

**Mortality and  
Serious Injury Determinations  
for Baleen Whale Stocks  
along the Eastern Seaboard  
of the United States, 2000-2004**

by

**Tim Cole, Dana Hartley,  
and Mendy Garron**

April 2006

## Recent Issues in This Series

- 05-04 **40th SAW Assessment Report**, by 40th Northeast Regional Stock Assessment Workshop. April 2005.
- 05-05 **Effectiveness of a Square-Mesh Escape Panel in Reducing Finfish Bycatch in a Small-Mesh Bottom Trawl Used in the Longfin Inshore Squid (*Loligo pealeii*) Fishery**, by L. Hendrickson. June 2005.
- 05-06 **Use of the Historic Area Remediation Site by Black Sea Bass and Summer Flounder**, by M.C. Fabrizio, J.P. Pessutti, J.P. Manderson, A.F. Drohan, and B.A. Phelan. June 2005.
- 05-07 **Benthic Macrofauna and Associated Hydrographic Observations Collected in Newark Bay, New Jersey, between June 1993 and March 1994**, by L.L. Stehlik, S.J. Wilk, R.A. Pikanowski, D.G. McMillan, and E.M. MacHaffie. July 2005.
- 05-08 **Mortality and Serious Injury Determinations for Large Whale Stocks along the Eastern Seaboard of the United States, 1999-2003**. By T.V.N. Cole, D.L. Hartley, and R.L. Merrick. July 2005.
- 05-09 **NEFSC Bycatch Estimation Methodology: Allocation, Precision, and Accuracy**, by P.J. Rago, S.E. Wigley, and M.J. Fogarty. August 2005.
- 05-10 **41st SAW Assessment Summary Report**, by 41st Northeast Regional Stock Assessment Workshop. August 2005.
- 05-11 **Expanding Opportunities in Oceanic and Atmospheric Sciences III: Proceedings of the Third National Conference to Strengthen the Links among HBMSCUs, NOAA, Business, and Graduate Studies in Marine and Atmospheric Sciences**, by A. Jearld, Jr., and D. Peloquin, compilers. August 2005.
- 05-12 **Total Bycatch Estimate of Loggerhead Turtles (*Caretta caretta*) in the 2004 Atlantic Sea Scallop (*Placopecten magellanicus*) Fishery**, by K.T. Murray. August 2005.
- 05-13 **Assessment of 19 Northeast Groundfish Stocks through 2004: 2005 Groundfish Assessment Review Meeting (2005 GARM), Northeast Fisheries Science Center, Woods Hole, Massachusetts, 15-19 August 2005**, by R.K. Mayo and M. Terceiro, editors. September 2005.
- 05-14 **41st SAW Assessment Report**, by the 41st Northeast Regional Stock Assessment Workshop. September 2005.
- 05-15 **Economic Analysis of Alternative Harvest Strategies for Eastern Georges Bank Haddock [5Zjm; 551, 552, 561, 562]**, by E.M. Thunberg, D.S.K. Liew, C.M. Fulcher, and J.K.T. Brodziak. October 2005.
- 05-16 **Northeast Fisheries Science Center Publications, Reports, and Abstracts for Calendar Year 2004**, by L. Garner. October 2005.
- 05-17 **Modification of Defined Medium ASP<sub>12</sub> for Picoplankter *Aureococcus anophagefferens*, with Limited Comparison of Physiological Requirements of New York and New Jersey Isolates**, by J.B. Mahoney. November 2005.
- 05-18 **Program Planning and Description Documents for the Northeast Fisheries Science Center, Its Component Laboratories, and Their Predecessors during 1955-2005**, by J.A. Gibson. December 2005.
- 05-19 **Seasonal Management Area to Reduce Ship Strikes of Northern Right Whales in the Gulf of Maine**, by R.L. Merrick. December 2005.
- 06-01 **42nd SAW Assessment Summary Report**, by the 42nd Northeast Regional Stock Assessment Workshop. January 2006.
- 06-02 **The 2005 Assessment of the Gulf of Maine Atlantic Cod Stock**, by R.K. Mayo and L.A. Col. March 2006.
- 06-03 **Summer Abundance Estimates of Cetaceans in US North Atlantic Navy Operating Areas**, by D.L. Palka. March 2006.

**Mortality and  
Serious Injury Determinations  
for Baleen Whale Stocks  
along the Eastern Seaboard  
of the United States, 2000-2004**

by

by **Tim Cole<sup>1,3</sup>, Dana Hartley<sup>2,4</sup>, and Mendy Garron<sup>2,5</sup>**

*Postal Address:* <sup>1</sup>*National Marine Fisheries Serv., 166 Water St., Woods Hole, MA 02543*

<sup>2</sup>*National Marine Fisheries Serv., Three Heritage Way, Gloucester, MA 01930*

*Email Address:* <sup>3</sup>*Tim.Cole@noaa.gov;* <sup>4</sup>*Dana.Hartley@noaa.gov;* <sup>5</sup>*Mendy.Garron@noaa.gov*

**U.S. DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
National Marine Fisheries Service  
Northeast Fisheries Science Center  
Woods Hole, Massachusetts**

April 2006

## Northeast Fisheries Science Center Reference Documents

**This series is a secondary scientific series** designed to assure the long-term documentation and to enable the timely transmission of research results by Center and/or non-Center researchers, where such results bear upon the research mission of the Center (see the outside back cover for the mission statement). These documents receive internal scientific review but no technical or copy editing. The National Marine Fisheries Service does not endorse any proprietary material, process, or product mentioned in these documents.

All documents issued in this series since April 2001, and several documents issued prior to that date, have been copublished in both paper and electronic versions. To access the electronic version of a document in this series, go to <http://www.nefsc.noaa.gov/nefsc/publications/series/crdlist.htm>. The electronic version will be available in PDF format to permit printing of a paper copy directly from the Internet. If you do not have Internet access, or if a desired document is one of the pre-April 2001 documents available only in the paper version, you can obtain a paper copy by contacting the senior Center author of the desired document. Refer to the title page of the desired document for the senior Center author's name and mailing address. If there is no Center author, or if there is corporate (*i.e.*, non-individualized) authorship, then contact the Center's Woods Hole Laboratory Library (166 Water St., Woods Hole, MA 02543-1026).

**This document's publication history** is as follows: manuscript submitted for review -- March 22, 2006; manuscript accepted through technical review -- April 5, 2006; manuscript accepted through policy review -- April 10, 2006; and final copy submitted for publication -- April 10, 2006. This document may be cited as:

Cole, T.; Hartley, D; Garron, M. 2006. Mortality and Serious Injury Determinations for Baleen Whale Stocks Along the Eastern Seaboard of the United States, 2000-2004. *U.S. Dep. Commer., Northeast Fish. Sci. Cent. Ref. Doc.* 06-04; 18 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026.

## TABLE OF CONTENTS

Abstract.....	iv
Introduction.....	1
Methods .....	1
Results.....	3
Discussion.....	4
Acknowledgments.....	6
Literature Cited.....	7

### List of Tables

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, 2000-2004 .....	9
Table 2. Summary of the confirmed human-caused mortality and serious injury events involving baleen whale stocks along the Gulf of Mexico coast, U.S. East coast and adjacent Canadian Maritimes, 2000-2004, with the number of events attributed to entanglements and/or vessel collisions by year.....	10
Table 3. Confirmed human-caused mortality and serious injury records of North Atlantic right whales, 2000-2004.....	11
Table 4. Confirmed human-caused mortality and serious injury records of Northwest Atlantic humpback whales, 2000-2004 .....	12
Table 5. Confirmed human-caused mortality and serious injury records of western North Atlantic fin whales, 2000-2004 .....	14
Table 6. Confirmed human-caused mortality and serious injury of Nova Scotian sei whales, 2000-2004.....	15
Table 7. Confirmed human-caused mortality and serious injury of Canadian East Coast minke whales, 2000-2004.....	16
Table 8. Confirmed human-caused mortality and serious injury of western North Atlantic Brydes whales, 2000-2004 .....	18

## **ABSTRACT**

The Northeast Fisheries Science Center has developed protocols for determining large whale serious injuries and human-caused mortalities. This report describes determinations made for right, humpback, fin, sei, blue, minke and Brydes whale events that occurred from 2000 through 2004 along the eastern seaboard of the United States. A total of 417 unique large whale events were reported during the period, including both carcasses stranded on beaches and sighted at sea. These included 171 entanglement reports and 42 reports of ship strikes. We were able to verify 147 entanglement events, 29 ship strikes, and 276 mortalities. Entanglements were identified as the cause of 27 whale deaths and ship strikes the cause of 21. Entanglements were determined to have caused serious injury in 18 events. Minke whales had the greatest number of entanglement mortalities (12). Humpback whales had the highest number of serious injury events resulting from entanglements (11) and the most incidents of ship strike mortalities (7). Right whales had six mortalities from ship strikes and fin whales had five. No serious injuries resulting from ship strikes were confirmed for any species. These human-caused mortality and serious injury rates represent the minimum levels of impact to these stocks. Procedures and methods for estimating actual serious injury and mortality rates have yet to be developed.

## INTRODUCTION

As part of the 1994 amendments to the Marine Mammal Protection Act (MMPA), the NOAA National Marine Fisheries Service (NMFS) was mandated to establish monitoring programs to obtain statistically reliable estimates of incidental mortality and serious injury of marine mammals taken during commercial fishing operations. The Agency was also charged with developing Take Reduction Plans (TRPs) to reduce commercial takes of strategic stocks of marine mammals below the Potential Biological Removal (PBR) levels specified in the TRPs within six months after TRP implementation. The longer-term goal of all the TRPs is to reduce--within 5 years of implementation--commercial takes and serious mortality of marine mammals to insignificant levels approaching zero mortality and serious injury rates.

In April 1997, NMFS convened a Serious Injury Workshop to develop a consistent set of guidelines for determining what constitutes a serious injury (Angliss and DeMaster 1998). Although the Workshop produced a set of recommendations, implementation of a national serious injury standard has not yet occurred.

Nonetheless, NOAA Fisheries staff and Scientific Review Group (SRG) members decided to take account of serious injuries in the annual marine mammal stock assessment reports (SAR). Subsequently, the Northeast Fisheries Science Center (NEFSC) implemented the Workshop's large cetacean recommendations and prepared serious injury determinations for the SARs.

This report presents the protocols and determinations for events involving right, humpback, fin, sei, blue, minke and Brydes whales during 2000 – 2004. Determinations for these species during 1999 – 2003 are presented in Cole *et al.* (2005).

## METHODS

Marine mammal strandings and human-induced interaction events were recorded and submitted to the NMFS Northeast Regional Office (NERO) and Southeast Regional Office (SERO) by members of the National Stranding Network, large whale disentanglement teams, the U.S. Coast Guard and civilian sources. The Regional Offices identified and obtained all available information for each event (photos, necropsy reports, etc.) and placed these in a central folder for each event. Case files were compiled for all individually identified whales with injuries. Several NEFSC and NERO staff were involved in reviewing event records, confirming each event's occurrence and the species involved, identifying duplicate records and consolidating unique information from each source into a single record for each event. Information from additional sightings of a previously documented event was added to the original event record. If an identified whale was involved in a second interaction, a new event record was assigned. The NEFSC staff then 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 within and across years.

### *Event and Species Confirmation Criteria*

Events and the species involved were considered confirmed if they meet one of the following criteria:

1. The event was observed by a trained marine mammal observer who was certain of the species or event;
2. The event was observed by a trained member of the Disentanglement Network and the species or event was verified via interview by NMFS, disentanglement or stranding network staff;
3. The observer was inexperienced, but the report was accompanied by photographs or videotape of sufficient quality to positively verify the species or event;
4. A fisherman reported a whale entangled in his/her gear or a shipper reported colliding with a whale;
5. Gear was retrieved from a whale.

Events and the species involved were considered confirmed in the following less certain cases:

1. The observer was experienced and was fairly certain, but not positive, of the species or event;
2. The observer was inexperienced, but was interviewed and the account was descriptive enough that the species or event was probable but not certain;
3. The report was accompanied by poorer quality photographs or video, and staff reviewing this material assessed the event as probable but not certain.

Events or the species involved were considered unconfirmed if:

1. The observer was inexperienced and no photographs or video were taken, and the observer's account did not provide sufficient detail to identify the species or event occurrence;
2. The observer was experienced, but did not see the whale long enough or in good enough conditions to state the species or event as being probable;
3. The event was photographed or video taped, but staff reviewing the images could not identify species or the event's occurrence;
4. A carcass was too decomposed to identify species or to show any indication of human interaction.

### *Human-Induced Mortality Determinations*

Events were categorized as entanglement mortalities if the following indications were confirmed to be present during gross inspection or necropsy of the carcass:

1. Fishing line constricted any body part;
2. Subdermal hemorrhaging or extensive necrosis was present at point of attachment.

Events were categorized as ship strike mortalities if any of the following indications were confirmed to be present on a 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 any of the following indications were 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 change in appearance following entanglement, including skin discoloration, lesions near the nares, fat loss, or increased cyamid loads;
4. Gear was ingested;
5. Whale was anchored.

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 change in skin discoloration, lesions near the nares, fat loss, or increased cyamid loads.

Injuries that impaired the whale's locomotion or feeding were not considered serious injuries unless they were likely to be fatal in the foreseeable future. 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 417 events was reported during 2000 - 2004, involving both live and dead whales (Table 1). There were 171 reports of entanglement and 42 of ship strike. From these, we confirmed 147 entanglement events and 29 ship strike events. We were able to verify 276 mortalities, and determine that 27 mortalities were due to entanglements and 21 mortalities were the result of ship strikes. The cause of death could not be established for the remaining mortalities. Entanglement was determined to have caused serious injury in 18 events. There were no records of serious injuries resulting from ship strikes. Annual human-caused mortality and serious injury rates for 2000 - 2004 are presented by stock in Table 2. Tables 3 through 8 provide the details of each confirmed serious injury or mortality record.

Right whales had the highest proportion of entanglements and ship strikes relative to the number of reports for a species--of 54 reports involving right whales, 29 were confirmed entanglements and 9 were confirmed ship strikes. Over the five-year period, there were 20 verified right whale mortalities (Table 1). Three of these mortalities were due to entanglements, and six were due to ship strikes. Serious injury was documented for five entanglement events involving right whales.

Humpbacks were involved in 173 reported events (Table 1). Of these, 74 of the 83 reported entanglements could be confirmed, as could 11 of the 15 reported ship strikes. Humpbacks

were the most commonly observed entangled whale species and the most commonly observed dead whale (97 confirmed mortalities). Entanglements accounted for eight mortalities and 11 serious injuries. Ship strikes were relatively uncommon, with only 11 confirmed events, seven of which were fatal. Whales identified as members of the Gulf of Maine stock accounted for five of the entanglement mortalities, eight of the entanglement serious injuries and three of the ship strike mortalities (see Table 2, Table 4).

Fin whales had a low proportion of entanglements; of 42 reported events, nine were of entanglements (all confirmed), three of which were fatal (Table 1). Eleven ship strikes were reported, five of which were confirmed and proved fatal. One serious injury resulted from an entanglement.

Only six events were reported for sei whales, four of which were confirmed mortalities. Two of the mortalities were determined to have resulted from ship strikes.

Minke whales were reported in 85 events. Entanglements accounted for 35 of these events, but only 27 could be confirmed (Table 1). Twelve of the confirmed entanglement events were fatal, the highest percentage for any of the whale species. One additional entanglement event was determined to have caused serious injury. There were only two ship strike reports, one of which resulted in death.

Blue whales and Brydes whales appeared in only one reported event each. The blue whale report was a confirmed entanglement in the St. Lawrence River, Canada, but there was not sufficient information available to confirm if a serious injury was sustained. The Brydes whale report was a confirmed entanglement which resulted in the death of the whale.

In 55 of the 417 large whale events reported during 2000 - 2004, positive species identification was not possible (Table 1). In seven events, the similarity in body shape and size between fin and sei whales prevented positive species identification. In another 13, the whales could only be identified as balaenopteriids based on the presence of ventral pleats. The taxonomic identity of the whales involved in the remaining 35 events could not be assigned with any certainty. Entanglement was reported in 10 of these cases, five of which were considered confirmed. Twenty-six of the 35 reported events involving unidentified whales were confirmed mortalities, but the cause of death could not be determined.

## **DISCUSSION**

The serious injury determinations for Northwest Atlantic baleen whales are performed annually, immediately prior to completion of the draft Stock Assessment Report for the next year (*i.e.*, determinations for animals observed in 2004 were made in late summer 2005 for the 2006 SAR). This delay helps facilitate careful examination of all available data for determinations, which are done on a case-by case basis. The same personnel are used to ensure consistency in the determinations both within and between years.

Differentiating causal injuries from pre-existing ones or post-mortem damage is problematic, but can be accomplished through examination of necropsy data. Necropsies frequently identify subdermal hemorrhaging or hematomas indicating that blood was still circulating at the time of

injury. McLellan *et al.* (2004) have provided an excellent right whale necropsy protocol that should be followed by qualified personnel when examining carcasses.

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. 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.

Events involving constricting entanglements with evidence of the whale's deteriorating health were considered confirmed serious injuries. Removal of constricting gear was generally considered to prevent 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) compromises the ability of an animal to fight other infections. Therefore, the removal of gear frees a whale's immune system resources to combat resident disease or infection that might otherwise lead to the whale's death. Loosely wrapped gear did not appear to elicit as much stress (some whales carried loose wraps for years), and were not considered serious injuries even if they impaired the locomotion or feeding of an animal. We also made no attempt to predict how an entanglement or injury might increase a whale's susceptibility to further injury; however, further research on the fate of individual entangled/injured/impaired animals might provide information to improve such predictions. Fishing gear interactions may also generate non-lethal effects, such as impacts to reproduction that may negatively affect population recovery (Robbins and Mattila 2001a; Robbins *et al.* 2004); however, such impacts require further investigation.

However, our greatest concern remains the number of animals we never saw. There is currently no reliable method for estimating the number of large whales that die each year from entanglements, although recovered carcasses provide minimum values. Scar-based studies suggest that interactions between whales and fishing gear are common, and that many whales survive those encounters. Hamilton *et al.* (1998) examined photographs of 357 individual right whales and found that 62% (n = 220) had scars from entanglement, and 124 had been entangled more than once. Approximately half (48-65%) of Gulf of Maine humpback whales have been entangled at least once in their life time, while 8-25% sustain new injuries each year (Mattila and Robbins 1998; Robbins and Mattila 1999, 2000, 2001a, 2001b, 2003, 2004). Although scar studies generally only provide information on non-lethal encounter rates, any interaction between a whale and fishing gear has the potential to be fatal if a constricting entanglement occurs. 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. Right whales may also become negatively buoyant if an injury precludes effective feeding for an extended period (Moore *et al.* 2004).

Vessel collisions frequently lack external evidence, and may not be detected unless a necropsy is conducted. Knowlton and Kraus (2001) reported on 45 right whale mortalities from 1970-1999. Of these, 16 (36%) were attributed to ship strikes, 13 (29%) to natural causes, 13 were from unknown causes, and 3 (7%) were the result of entanglements. Of 15 right whales identified as ship strike mortalities, four (27%) showed no outward appearance of a strike (Hamilton *et al.* 1998). Wiley *et al.* (1995) reported a similar lack of external evidence of vessel collisions; of 20

large whale carcasses examined from the Carolina, Virginia and New Jersey coasts, 6 (30%) had major injuries potentially attributable to ship strikes and two of these showed no external signs of trauma. 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. Of the 30 right whales necropsied during 1970 through 2002, 13 (43%) were confirmed as ship strike mortalities, four (13%) were confirmed to be the result of entanglement, and one was due to natural causes (Moore *et al.* 2004). The causes of death were not identified for the remaining cases, however, one was possibly the result of a ship strike. An additional 24 mortalities were reported during the period, but no internal examination was conducted (Moore *et al.* 2004).

The Marine Mammal Commission has indicated that serious injury and mortality estimates based only on confirmed reports are not precautionary because these estimates are negatively biased. That is, not all injured or dead animals are accounted for. Given the low sighting probability and apparently high rate of interaction of whales with fishing gear and ships, we concur that any estimate based on observed dead or seriously injured animals is a very conservative lower bound. Thus, if the observed mortality and serious injury estimate developed from stranding/floater/ entanglement data is near but below a threshold value (*e.g.*, PBR for a marine mammal stock), it is reasonable to assume that the true mortality/serious injury value exceeds the threshold.

## **ACKNOWLEDGMENTS**

We are especially grateful to the East Coast stranding and entanglement networks, whose members searched for and examined whales both live and dead. It is a difficult and seemingly thankless job that deserves special recognition. We are also grateful to the staff of the Provincetown Center for Coastal Studies and New England Aquarium, NOAA aerial survey teams, Wildlife Trust, the States of Florida/Georgia and many others for providing the sightings that have allowed this work to be conducted. Liz Pomfret-Wiley, Amy Whittingham Chase, Brenda Rone and Misty Niemeyer verified records. Misty Nelson triple-checked everything. Members of the Atlantic Scientific Review Group have provided numerous useful comments on the protocols described here. We also thank the anonymous reviewers of earlier drafts of this report. Also thanks to Dr. Richard Merrick, who provided the momentum to put these protocols in manuscript form.

## LITERATURE CITED

Angliss, R. P., and D. P. DeMaster. 1998. Differentiating serious and non-serious injury of marine mammals taken incidental to commercial fishing operations: Report of the Serious Injury Workshop, 1-2 April 1997, Silver Spring, Maryland. U.S. Dep. Commer., NOAA Tech Memo. NMFS-OPR-13, 48 p.

Barco, S. G., W. A. McLellan, J. M. Allen, R. A. Asmutis-Silvia, R. Mallon-Day, E. M. Meagher, D. A. Pabst, J. Robbins, R. E. Seton, W. M. Swingle, M. T. Weinrich, and P. J. Clapham. 2002. Population identity of humpback whales (*Megaptera novaeangliae*) in the waters of the US mid-Atlantic states. *Journal of Cetacean Research and Management* 4(2): 135-141.

Cole, T.V.N., D. L. Hartley and R. L. Merrick. 2005. Mortality and Serious Injury Determinations for Large Whales Stocks Along the Eastern Seaboard of the United States, 1999-2003. *U.S. Dep. Commer. Northeast Fish. Sci. Cent. Ref. Doc. 05-08 revised*; 20 pp. Available at: [www.nefsc.noaa.gov/publications](http://www.nefsc.noaa.gov/publications).

Hamilton, P.K., M.K. Marx, and S.D. Kraus. 1998. Scarification analysis of North Atlantic right whales (*Eubalaena glacialis*) as a method of assessing human impacts. Paper SC/M98/RW28 presented to the IWC Special Meeting of the Scientific Committee towards a Comprehensive Assessment of Right Whales Worldwide, 16-25 March 1998, Cape Town, South Africa.

Knowlton, A.R., and S.D. Kraus. 2001. Mortality and serious injury of northern right whales (*Eubalaena glacialis*) in the western North Atlantic Ocean. *Journal of Cetacean Research and Management* (Special Issue 2): 193-201

Kraus, S.D. 1990. Rates and potential causes of mortality in North Atlantic right whales (*Eubalaena glacialis*). *Marine Mammal Science* 6(4): 278-291.

Mattila, D. K., and J. Robbins. 1998. Monitoring of entanglement scars on the caudal peduncle of humpback whales in Gulf of Maine. Center for Coastal Studies. Order number 40EMNF700232 pp.

McLellan, W.A., Rommel, S.A., Moore, M., Pabst, D.A. 2004. Right whale necropsy protocol. Final report to NOAA Fisheries for contract #40AANF112525 51pp.

Moore, M.J., A.R. Knowlton, S.D. Kraus, W.A. McLellan, R.K. Bonde. 2004. Morphometry, gross morphology and available histopathology in North Atlantic right whale (*Eubalaena glacialis*) mortalities (1970–2002). *Journal of Cetacean Research and Management* 6(3): 199-214.

Robbins, J., and D. K. Mattila. 1999. Monitoring entanglement scars on Gulf of Maine humpback whales. Center for Coastal Studies. Order number 40ENNF800288.

Robbins, J., and D. K. Mattila. 2000. Monitoring entanglement scars on the caudal peduncle of

Gulf of Maine humpback whales: 1997-1999. Center for Coastal Studies. Order number 40ENNF900253. 24 p.

Robbins, J., and D. K. Mattila. 2001a. Monitoring entanglements of humpback whales (*Megaptera novaeangliae*) in the Gulf of Maine on the basis of caudal peduncle scarring. Unpublished report to the Scientific Committee of the International Whaling Commission: SC/53/NAH, 25 p.

Robbins, J., and D. K. Mattila. 2001b. Gulf of Maine humpback whale entanglement scar monitoring results, 2000. Center for Coastal Studies. Order number 40ENNF030121.

Robbins, J., and D. K. Mattila. 2003. Gulf of Maine humpback whale entanglement scar monitoring results, 2001. Report to the National Marine Fisheries Service. Order number 40ENNF030121.

Robbins, J., and D. K. Mattila. 2004. Estimating humpback whale (*Megaptera novaeangliae*) entanglement rates on the basis of scar evidence. Report to the National Marine Fisheries Service. Order number 43ENNF030121, 22 pp.

Robbins, J., D., W. McKay, and M. L. Sheridan. 2004. Gulf of Maine humpback whale, *Megaptera novaeangliae*, vital rates inferred from blubber progesterone concentrations. Report to the National Marine Fisheries Service, Order number EA133F03SE0293, 25 pp.

Wiley, D. N., R. A. Asmutis, T. D. Pitchford, and D. P. Gannon. 1995. Stranding and mortality of humpback whales, *Megaptera novaeangliae*, in the mid-Atlantic and southeast United States, 1985-1992. Fishery Bulletin 93 [1]: 196-205.

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, 2000 -2004.

Species	North Atlantic right whale	Northwest Atlantic humpback whale <sup>b</sup>	Western North Atlantic fin whale	Nova Scotian sei whale	Western North Atlantic blue whale	Canadian East Coast minke whale	Western North Atlantic Brydes whale	Unidentified fin/sei whale	Unidentified balaeopterid <sup>e</sup>	Unidentified whale spp.	TOTALS
Total reports <sup>a</sup> (2000, 2001, 2002, 2003, 2004)	<b>54</b> (12, 10, 12, 7, 13)	<b>173</b> (34, 30, 35, 53, 21)	<b>42</b> (4, 9, 5, 14, 10)	<b>6</b> (0, 2, 1, 1, 2)	<b>1</b> (0, 0, 1, 0, 0)	<b>85</b> (14, 10, 14, 24, 23)	<b>1</b> (0, 0, 0, 1, 0)	<b>7</b> (0, 2, 0, 3, 2)	<b>13</b> (0, 2, 2, 7, 2)	<b>35</b> (5, 7, 4, 16, 3)	<b>417</b>
Total entanglement reports <sup>a</sup>	<b>30</b> (10, 4, 8, 5, 3)	<b>83</b> (17, 13 <sup>c</sup> , 21, 21, 11)	<b>9</b> (0, 2, 1, 2, 4)	<b>0</b>	<b>1</b> (0, 0, 1, 0, 0)	<b>35</b> (6, 5 <sup>d</sup> , 5, 11, 8)	<b>1</b> (0, 0, 0, 1, 0)	<b>0</b>	<b>2</b> (0, 0, 0, 0, 2)	<b>10</b> (2, 4, 1, 2, 1)	<b>171</b>
Total ship strike reports	<b>11</b> (2, 2, 2, 2, 3)	<b>15</b> (2, 6 <sup>c</sup> , 3, 3, 1)	<b>11</b> (1, 3, 0, 4, 3)	<b>3</b> (0, 1, 0, 1, 1)	<b>0</b>	<b>2</b> (0, 1 <sup>d</sup> , 0, 0, 1)	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>42</b>
Confirmed entanglement events	<b>29</b> (9, 4, 8, 4, 4)	<b>74</b> (15, 11 <sup>c</sup> , 18, 20, 10)	<b>9</b> (0, 2, 1, 2, 4)	<b>0</b>	<b>1</b> (0, 0, 1, 0, 0)	<b>27</b> (5, 4, 3, 9, 6)	<b>1</b> (0, 0, 0, 1, 0)	<b>0</b>	<b>1</b> (0, 0, 0, 0, 1)	<b>5</b> (0, 2, 1, 1, 1)	<b>147</b>
Confirmed ship strike events	<b>9</b> (2, 2, 1, 2, 2)	<b>11</b> (1, 5 <sup>c</sup> , 2, 2, 1)	<b>5</b> (1, 2, 0, 0, 2)	<b>3</b> (0, 1, 0, 1, 1)	<b>0</b>	<b>1</b> (0, 0, 0, 0, 1)	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>29</b>
Total confirmed mortalities	<b>20</b> (1, 8, 5, 1, 5)	<b>97</b> (14, 22, 18, 31, 12)	<b>36</b> (4, 8, 5, 12, 7)	<b>4</b> (0, 2, 1, 1, 0)	<b>0</b>	<b>73</b> (10, 8, 12, 22, 21)	<b>1</b> (0, 0, 0, 1, 0)	<b>7</b> (0, 2, 0, 3, 2)	<b>12</b> (0, 2, 2, 7, 1)	<b>26</b> (3, 3, 3, 15, 2)	<b>276</b>
Confirmed entanglement mortalities	<b>3</b> (0, 1, 1, 0, 1)	<b>8</b> (0, 3, 3, 1, 1)	<b>3</b> (0, 1, 1, 0, 1)	<b>0</b>	<b>0</b>	<b>12</b> (1, 2, 2, 5, 2)	<b>1</b> (0, 0, 0, 1, 0)	<b>0</b>	<b>0</b>	<b>0</b>	<b>27</b>
Confirmed ship strike mortalities	<b>6</b> (0, 2, 1, 1, 2)	<b>7</b> (0, 3, 2, 1, 1)	<b>5</b> (1, 2, 0, 0, 2)	<b>2</b> (0, 1, 0, 1, 0)	<b>0</b>	<b>1</b> (0, 0, 0, 0, 1)	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>21</b>
Confirmed entanglement serious injuries	<b>5</b> (1, 1, 2, 1, 0)	<b>11</b> (5, 0, 1, 4, 1)	<b>1</b> (0, 0, 0, 0, 1)	<b>0</b>	<b>0</b>	<b>1</b> (1, 0, 0, 0, 0)	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>18</b>
Confirmed ship strike serious injuries	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

<sup>a</sup> Excludes resightings of previously entangled individuals unless a new entanglement was documented.

<sup>b</sup> Includes all humpback reports, whether confirmed as members of the Gulf of Maine feeding stock or not.

<sup>c</sup> One humpback report included as both a confirmed entanglement and confirmed ship strike event.

<sup>d</sup> One minke report included as both an unconfirmed entanglement and unconfirmed ship strike report.

<sup>e</sup> Described as having throat grooves (torqual pleats).

Table 2. 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, 2000 - 2004, with number of events attributed to entanglements or vessel collisions by year.

Stock	Mean annual mortality and SI rate (and PBR)	Entanglements			Vessel Collisions		
		Annual rate (US waters / Canadian waters / other waters)	Confirmed mortalities (2000, 2001, 2002, 2003, 2004)	Confirmed SI's (2000, 2001, 2002, 2003, 2004)	Annual rate (US waters / Canadian waters)	Confirmed mortalities (2000, 2001, 2002, 2003, 2004)	Confirmed SI's
North Atlantic right whale	<b>2.8</b> (0)	<b>1.6</b> (0.6 / 1.0 / 0)	<b>3</b> (0, 1, 1, 0, 1)	<b>5</b> (1, 1, 2, 1, 0)	<b>1.2</b> (1.0 / 0.2)	<b>6</b> (0, 2, 1, 1, 2)	<b>0</b>
Gulf of Maine humpback whale <sup>1</sup>	<b>3.0</b> (1.3)	<b>2.4</b> (1.8 / 0.6 / 0)	<b>4</b> (0, 1, 2, 0, 1)	<b>8</b> (3, 0, 1, 3, 1)	<b>0.6</b> (0.6 / 0)	<b>3</b> (0, 2, 1, 0, 0)	<b>0</b>
Western North Atlantic fin whale <sup>2</sup>	<b>1.8</b> (4.7)	<b>0.8</b> (0.6 / 0 / 0.2)	<b>3</b> (0, 1, 1, 0, 1)	<b>1</b> (0, 0, 0, 0, 1)	<b>1.0</b> (0.8 / 0.2)	<b>5</b> (1, 2, 0, 0, 2)	<b>0</b>
Nova Scotian sei whale <sup>3</sup>	<b>0.4</b> (-)	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.4</b> (0.4 / 0)	<b>2</b> (0, 1, 0, 1, 0)	<b>0</b>
Western North Atlantic blue whale <sup>4</sup>	<b>0</b> (-)	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Canadian East Coast minke whale	<b>2.8</b> (3.1)	<b>2.6</b> (2.6 / 0 / 0)	<b>12</b> (1, 2, 2, 5, 2)	<b>1</b> (1, 0, 0, 0, 0)	<b>0.2</b> (0.2 / 0)	<b>1</b> (0, 0, 0, 0, 1)	<b>0</b>
Western North Atlantic Brydes whale	<b>0.2</b> (0.3)	<b>0.2</b> (0.2 / 0 / 0)	<b>1</b> (0, 0, 0, 1, 0)	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

<sup>1</sup> Includes only events involving confirmed members of the Gulf of Maine feeding stock.

<sup>2</sup> Includes an entanglement mortality found off Bermuda in 2001.

<sup>3, 4</sup> Stock abundance estimates outdated; no PBR established for these stocks.



Table 3. Confirmed human-caused mortality and serious injury records of North Atlantic right whales, 2000 - 2004.

Date	Report Type	Sex, age, ID	Location	Assigned Cause: P=primary, S=secondary		Notes / Observations
				Ship strike	Entang./ Fsh inter	
3/01/00	serious injury	Adult male #1130	6mi east of Manomet, MA		P	Line constricting left flipper; flipper discolored; abnormal cyamid distribution; bullet buoy trailing, line weighted down between whale and buoy; no gear recovered
3/17/01	mortality	Male calf	Assateague, VA	P		Large fresh propeller gashes on dorsal caudal and acute muscular hemorrhage
6/8/01	serious injury	Adult male #1102	58mi east of Cape Cod, MA		P	Entangling line deeply embedded; signs of poor health including emaciation, skin discoloration, and abnormal cyamid distribution
6/18/01	mortality	female calf	Long Island, NY	P		Dorsal propeller wounds, sub-dermal hemorrhage
11/3/01	mortality	Adult male #1238 14 m	Magdellen Islands, Canada		P	Thoroughly wrapped up in Danish seine gear, whale seen alive and well five months earlier
7/6/02	mortality	11.0m (est) female #3107	off Briar Island, NS Canada		P	Carcass ashore on Nantucket, MA, on October 12, 2002; tail stock severely lacerated where entangled; gear consistent with inshore lobster fishery
8/22/02	serious injury	Adult female #1815	Scotian Shelf, Canada		P	Line tightly wrapped around head and tail stock; no gear recovered
8/22/02	mortality	12.6m female 1y.o.	off Ocean City, MD	P		Large laceration on dorsal surface
8/30/02	serious injury	#3210 age & sex unknown	Bay of Fundy, NS		P	Line tightly wrapped around rostrum, seen in 2004 in poor condition; no gear recovered
1/14/03	serious injury	Adult female #2240	Jacksonville, FL		P	Line in mouth no longer visible, possibly ingested; body condition poor; no gear recovered
10/02/03	mortality	Adult female #2150	Digby, NS	P		Large fracture in skull, sub-dermal hemorrhage
2/7/04	mortality	Adult female #1004	Virginia Beach, VA	P		Severe subdermal bruising, complete fracture of rostrum and laceration of oral rete
9/6/04	mortality	Adult female #2301	Roseway Basin, NS		P	Extensive constricting line on head and left flipper; found dead March 3, 2005 on Ship Shoal Island, VA
11/24/04	mortality	Adult female #1909	Ocean Sands, NC	P		Left fluke lobe severed and large bore blood vessels exposed.

Table 4. Confirmed human-caused mortality and serious injury records of Northwest Atlantic humpback whales, 2000 - 2004. Records from the Gulf of Maine humpback whale stock are indicated by an asterisk (\*) following the date. Stock identification of the remaining records awaits genetic analysis results. These may identify additional Gulf of Maine whales.

Date	Report Type	Sex, age, ID length	Location	Assigned Cause: P=primary, S=secondary		Notes / Observations
				Ship strike	Entang./ Fsh.inter	
1/8/00	serious injury	9.9m estimated	30mi east Cape Lookout, NC		P	Whale swam off with 600' of sea trout sink gillnet, a chain anchor and a high flyer in tow
8/4/00*	serious injury	10.7m estimated	Bay of Fundy, Canada		P	Line wrapped on head with weighted trailing line giving tension; no gear recovered
9/6/00*	serious injury	<1 yr old, calf of "Giraffe"	Stellwagen Bank, MA		P	Single line wrapped across back; constriction will increase as whale grows; no gear recovered
10/14/00	serious injury	9.9m estimated	off Ocean City Inlet, MD		P	Heavily entangled in line; constrictive--fresh wounds noted; no gear recovered
10/20/00*	serious injury	10 yr old male "Tribble"	Stellwagen Bank, MA		P	Entangled in green poly line on multiple body parts; appears constrictive; no gear recovered
1/25/01	mortality	6.9m estimated	Avon, NC	P		Extensive hemorrhaging along left thoracic; clean cut through vertebrae
4/7/01	mortality	7.6m juvenile male	Emerald Isle, NC		P	Extensive edema and hemorrhaging from entanglement around tail stock
4/8/01	mortality	7.9m juvenile male	Myrtle Beach, SC	S	P	Chronic entanglement in line; severe prop wounds
4/9/01*	mortality	8.8m juvenile female "Inland"	offshore of Sandbridge, Virginia Beach		P	Found anchored in croaker sink gillnet gear; line wraps around rostrum had immobilized the whale
7/29/01*	mortality	8.5m juvenile female	floating south of Verrazano Bridge, NY	P		Large laceration on left side of head, extensive fracturing of skull
10/1/01*	mortality	11.4m 3 yr old female "Pitfall"	Duxbury Beach, MA	P		Massive fracturing to skull, focal bruising indicative of pre-mortem ship strike
2/8/02	mortality	8.4m juvenile female	off Cape Henry, VA	P		Three large lacerations, hemorrhaging and broken bones

Date	Report Type	Sex, age, ID length	Location	Assigned Cause: P=primary, S=secondary		Notes / Observations
				Ship strike	Entang./ Fsh.inter	
3/24/02	mortality	8.0m juvenile male	off Virginia Beach, VA		P	Deep cuts on tail stock and tail indicative of embedded line; no gear recovered
6/3/02*	mortality	9.9m	off Cape Elizabeth, ME		P	Deep cuts on tail stock from embedded line; state waters lobster fishery
6/17/02*	serious injury	10.2m estimated	Cape Cod Bay, MA		P	Fluke severely damaged by line, whale emaciated
8/1/02*	mortality	9.3m male	Long Island, NY	P		Large hematoma posterior to blow holes
10/1/02*	mortality	7.5m female calf	Plymouth, MA		P	Extensive line chaffing and bruising on carcass; no gear recovered
6/6/03	mortality	8.3m female	Chesapeake Bay mouth, VA	P		Major trauma to right side of head, hematoma present
7/9/03*	serious injury	calf of Shockwave	Bay of Fundy, Canada		P	Constricting entanglement on a young whale; no gear recovered
7/12/03	serious injury	unknown	Oregon Inlet, NC		P	Entangled in substantial amount of gear
8/15/03*	mortality	7.3m (est) calf	Petit Manan Island, ME		P	Floating offshore wrapped in line
8/16/03*	serious injury	unknown	off Cape Cod, MA		P	Poor body condition; line deeply embedded; gear recovered included sink gillnet, vessel anchoring system and surface buoy system and endline
8/18/03*	serious injury	unknown	off Cape Cod, MA		P	Extensive entanglement; no gear recovered
7/11/04*	serious injury	"Lucky" subadult	Briar Island, NS		P	Constricting entanglement on a young whale
10/3/04*	mortality	15m (est) unknown	Georges Bank		P	Fresh carcass with entangling line and high flyer; no gear recovered
12/19/04	mortality	8.0m calf	Bethany Beach, DE	P		Hematoma and skeletal fracturing

Table 5. Confirmed human-caused mortality and serious injury records of North Atlantic fin whales, 2000 - 2004.

Date	Report Type	Sex, age, ID length	Location	Assigned Cause: P=primary, S=secondary		Notes / Observations
				Ship strike	Entang./ Fsh.inter	
12/11/00	mortality	10.9m female	New York harbor	P		Hemorrhage and fractured bones on right side
1/2/01	mortality	18.1m female	New York harbor	P		Dorsal abrasion marks, hematoma
2/1/01	mortality	14.5m female	Port Elizabeth, NJ	P		Fresh carcass hung on ship's bow
9/19/01	mortality	10.7m unknown	off Bermuda		P	Extensive fresh entanglement marks; no gear recovered
7/28/02	mortality	unknown	Georges Bank		P	Heavy line seen on tail stock, appeared embedded; no gear recovered
2/12/04	serious injury	unknown	Pea Island, NC		P	Entangled whale noticeably emaciated; no gear recovered
2/25/04	mortality	16.3m female	Port Elizabeth, NJ	P		Displaced vertebrae, ruptured aorta
6/30/04	mortality	12m est. unknown	Georges Bank		P	Fresh dead; heavy line constricting mid-section; no gear recovered
9/26/04	mortality	15m est. unknown	St. Johns, NB	P		Fresh carcass caught on bow of ship

Table 6. Confirmed human-caused mortality and serious injury records of Nova Scotian sei whales, 2000 - 2004.

Date	Report Type	Sex, age, ID	Location	Assigned Cause: P=primary, S=secondary		Notes / Observations
				Ship strike	Entang./ Fsh inter	
5/2/01	mortality	13.0 m female	New York Harbor	P		Fresh carcass hung on ship's bow; hemorrhaging
2/19/03	mortality	11.0m male	Norfolk, VA 36 58'N 76 21'W	P		Large gash into muscle, hemotoma and abrasions

Table 7. Confirmed human-caused mortality and serious injury records of Canadian East Coast minke whales, 2000 - 2004.

Date	Report Type	Sex, age, ID	Location	Assigned Cause: P=primary, S=secondary		Notes / Initial observations
				Ship strike	Entang./ Fsh.inter	
8/11/00	serious injury	unk sex and size	Port Clyde, ME 43° 55'N 69° 11'W		P	Unknown fishery. Dark line with several bullet buoys. Unusual minke behavior - whale probably anchored. No gear recovered.
10/3/00	mortality	unk sex and size	Rockland, ME 44° 05'N 69° 01'W		P	Unknown fishery. Very fresh carcass with fresh entanglement wounds on tail stock. No gear recovered.
8/17/01	mortality	3.9m male,	Middletown, RI 41° 28'N 71° 15'W		P	Unknown fishery. Severe rope entanglement around mouth and rostrum caused malnutrition and infection. No gear recovered.
12/13/01	mortality	7m (est) unk sex,	Massachusetts Bay, MA 42° 21'N 70° 43'W		P	Unknown fishery. Pictures show evidence of fairly fresh entanglement marks on tail stock and across flukes. No gear recovered.
7/17/02	mortality	4.6m (est) female	Bar Harbor, ME 44° 18'N 68° 07'W		P	Unknown fishery. Carcass had a rope scar on the peduncle with associated hemorrhaging. Additional bruising around the epiglottis and larynx. No gear recovered.
10/15/02	mortality	5.1m female	Gloucester, MA 42° 36'N 70° 39'W		P	Gear from state waters lobster fishery. Whale was entangled through the mouth and around the pectoral flippers. Gear still on the whale.
5/24/03	mortality	7.6m male	Glouster, MA 42° 41'N 70° 39'W		P	Unknown fishery. Line marks on head and dorsal fin, no line present. Cut across back anterior to dorsal fin. No gear recovered.
5/31/03	mortality	3.6m (est) female	Martha's Vineyard, MA 41° 21'N 70° 47'W		P	Unknown fishery. Whale stranded live wrapped in about 15 feet of 2-3 inch mesh netting; probably trawl gear.
6/28/03	Mortality	5.1m male	Chatham, MA 41° 40'N 69° 55'W		P	Lobster fishery. Whale wrapped in line.
8/9/03	Mortality	3.5m (est) unk sex	Harwich, MA 41° 37'N 70° 03'W		P	Unknown fishery. Hemorrhaging in areas with net marks on whale. No gear recovered.

Date	Report Type	Sex, age, ID	Location	Assigned Cause: P=primary, S=secondary		Notes / Initial observations
				Ship strike	Entang./ Fsh.inter	
9/13/03	Mortality	6m (est) female	Casco Bay, ME 43° 42'N 69° 58'W		P	Unknown fishery. Fresh dead. External chaffing marks and belly slit open. No gear recovered.
5/6/04	Mortality	7.7m female subadult	Marthas Vineyard, MA 41° 21'N 70° 40'W		P	Unknown fishery. Constricting line marks on tail stock. Indications of drowning from internal exam. No gear recovered.
6/1/04	Mortality	6.5m female subadult	Chatham, MA 41° 40'N 69° 56'W	P		Shipe strike. Large area of subdermal hemorrhaging.
7/19/04	Mortality	7.9m female adult	Eastham, MA 41° 54'N 69° 58'W		P	Unknown fishery. Extensive entanglement markings. No gear recovered.

Table 8. Confirmed human-caused mortality and serious injury records of western North Atlantic Brydes whales, 2000 - 2004.

Date	Report Type	Sex, age, ID	Location	Assigned Cause: P=primary, S=secondary		Notes / Initial observations
				Ship strike	Entang./ Fsh inter	
3/13/03	mortality	11.0m male	New Hanover, NC 33° 55'N 78°13'W		P	Deeply embedded line; whale extremely emaciated NC03-052



# Procedures for Issuing Manuscripts in the *Northeast Fisheries Science Center Reference Document (CRD) Series*

---

**Clearance:** All manuscripts submitted for issuance as CRDs must have cleared the NEFSC's manuscript/abstract/webpage review process. If any author is not a federal employee, he/she will be required to sign an "NEFSC Release-of-Copyright Form." If your manuscript includes material lifted from another work which has been copyrighted, then you will need to work with the NEFSC's Editorial Office to arrange for permission to use that material by securing release signatures on the "NEFSC Use-of-Copyrighted-Work Permission Form."

**Organization:** Manuscripts must have an abstract and table of contents, and — if applicable — lists of figures and tables. As much as possible, use traditional scientific manuscript organization for sections: "Introduction," "Study Area"/"Experimental Apparatus," "Methods," "Results," "Discussion" and/or "Conclusions," "Acknowledgments," and "Literature/References Cited."

**Style:** The CRD series is obligated to conform with the style contained in the current edition of the *United States Government Printing Office Style Manual*. That style manual is silent on many aspects of scientific manuscripts. The CRD series relies more on the *CBE/CSE Style Manual*. Manuscripts should be prepared to conform with these style manuals.

The CRD series uses the American Fisheries Society's guides to names of fishes, mollusks, and decapod crustaceans, the Society for Marine Mammalogy's guide to names of marine mammals, the Biosciences Information Service's guide to serial title abbreviations, and the International Standardization Organization's guide to statistical terms.

For in-text citation, use the name-date system. A special effort should be made to ensure that all necessary bibliographic information is included in the list of cited works. Personal communications must include date, full name, and full mailing address of the contact.

**Preparation:** Type a clean/neat, single-spaced version of the document. The document must be paginated continuously from beginning to end and must have a "Table of Contents." Begin the preliminary pages of the document — always the "Table of Contents" — with page "iii." Begin the body of the document — normally the "Introduction" — with page "1," and continuously paginate all pages including tables, figures, appendices, and indices. You can insert blank pages as appropriate throughout the document, but account for them in your pagination (*e.g.*, if your last figure ends on an odd-numbered/right-hand page such as "75," and if your next page is the first page of an appendix, then you would normally insert a blank page after the last figure, and paginate the first page of the appendix as "77" to make it begin on an odd-numbered/right-hand page also). Forward the final version to the Editorial Office as both a paper copy and electronically (*i.e.*, e-mail attachment, 3.5-inch floppy disk, high-density zip disk, or CD). Microsoft Word should be used to create all text files.

**Production and Distribution:** The Editorial Office will develop the inside and outside front covers, the inside and outside back covers, and the title and bibliographic control pages (pages "i" and "ii") of the document, then combine those covers and preliminary pages with the text that you have supplied. The document will then be issued online.

Paper copies of the four covers and two preliminary pages will be sent to the sole/senior NEFSC author should he/she wish to prepare some paper copies of the overall document as well. The Editorial Office will only produce three paper copies (*i.e.*, two copies for the NEFSC's libraries and one copy for its own archives) of the overall document.

A number of organizations and individuals in the Northeast Region will be notified by e-mail of the availability of the online version of the document. The sole/senior NEFSC author of the document will receive a list of those so notified.

---

Research Communications Branch  
Northeast Fisheries Science Center  
National Marine Fisheries Service, NOAA  
166 Water St.  
Woods Hole, MA 02543-1026

**MEDIA  
MAIL**

## **Publications and Reports of the Northeast Fisheries Science Center**

The mission of NOAA's National Marine Fisheries Service (NMFS) is "stewardship of living marine resources for the benefit of the nation through their science-based conservation and management and promotion of the health of their environment." As the research arm of the NMFS's Northeast Region, the Northeast Fisheries Science Center (NEFSC) supports the NMFS mission by "conducting ecosystem-based research and assessments of living marine resources, with a focus on the Northeast Shelf, to promote the recovery and long-term sustainability of these resources and to generate social and economic opportunities and benefits from their use." Results of NEFSC research are largely reported in primary scientific media (*e.g.*, anonymously-peer-reviewed scientific journals). However, to assist itself in providing data, information, and advice to its constituents, the NEFSC occasionally releases its results in its own media. Currently, there are three such media:

*NOAA Technical Memorandum NMFS-NE* -- This series is issued irregularly. The series typically includes: data reports of long-term field or lab studies of important species or habitats; synthesis reports for important species or habitats; annual reports of overall assessment or monitoring programs; manuals describing program-wide surveying or experimental techniques; literature surveys of important species or habitat topics; proceedings and collected papers of scientific meetings; and indexed and/or annotated bibliographies. All issues receive internal scientific review and most issues receive technical and copy editing.

*Northeast Fisheries Science Center Reference Document* -- This series is issued irregularly. The series typically includes: data reports on field and lab studies; progress reports on experiments, monitoring, and assessments; background papers for, collected abstracts of, and/or summary reports of scientific meetings; and simple bibliographies. Issues receive internal scientific review, but no technical or copy editing.

*Resource Survey Report* (formerly *Fishermen's Report*) -- This information report is a quick-turnaround report on the distribution and relative abundance of selected living marine resources as derived from each of the NEFSC's periodic research vessel surveys of the Northeast's continental shelf. There is no scientific review, nor any technical or copy editing, of this report.

**OBTAINING A COPY:** To obtain a copy of a *NOAA Technical Memorandum NMFS-NE* or a *Northeast Fisheries Science Center Reference Document*, or to subscribe to the *Resource Survey Report*, either contact the NEFSC Editorial Office (166 Water St., Woods Hole, MA 02543-1026; 508-495-2350) or consult the NEFSC webpage on "Reports and Publications" (<http://www.nefsc.noaa.gov/nefsc/publications/>).

**ANY USE OF TRADE OR BRAND NAMES IN ANY NEFSC PUBLICATION OR REPORT DOES NOT IMPLY ENDORSEMENT.**