

Entanglement in commercial fishing ropes threatens the recovery of the North Atlantic right whale (*Eubalaena glacialis*), a species largely restricted waters off of eastern North America. In recent years, serious entanglements have been increasing, and mortality from conflicts with fishing operations exceeds US legal mandates, with 83% of the population showing incidence of scarring as a consequence of these encounters.

What happens when whales encounter fishing gear is complex and poorly understood. The goal of creating these [case studies](#) (see: *North Atlantic Right Whale Entanglement Case Studies* on the [Publications Page](#)) was to combine what we know to date on the individual whales entangled, the configuration of ropes entangling them, the extent of their injuries, and what can be learned about the gear retrieved from them. There is much to learn about the nature of these conflicts, and increasing our understanding about these events can help point to some of the more promising ways to avoid them or reduce their severity.

These whale entanglement case studies are a subset of total whale bycatch that has occurred off the eastern shores of the US and Canada, with a particular emphasis on the waters south and west of Nova Scotia. Featured here are cases involving the endangered North Atlantic right whales for which:

1. Fishing gear was retrieved and warehoused by NOAA/NMFS;
2. Gear archived prior to June 2010 was made available for analysis by an independent rope engineer reflecting 30 right whale events which occurred from 1994-2010;
3. A disentanglement responder team or a necropsy team was able to document how ropes and other gear were attached to the animal; and
4. A relatively good understanding exists of some or all the injuries produced by entangling ropes (from images, video or assessments made by disentanglers).

Each two-page case study integrates into five main categories a suite of information from a variety of different sources. Together they are intended to provide a comprehensive picture about the entangling gear and its impacts on individual animals. The information contains:

- Life history information of the individual whale including catalog number/name, gender, birth year if known, age/age class when first seen entangled, and reproductive status before and after entanglement (if known);
- Timing and duration of the entanglement, wounds acquired from entanglement, disentanglement efforts, the animal's present status, and the number of prior entanglement events for the individual;
- A drawing of the gear configuration with explanatory text;
- Gear type and component if known, rope polymer, measurements of rope diameter, tested and new breaking strengths of ropes; and
- Photographs of entanglement configuration and injuries.

Appended to each two-page case study, when available, are the findings of the gear analysis carried out during this study including images of the gear.

Documentation of each entanglement case originated with the efforts of the Atlantic Large Whale Disentanglement Network, a consortium of researchers, fishermen, government managers and other professional mariners, to provide safe and efficient responses to reports of entangled whales along the North American East Coast. Further assessment was done by the authors after reviewing all sightings data, response actions, photographs and videos of the animal over the duration of its entanglement or at a necropsy. The entanglement configuration diagrams were created by an entanglement case expert who was directly involved in many of the events (Scott Landry/Provincetown Center for Coastal Studies). The diagrams are intended to make as clear as possible the most plausible layout of gear on a whale's body at the time of its first discovery, and not depict the details of the gear itself or the level of injury to whales.

Life history, sighting, and fate information for North Atlantic right whales was obtained by permission from the North Atlantic Right Whale Consortium Catalog (curated by the New England Aquarium [NEAq]).

Fishing ropes retrieved from the entanglements and warehoused by NMFS were examined by a rope engineer, Hank McKenna, to determine their polymer type, diameter, color, breaking strength, condition, and other properties of their construction. These data supplement reports already compiled by NMFS about these ropes.

Acknowledgments

These case studies resulted from the work of many individuals who have been involved in whale research, gear research, necropsies, and disentanglement interventions over several decades. The case studies were prepared by Amy Knowlton and Candace Borutskie of the New England Aquarium, and Scott Landry of the Provincetown Center for Coastal Studies. We would like to thank John Kenney from NMFS for access and assistance with retrieved gear, and Patrice McCarron and Heather Tetreault of Maine Lobstermen's Association, Stormy Mayo and Brian Sharp of PCCS, and Michael Moore of Woods Hole Oceanographic Institution for their guidance and input in developing the case studies.

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For more information, see also the Conservation Biology paper by [Knowlton et al \(2016\)](#) on the Publications Page, or on the [Conservation Biology Website](#).