

**Scientific Advice from the
Working Group on Marine Mammal Unusual
Mortality Events to NOAA Fisheries
on the Entanglement Risk to Whales from the use
of Knots in Fixed Gear Fisheries**

Working Group on Marine Mammal Unusual Mortality Events
August 2022



A. Background

The purpose of the Working Group on Marine Mammal Unusual Mortality Events (Working Group) is to provide guidance to the Secretary of Commerce and the Secretary of Interior on characterizations of and responses to unusual marine mammal mortality events as authorized under the Marine Mammal Health and Stranding Response Act of 1992 which was codified under Title IV of the Marine Mammal Protection Act (MMPA; Public Law 102-587, 16 U.S.C. 1421-1421(h)). The Federal Advisory Committee Act (5 App. U.S.C.) does not apply to the Working Group (Section 404. (a)(1)(B)). There are currently several large whale unusual mortality events (UMEs) in which fishery interactions and entanglements are causes of injury and death in multiple species including North Atlantic right, humpback, and minke whales. Therefore, National Marine Fisheries Service (NMFS) requested that the Working Group provide expert scientific advice following briefings by subject matter experts on the subject of the entanglement risk to whales from knots in rope used in fixed gear fishing.

While we know whales become entangled in fishing gear, we do not yet fully understand the nature of how whales become entangled and whether knots and knot types may pose additional risks for entanglements leading to serious injury or mortality. For example, we do not understand the risk of injury from specific types or pieces of fishing gear (e.g., buoy lines used in fixed gear fisheries). There are various methods for weakening vertical lines, but knots represent a simple, inexpensive option. NMFS' partners are currently testing several gear configurations, including knots, to determine whether and to what extent various types of line are weakened by these gear configurations. Take Reduction Teams (TRT) are authorized under Section 118 of the MMPA and early in the discussions at the Atlantic Large Whale Take Reduction Team, it was suggested that knots in a buoy line could increase the risk to whales of entanglement as it increases the potential for the line to become caught in the whale's baleen. Over time, TRT members have gone back and forth on this; worrying about an increased risk if a knot "cleats" into the baleen, while recognizing the value of knots in weakening lines and possibly reducing the risks associated with a gear interaction. Knots are not prohibited at this time and knots are commonly used in buoy lines due to various fishing practices (e.g., at-sea repairs, or lengthening and shortening lines when moving between depths). However, the Take Reduction Plan regulations do "discourage" the addition of knots. Given the lack of empirical data and the critical need to provide timely informed assessment to support conservation and management decisions, NMFS requested the Working Group provide expert scientific advice on the entanglement risk to whales of knots in fixed gear fishing buoy lines, compared to absence of knots. Other weak link contrivances were not considered.

B. Process

Three virtual education webinars given by subject matter experts were held for the Working Group to provide background material on the following subjects prior to answering the questions.

1. North Atlantic right whale and other baleen whale mouth entanglements in general, including configurations and injuries – July 14, 2021; Speakers, Scott Landry, Center for Coastal Studies, and Dr. Michael Moore, Woods Hole Oceanographic Institute

2. Anatomy of the mouth and baleen – July 29, 2021; Speakers Dr. Ann Pabst and Bill McLellan, University of North Carolina, Wilmington

3. Existing fishing gear and information on knots (strengths, weaknesses) including gear types and rope and how knots impact rope strength, etc. – July 30, 2021; Speakers Erin Summers, Maine Department of Marine Resources, Kevin Staples, Maine Department of Marine Resources, Bob Glenn, Massachusetts Department of Marine Resources and Rob Martin, NMFS

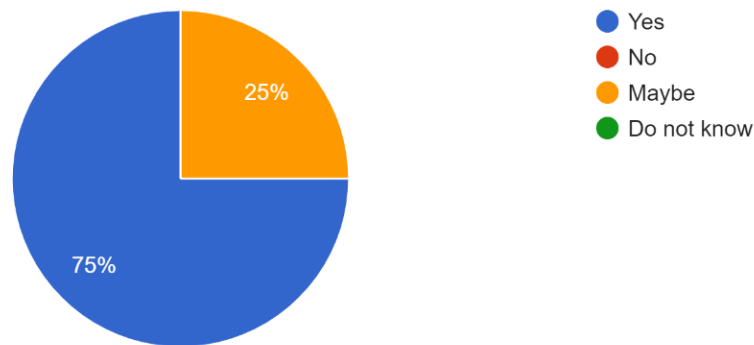
These educational webinars were followed by four additional virtual webinar sessions to discuss, clarify and refine the final questions. Below is a summary of the five questions, answers, and additional comments provided by the Working Group members. We had eight of the 12 Working Group members answer the questions. The four members that did not participate included two members that recused themselves and two that could not participate due to work, family, or health reasons.

C. Questionnaire Summary

Question 1

1. Would knots in ropes attached to typical fixed gear fishing buoy lines (compared to no knots) increase the likelihood that a whale would become entangled when it encounters rope?

8 responses



Comments Question 1

We had 100% (8 of 8) of Working Group members respond either Yes (75%) or Maybe (25%) that knots in rope would increase the likelihood that a whale would become entangled when it encountered rope. Below are some of the comments the Working Group members provided when answering this question.

For clarity, encounter was interpreted to mean physical contact with rope. Minimally, knots are likely to increase the potential of oral/baleen entanglements due to their size making it more difficult for line to self-release by spooling through the baleen. Additionally, because knots are attached to gear, this tension and resulting drag in rope makes entanglement more likely. Also given that knots in rope add friction to potentially limit the movement of rope or may catch more

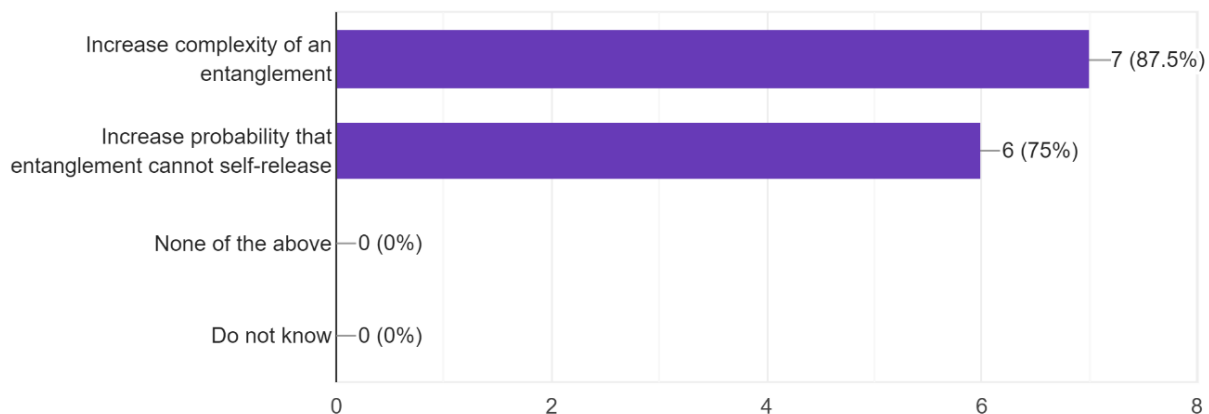
easily on mouth and body parts, it is likely knots increase the likelihood of a whale remaining entangled if it encounters rope

From anecdotal evidence of non-mouth entanglements, it also seems likely that knots increase the likelihood of rope cleating off on different body parts. The physics appear relatively self-evident when handling rope under tension as it goes over pronounced edges or sharp features (e.g., boat gunnel/transom), as are found in areas like the peduncle, flukes, blowhole/rostrum, and axillae.

Question 2

2. Would knots in rope (compared to no knots) affect the likelihood of any of the following outcomes or risks (select all that apply)?

8 responses



Comments Question 2

Working Group members responded to this question agreeing that either knots Increased Complexity of an Entanglement (87.5%) and/or Increased the Probability that the Entanglement Cannot Self-release (75%). No Working Group members thought that knots would not result in one of the above consequences. Below are some of the comments the Working Group members provided when answering this question.

Regarding the increased complexity of an entanglement question, it is logical that existing knots in lines would provide a location for other line to cleat or bind thus increasing the complexity of the entanglement. Regarding increased probability that entanglement cannot self-release, it is logical that if a knot becomes cleated on a baleen or another part of the body, the probability of self-release goes down, especially if the whale rolls/thrashes and the entanglement becomes more complex. Additionally, since knots can increase the likelihood of cleating, this would consequently reduce likelihood of shedding or the line spooling out past the animal. Lastly, some members answered this question by considering only the likelihood of these things occurring with mouth entanglements since data on entanglements of other parts of the body was limited.

Question 3

3. Do knots in rope (compared to no knots) increase the likelihood of line getting caught in the baleen or wrapped around the head?

8 responses



Comments Question 3

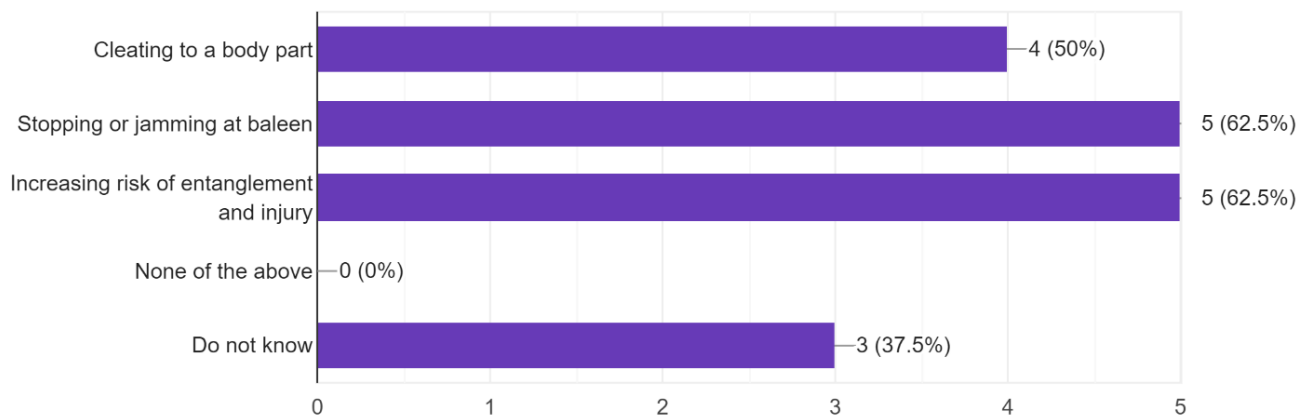
We had 100% (8 of 8) of Working Group members respond Yes (100%) that knots in rope would increase the likelihood of rope getting caught in the baleen or wrap around the head. Below are some of the comments the Working Group members provided when answering this question.

The narrow regions of the baleen plates provide a cleat for knot entanglement. This then increases the likelihood of rope wrapping around some region of the head. As discussed in Question 1, knots will not allow line to spool through the baleen and self-release.

Question 4

4. Would a wider knot diameter have a higher likelihood of the following (select all that apply)?

8 responses



Comments Question 4

Working Group members responded to this question agreeing that a wider knot diameter could increase the Likelihood of Cleating to a Body Part (50%); Stopping or Jamming at the Baleen (62.5%); Increasing the Risk of Entanglement and Injury (62.5%) and/or Do Not Know (37.5%). Below are some of the comments the Working Group members provided when answering this question.

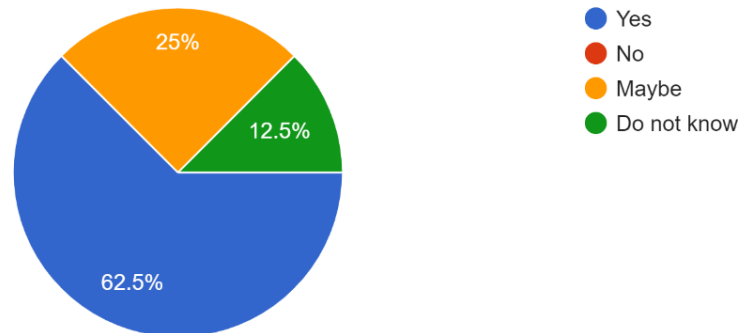
It seems logical that the wider the knot diameter, the higher the likelihood that the knot would become stopped or jammed at the baleen and/or cleated to a body part. This would especially be the case if the knot diameter was larger than the space between the baleen. Additionally, a larger knot will require greater forces and more baleen deformation to thread through.

This question was difficult to answer, “Do not know” was chosen because data on knot diameter was not presented to the group. However, it seems logical that a larger knot could make entanglement more likely, especially for a very wide range of knot sizes. That is, a very small knot may be more likely to “pull through” without cleating on the body or stopping in baleen compared to a larger knot.

Question 5

5. Would knots interfere with or make an entanglement response more difficult for responders?

8 responses



Comments Question 5

We had 87.5% (7 of 8) of Working Group members respond either Yes (62.5%) or Maybe (25%) that knots would interfere with or make an entanglement response more difficult, with one member responding Do Not Know (12.5%). Below are some of the comments the Working Group members provided when answering this question.

Material presented by the subject matter experts during the education webinars and answers to follow up questions made it quite clear that knots do complicate disentanglement efforts. Though there may be some scenarios in which knots could be beneficial, the most common empirical evidence appears to be knots causing the line to part prematurely, resulting in loss of the disentanglement “control line”. This can either mean premature disconnecting of

disentanglement tools (*e.g.*, buoys, control lines, etc.) or shortening of the control line to an inaccessible length or dangerous anatomical location for re-attaching. In addition, when cuts are made in the line by disentanglement teams, knots can prevent the cut line from slipping past baleen and/or appendages.

Question 6. Any additional comments?

Several Working Group members added some additional comments and identified some areas of data or research gaps during the virtual discussions.

The following data or research gaps were identified:

- 1 The need to collate existing data on the occurrence of knots involved in entanglements occurring around different body parts from dead stranded and live free-swimming entangled whales.
- 2 The need to collate existing data on the knot diameter size involved in entanglements from dead stranded and live free-swimming entangled whales.
- 3 The need to collate existing data on whether knots present in previous entanglements have led to increased complexity of the entanglement from dead stranded and live free-swimming entangled whales.
- 4 The need to acquire more data on the impacts of line diameter size (thin vs thick line) cutting into a whale; and impact of diameter of line and knot size (thin vs thick knots in relation to line diameter) on entanglement risk. There may be existing data that could be collated or this may be an area where new research is required.

As well, some Working Group members felt that if more detailed information is needed in the future on this topic, especially for items already mentioned above as data gaps or gaps in research, that an expert elicitation with appropriate gear and whale experts might be beneficial to the process.

D. Conclusion

After three educational webinars and four virtual discussion sessions, the Working Group provided expert scientific advice on the risk to whales of the use of knots in fixed gear fishing buoy lines by answering the above questionnaire.

In summary, the majority of Working Group members agreed that knots in rope attached to typical fixed gear fishing buoy lines (compared to no knots) would:

1. Increase the likelihood that a whale would become entangled when it encounters rope;
2. Increase the complexity of an entanglement;
3. Increase the probability that an entanglement cannot self-release;
4. Increase the likelihood of line getting caught in the baleen or wrapped around the head;
5. Interfere with or make an entanglement response more difficult; and
6. That a wider knot diameter could increase the likelihood of stopping or jamming at the baleen, and increasing the risk of entanglement and injury.

Therefore, although this is a complex issue, the Working Group overall agreed that on balance knots in fixed gear fishing buoy lines could be detrimental to whales and increase the risk of entanglement.