/09/06	mortality	Adult Female #8667 14.0m	off Charleston, SC	P		Extensive muscle hemorrhaging; rib fractures; dislocated flipper on left side of animal
03/17/06	mortality	Juvenile Female 10.0m	Virginia Beach, VA	P		Crushed cranium and fractured mandible; hemorrhaging associated with fractures; ventral lacerations consistent with propeller wounds
03/25/06	serious injury	Juvenile sex unknown 8m (est.)	Flagler Beach, FL		P	Heavy cyamid load; emaciated; spinal deformity that may or may not have been caused by the entanglement; gear recovered included line and buoys and was identified as lobster pot gear
08/06/06	serious injury	age & sex unknown	Georges Bank		P	Multiple constricting wraps around head; line cutting into upper lip; wraps around both flippers; no gear recovered
8/23/06	serious injury	age & sex unknown 12m (est.)	Great South Channel		P	Flukes necrotic and nearly severed as a result of entanglement; pale skin and emaciated; gear recovered included heavy line and wire trap
09/06/06[b]	mortality	age & sex unknown	East of Cape Cod, MA		P	Whale entangled through mouth, continuing back to multiple wraps around peduncle; no gear recovered
10/15/06	mortality	Juvenile Female 10.1m	off Fenwick Island, DE	P	S	Large laceration, penetrating through the bone, across rostrum with accompanying fractures; no gear, but marks around right flipper consistent with entanglement; subdermal hemorrhaging and bone trauma at entanglement point
01/27/07	serious injury	age & sex unknown	off Beach Haven, NJ		P	Body wrap likely to become constricting; random cyamid patches; thin body condition.; probable flipper wraps; no gear recovered
05/10/07	mortality	Adult Female 12.5m	off Wachapreague, VA	P		Cranium shattered, hemorrhaging on left lateral side midway between flippers & fluke
05/13/07	mortality	Juvenile Male 9.3m	Rockport, MA	P		Areas of hemorrhaging indicate major blunt trauma to chest, neck & head

Date[a]	Report Type	Age, Sex, ID, Length	Location[a]	Assigned Cause: P=primary, S=secondary		Notes/Observations
				Ship strike	Entang./ Fsh. Inter.	
06/23/07	serious injury	age unknown Male	Wildcat Knoll		P	Body wrap of gear imbedded; no gear recovered
06/24/07	mortality	Juvenile Female "Tofu" 9.9m	Stellwagen Bank	P		Subdermal hemorrhaging involving blubber, fascia, & muscle extending from/around the insertion of the right flipper ventrally to the axilla
12/21/07	mortality	age unknown Male 9.4m	Ocean Sands, NC		P	Documented wrapped in gear, gear removed without permission prior to necropsy; external lesions at flukes, flippers, mouth, dorsal fin, dorsal keel & ventral pleats consistent with gillnet entanglement; animal emaciated; 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. Record was added after review of carcasses sighted on 08/20/06 and 09/06/06. Previous reports stated these were the same animal. Recent review could not confirm the resight; therefore they are now being treated as two separate events. There was inconclusive evidence with regard to the carcass on 08/20/06 to determine mortality due to entanglement.

Table 6. Confirmed human-caused mortality and serious injury records of Western North Atlantic fin whales, 2003 - 2007.

Date[a]	Report Type	Age, Sex, Length	Location[a]	Assigned Cause: P=primary, S=secondary		Notes/Observations
				Ship strike	Entang./ Fsh. Inter.	
02/12/04	serious injury	age & sex unknown	Pea Island, NC		P	Entangled whale noticeably emaciated; no gear recovered
02/25/04	mortality	Adult Female 16.3m	Port Elizabeth, NJ	P		Displaced vertebrae; ruptured aorta
06/30/04	mortality	age & sex unknown 12m (est.)	Georges Bank		P	Freshly dead; heavy line constricting mid-section; no gear recovered
09/26/04	mortality	age & sex unknown 15m (est.)	St. Johns, NB	P		Fresh carcass on bow of ship
03/26/05	mortality	Adult Female 16.3m	off Virginia Beach, VA	P		Extensive hemorrhaging and vertebral fractures
04/03/05	mortality	Adult Female 18.8m	Southampton, NY	P		Subdermal hemorrhaging
08/23/05	mortality	Juvenile Male 13.7m	Port Elizabeth, NJ	P		Brought in on bow of ship
09/11/05	mortality	Juvenile Male 11.0m	Bonne Esperance, QC	P		Bottom jaw completely severed/broken
09/17/06	serious injury	age & sex unknown 18m (est.)	off Mt. Desert Rock, ME		P	Pale skin overall; cyamid load at point of attachment; emaciated; no gear recovered
03/25/07	mortality	age unknown Female 18.0m	Norfolk Harbor, VA	P		Extensive fracturing of ribs, skull and vertebrae w/ associated hemorrhage & edema

Date[a]	Report Type	Age, Sex, Length	Location[a]	Assigned Cause: P=primary, S=secondary		Notes/Observations
				Ship strike	Entang./ Fsh. Inter.	
05/24/07	mortality	age unknown Male	Newark Bay, NJ	P		Hemorrhage (epaxial muscle, diaphragm, pleural lining) and multiple fractures of the ribs, vertebrae & sternum and the trailing tissue of the animal was marked by propeller cuts
06/25/07	serious injury	age & sex unknown	Great South Channel		P	Wrap on tail assoc w/ cyamid load; flippers & mouth involved; extremely emaciated; lethargic; no gear recovered
08/11/07	mortality	age & sex unknown	Cabot Strait, Nova Scotia		P	Constricting wrap around body, between the head and flippers
09/26/07	mortality	Juvenile Male 13m (est.)	off Martha's Vineyard, MA		P	Freshly dead, scavenged carcass with gear present; evidence of multiple body wraps with associated hemorrhaging; 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.

Table 7. Confirmed human-caused mortality and serious injury records of Nova Scotian sei whales, 2003 - 2007.

Date[a]	Report Type	Age, Sex, Length	Location[a]	Assigned Cause: P=primary, S=secondary		Notes/Observations
				Ship strike	Entang./ Fsh. Inter.	
02/19/03	mortality	age unknown Male 11.0m	Norfolk, VA	P		Large gash into muscle, hematoma and abrasions
04/17/06	mortality	Juvenile Male 10.9m	Baltimore, MD	P		Brought in on bow of ship, freshly dead; massive hemorrhaging on right side; large blood clot behind head; several broken ribs
09/16/06	serious injury	age & sex unknown	Jeffreys Ledge		P	Constricting wrap cutting into skin; no gear recovered
05/30/07	mortality	Adult Female 14.4m	off Deer Island, MA	P		Broken left flipper, 8 vertebral processes, and 4 ribs; right flipper sheared off; lower jaw dislocated; hemorrhaging and/or edema associated with lower jaw and left flipper region

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.

Table 8. Confirmed human-caused mortality and serious injury records of Canadian East Coast minke whales, 2003 - 2007.

Date[a]	Report Type	Age, Sex, Length	Location[a]	Assigned Cause: P=primary, S=secondary		Notes/Observations
				Ship strike	Entang./ Fsh. Inter.	
05/24/03	mortality	Adult Male 7.6m	Gloucester, MA		P	Unknown fishery; line marks on head and dorsal fin; no line present; cut across back anterior to dorsal fin; no gear recovered
05/31/03	mortality	Juvenile Female 3.6m (est.)	Martha's Vineyard, MA		P	Unknown fishery; whale stranded live wrapped in about 15 feet of 5.5 inch mesh netting, probably trawl gear
06/28/03	mortality	Yearling Male 5.1m[e]	Chatham, MA		P	Unknown fishery; wrapped in gear; gear not recovered
08/09/03	mortality	Juvenile Female, 3.5m (est.)	Harwich, MA		P	Unknown fishery; hemorrhaging in areas with net marks on whale; no gear recovered
09/13/03	mortality	Juvenile Female 6m (est.)	Casco Bay, ME		P	Unknown fishery; freshly dead; external chaffing marks and belly slit open; no gear recovered
05/06/04	mortality	Adult Female 7.7m	Martha's Vineyard, MA		P	Unknown fishery; constricting line marks on peduncle; indications of drowning from internal exam; no gear present
06/01/04	mortality	Juvenile Female 6.5m	Chatham, MA	P		Large area of subdermal hemorrhaging
07/19/04	mortality	Adult Female 7.9m	Eastham, MA		P	Unknown fishery; extensive entanglement markings; no gear present
08/04[b]	mortality	age & sex unknown 4m (est.)	Georges Bank		P	Bottom Otter Trawl; fresh dead, rigid, had to cut out of net, rope in mouth

Date[a]	Report Type	Age, Sex, Length	Location[a]	Assigned Cause: P=primary, S=secondary		Notes/Observations
				Ship strike	Entang./ Fsh. Inter.	
05/23/05	mortality	Juvenile Male 5.9m	Port Elizabeth, NJ	P		Ribs shattered; liver ruptured; evidence of internal hemorrhaging
07/16/07	serious injury	age & sex unknown 10m (est.)	Trescott, ME		P	Wrapped in gear and anchored; no gear recovered
08/05/07	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 11/64" diameter rope

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 9. Confirmed human-caused mortality and serious injury records of Western North Atlantic Bryde's whales, 2003 - 2007.

Date[a]	Report Type	Sex, age, length	Location[a]	Assigned Cause: P=primary, S=secondary		Notes/Observations
				Ship strike	Entang./ Fsh. Inter.	
03/13/03	mortality	age unknown Male 11.0m	New Hanover, NC		P	Deeply embedded line; whale extremely emaciated; gear is from a pot related fishery

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.

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