New England Aquarium

Protecting the blue planet

Mr. Ben Friedman
Deputy Under Secretary for Operations, performing the duties of Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator
National Oceanic and Atmospheric Administration

Re: Document ID NOAA-NMFS-2020-0031-0006 on the Proposed Rule *Taking of Marine Mammals Incidental to Commercial Fishing Operations; Atlantic Large Whale Take Reduction Plan Regulations; Atlantic Coastal Fisheries Cooperative Management Act Provisions; American Lobster Fishery*

March 1, 2021

Dear Mr. Friedman,

In response to the National Oceanic and Atmospheric Administration's (NOAA) Proposed Rule (Proposed Rule) to amend the regulations implementing the Atlantic Large Whale Take Reduction Plan to reduce the incidental mortality and serious injury to North Atlantic right whales (*Eubalaena glacialis*), fin whales (*Balaenoptera physalus*), and humpback whales (*Megaptera novaeangliae*) in northeast commercial lobster and crab trap/pot fisheries to meet the goals of the Marine Mammal Protection Act and the Endangered Species Act, the New England Aquarium (Aquarium) submits this comment to express our strong reservations that the measures outlined in the Proposed Rule and accompanying Draft Environmental Impact Statement (DEIS) are not nearly aggressive enough to change the fate of North Atlantic right whales (NARW) in U.S. waters. ***Based on our decades of NARW expertise, the Aquarium strongly urges NOAA to revise this Proposed Rule substantially before finalizing it***.

Founded in 1969, the Aquarium is a catalyst for global change through public engagement, commitment to marine animal conservation, leadership in education, innovative scientific research, and effective advocacy for a vital and vibrant ocean. For decades, the Aquarium has been working to protect marine and freshwater ecosystems from human impacts and conserve threatened and endangered animals and habitats. The Aquarium's scientists conduct cutting-edge research to understand, quantify, and reduce the consequences of human activities on the health of marine species and ecosystems by developing science-based solutions and advocating for policies that balance human use of the ocean with the need for a healthy, thriving ocean now and in the future.

Scientists at the Aquarium have been researching NARWs for more than 40 years with the express goal of preventing this species from going extinct. To that end, scientists from the Aquarium have served on the Atlantic Large Whale Take Reduction Team (ALWTRT) since it was formed in 1996. While we are pleased to see that published research by our scientists was used to inform aspects of the Proposed Rule, our primary concern with the Proposed Rule is that it fails to utilize more recent scientific results and, as a result, the proposed measures will fail to reduce the risks to NARWs and other whales from entanglements in fixed fishing gear resulting in serious injuries and mortalities.

The Aquarium's detailed comments regarding the Proposed Rule and DEIS follow together with specific, scientifically-informed recommendations on how to strengthen the regulations before they becomes final. We trust these comments will be viewed as a constructive contribution to the ongoing deliberations, and we are pleased to elaborate or clarify further as needed.

North Atlantic right whales: Status and Overview of Risks

The population of NARWs has been in decline since 2010, and the best population estimates indicate that there are only 356 animals alive today[1]. Given the small size of the population, this species does not have the capacity to sustain high death rates and unpredictable, but declining birth rates.

During the 2000s, calving rates averaged 24 calves per year, but over the past 12 years (2010-2021), calving rates have decreased to an average of 12 per year and, in 2018, no calves were born[2]. Low calving rates, likely exacerbated by the deteriorating health of reproductive females (Christiansen et al. 2020) caused by prolonged stress from entanglements in fixed fishing gear and other stressors, make it less and less likely that the population will be able to recover unless changes are made to eliminate human-caused mortality and help this species survive.

Human-caused mortality and serious injury of NARWs has exceeded legal limits for the past 20 years and has increased in recent years (Sharp et al. 2019). Furthermore, recently published results show that for the period 2010-2017, the probability of detecting a whale carcass was just 29 percent, which means that for every observed death of a NARW, as many as three additional whales have likely died (Pace et al. 2021). This is particularly relevant to the Proposed Rule because, as the Pace et al. (2021) paper details, unobserved mortalities likely result from entanglements rather than vessel strikes.

Mortalities and serious injuries of NARWs from fishing gear entanglements have steadily increased from 2001 to the present (Pace et al. 2021; Sharp et al. 2019; and Knowlton et al. 2016). Changes in the fishing industry likely contributed to this increase. First, the annual number of trap tags documented by the Maine Department of Marine Resources has steadily increased over time, first exceeding one million traps in 1970, followed by two million traps in 1982, and three million traps in 1999. The number of trap tags sold has remained close to or over three million through 2019[3]. Second, in the mid-1990s, rope manufacturing technology changed, which nearly doubled the strength of ropes used for fishing (McKenna et al. 2004). Finally, lobster distribution has shifted and more fishermen are choosing to fish offshore in more months of the year[4], which is resulting in greater and more unpredictable overlap with NARWs who are shifting their movements due to climate change (Record et al. 2019). An assessment of 30 years of entanglement data (1980-2009) showed a total of 83 percent of all NARWs had been entangled at least once in their lives, and 59 percent had been entangled more than once (Knowlton et al. 2012). Subsequent analyses that included data through 2018 showed that the number of NARWs that had been entangled at least once increased to 87 percent and that the frequency of moderate and severe injuries also increased[5]. From 2010-2018, a total of 558 entanglements were documented, resulting in 112 moderate injuries and 84 severe injuries that had both lethal (Sharp et al. 2019) and sublethal effects (Robbins et al. 2015; Knowlton et al. 2016) on this species[6].

[1] https://www.narwc.org/report-cards.html
[2] https://www.narwc.org/report-cards.html
[3] https://www.maine.gov/dmr/commercial-fishing/landings/documents/lobster.table.pdf
[4] https://mlcalliance.org/all-about-lobster/lobster-2-2-inshore-vs-offshore-fishing/
[5] https://www.narwc.org/uploads/1/1/6/6/116623219/catalog_report-2020_-_final.pdf
[6] https://www.narwc.org/uploads/1/1/6/6/116623219/catalog_report-2020_-_final.pdf

Percent Risk Reduction

RECOMMENDATION 1: In its Final Rule, NOAA should implement measures that reduce the risk of entanglements of NARWs and other cetaceans in fixed fishing gear by at least 80 percent.

North Atlantic right whales have been in decline for a decade after a slow documented recovery from the whaling era (Pace et al. 2017). In the absence of strong rules preventing entanglements and vessel strikes, the abundance of the species has declined at an unacceptable rate to the current number of 356 remaining animals[7]. Recognizing the time required to finalize regulations that result in action on the water, we expect the species' abundance will only continue to decline. The Proposed Rule was developed to reduce the risks of entanglements in fishing gear by a minimum of 60 percent, which may have been satisfactory when this process started in 2017, but is no longer sufficient now that that there are substantially fewer (16 percent) NARWs today than in 2017.

Because the Proposed Rule does not account for the most recent population number and the delays in finalizing regulations despite having this information available while the rule was being drafted (Pace et al. 2021), reducing the risk by at least 80 percent is now more appropriate. The Proposed Rule should be revised to reflect the best-available scientific data on the status of the population and to meet NOAA's legal requirements under the Marine Mammal Protection Act and the Endangered Species Act.

The Proposed Rule's accompanying DEIS states that "the immediate goal of a take reduction plan is to reduce the serious injury and mortality of strategic stocks being taken during U.S. commercial fishing operations to below PBR levels within six months of its implementation. The long-term goal of a take reduction plan is to reduce, within five years of its implementation, the incidental mortality and serious injury of strategic marine mammals taken in the course of commercial fishing operations to insignificant levels approaching a zero mortality and serious injury rate…" (p. 299); however, the Aquarium argues that reducing risk by 60 percent will not reduce mortalities and serious injuries to below the Potential Biological Removal (PBR) of 0.8 in a five-year timeframe.

The Aquarium would like to take this opportunity to address a common misinterpretation of the modeling results presented in Linden (2021) that suggested removing all mortality attributed to lobster fishing will not prevent the population from declining. This misinterpretation is used to argue that restrictions to the lobster fishery are not justified as they will not improve the conservation status of NARWs. This reasoning is fallacious. The matrix model used in Linden (2021) is the same one published in Corkeron et al. (2018), using the R code from that paper. What Linden (2021) does not provide is the estimates of annual survival and fecundity used to populate the model matrix. As Corkeron et al. (2018) demonstrate, using the upper estimates of survival that NARWs are capable of results in an annual population increase on the order of four percent. Corkeron et al. (2018) also demonstrate that the vast majority of NARW mortality is due to anthropogenic causes (including lobster fishing). Therefore, if all anthropogenic mortality were eliminated to allow NARWs to recover, their population should increase in abundance at about four percent per year. As entanglement in fishing gear accounts for a significant proportion of anthropogenic mortality and morbidity of NARWs (Sharp et al. 2019 and Pace et al. 2021), reducing the risks of mortality and serious injury from entanglements will have a conservation benefit.

[7] https://www.narwc.org/report-cards.html

Closures

RECOMMENDATION 2: The Aquarium supports closures as a highly effective tool to reduce the risk of entanglements in fishing gear and is a proponent of ropeless gear. The Aquarium recommends that NOAA take following actions to reduce the risks even further:

a. Re-evaluate the closures in the Proposed Rule using a risk-reduction target of 80 percent rather than 60 percent.

b. Develop a mechanism that allows that allows for expeditious adjustments to be made to the timing and spatial extent of the closures based on scientific observations that include visual and acoustic sighting detections and computer modeling confirming the absence or presence of NARWs.

c. Allow Exempted Fishing Permits (EFPs) in closed areas to evaluate the feasibility of ropeless gear and further assess potential risks posed by groundlines, early release of endlines, and increased fishing vessel traffic.

Eliminating vertical lines in the water column is the best tool for eliminating risk of entanglements of NARWs, and closures are an effective tool to accomplish that. Whales and other marine life in closed areas typically experience zero risk of becoming entangled in fishing gear, and the Aquarium supports implementing these measures as one of the methods NOAA can and should employ to reduce the risks of entanglements.

The distribution of NARWs has shifted dramatically over the past decade, and climate change has made their movements more difficult to predict. As new aggregation areas are identified from direct observations, acoustic detections, and/or modelling, it is important to have a rapid regulatory response method to change, expand, or extend closures as needed and to allow ropeless fishing in these closed areas. A network of closures should occur throughout the species' range and protect a sufficiently large enough area to help the population recover (see "Scientist letter," Appendix 1).

To ensure testing of ropeless gear is conducted as safely as possible, the Aquarium recommends the following:

1. A thorough evaluation and report by the National Marine Fisheries Service (NMFS) gear team to determine if sinking groundlines have been found on known U.S. gear entangling large whales since that regulation was implemented in 2009;

2. A mandate that endlines used in ropeless gear are 1700 pound of force (LBF) breaking strength through the entire length of the rope; and

3. A requirement that fishing vessels operate at less than ten knots in the EFP and the closed area regardless of their vessel length.

Allowing EFPs into existing closures (Massachusetts Restricted Area and Great South Channel Restricted Trap/Pot Area), where entanglement risk is currently zero, will inherently increase risk. Considerations of EFPs in these areas must be conservative and include both careful evaluation of this introduced risk as well as extensive monitoring. The Aquarium recommends EFPs be allowed in these presently closed areas only after careful review of testing being conducted elsewhere in the United States and Canada to understand how much risk might be introduced and whether or not that risk can be reduced.

With respect to the closures detailed in the Proposed Rule, the Aquarium supports maintaining the two existing closures (the Massachusetts Restricted Area and the Great South Channel Restricted Trap/Pot Area) as well as implementing the two new seasonal restricted areas (offshore of Maine along the LMA1 and LMA3 border and south of Cape Cod and Nantucket) with the caveat that the closed areas—including both existing and new closures—be reassessed for both spatial extent and timing using a risk reduction target of 80 percent to reduce mortalities and serious injuries below PBR and enable NARWs to recover.

The Aquarium is concerned that the restricted area offshore of Maine (LMA1 restricted area) is not large enough as the Northeast Fisheries Science Center model is based on outdated survey data that are only from summer months. In determining the boundaries and extent of the LMA 1 restricted area, the DEIS relies on its Decision Support Tool (DST), which the Aquarium believes does not consider uncertainty appropriately. For more information, please see the "Incorporating Uncertainty" section of the Aquarium's recent comment on NOAA's Biological Opinion (Appendix 2).

With respect to the proposed restricted area south of Nantucket and Martha's Vineyard, aerial surveys show NARWs in the region most months of the year since 2017 (Quintana-Rizzo pers. comm., paper in review) with as much as 25 percent of the population present from December through May (Figure 1). Given these data, we argue that this region should be considered for a year-round closure and that the largest area proposed be implemented in the Final Rule. In the absence of a year-round closure south of Nantucket and Martha's Vineyard, areas where 1700 lbf rope and/or contrivances can't be used (i.e. offshore) should remain closed except for fishermen with permits to use ropeless gear.

Finally, according to recently published technical guidelines from the United Nations' Food and Agriculture Organization, time-area or spatial closures can be effective when data about the marine mammals are known, such as distribution, abundance, survival rates, population viability, year-to-year variability, distribution of fishing effort, and level of bycatch (FAO 2021). Additionally, the guidelines state:

> *To be effective, spatial closures should have positive impacts not only within the areas themselves but also for the population as a whole. Only a few studies have quantified the effect of closures on the bycatch species or populations of marine mammals for which they were established. Gormley et al. (2012) used tag-recapture data of Hector's dolphins in the vicinity of a small reserve in New Zealand that bans the use of gillnets: they found that the reserve increased the means of survival probability for the resident population, but the size of the reserve was in itself insufficient for the recovery of the overall population. Slooten (2013) modelled the potential for population recovery of this endangered species throughout its entire range under the existing spatial management system,*

and concluded that the existing scheme (reserve locations, sizes and management regimes) was unlikely to lead to a recovery of the Hector's dolphin population, and nor would it prevent the species from continuing its decline. Rojas-Bracho and Reeves (2013) concluded that protected areas needed to encompass the entire range of the critically endangered vaquita (Phocoena sinus) in order to eliminate bycatch completely and give the remaining population a higher probability of recovery. The consensus from these studies is that adopting spatial closures as a principal management response for the reduction of bycatch of marine mammals did not achieve adequate – or indeed measurable – population recovery. This does not mean that they cannot contribute to achieving population stabilization (FAO 2021).

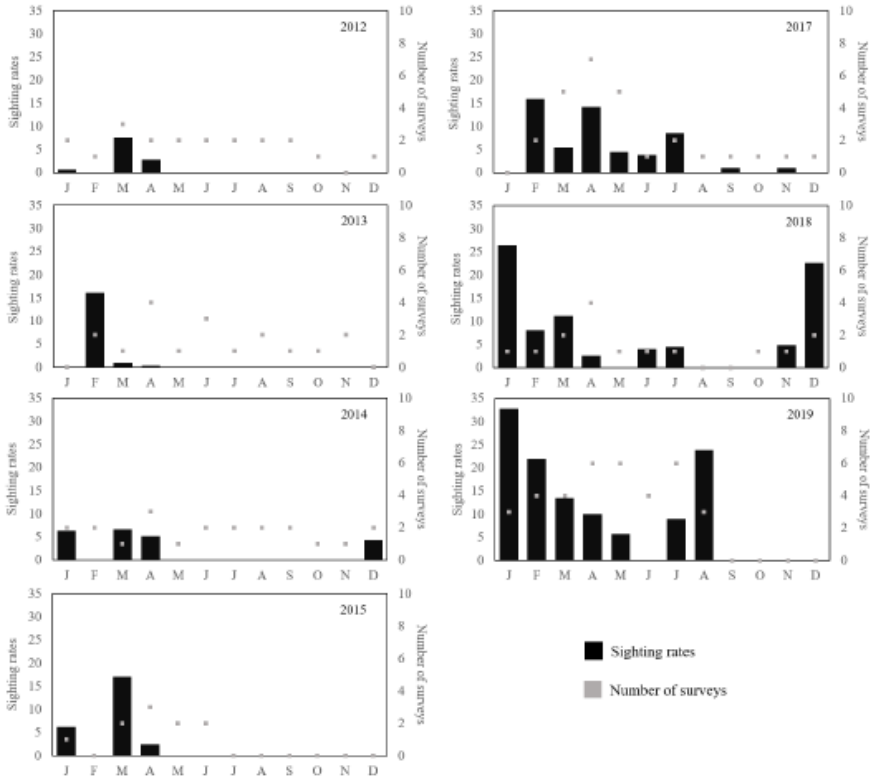

Figure 1: Monthly sighting rates of NARWs and monthly aerial surveys conducted in the southern New England wind energy area. Sighting rate is defined as the number of NARWs per 1,000 km of survey (Quintana-Rizzo, pers. comm, paper in review).

While closures reduce the risk of entanglement in the closed areas for the duration of the closed period, the Aquarium notes that both fishing effort and the number of vertical lines ***outside*** the closed areas may increase and needs to be accounted for in NOAA's calculations of risk reduction. The FAO also identifies the risk of pushing fishing effort into other areas where denser gear can lead to more entanglements, as noted by NMFS in the DEIS. This is a particular concern in areas where data on gear density and sightings are not robust due to low survey effort and lack of historical reporting.

Recognizing that the Proposed Rule only addresses the commercial lobster and crab fishery in New England, the Aquarium suggests that in subsequent rulemakings NOAA also consider and propose additional closures for other fisheries throughout the NARW's entire U.S. range to bring the risk of mortalities and serious injuries below the PBR level.

Weak Rope and Other Proposed Gear Modifications

RECOMMENDATION 3: The Aquarium supports implementing 1700 lbf weak rope and/or contrivances every 40 feet throughout the full length of an endline outside of closed areas as an interim measure to reduce the likelihood of sustained and chronic entanglements as well as severe and lethal injuries to whales until the industry transitions to ropeless gear. The Aquarium does not view weak rope and/or contrivances as a permanent solution to eliminate the risk from entanglement impacts.

Recognizing that ropeless fishing gear is not yet ready for widespread commercial deployment in the fisheries subject to these regulations, the Aquarium realizes the need for interim measures that allow fishing to continue while also reducing the risk of mortality and serious injury to whales from entanglements in fixed fishing gear, which is why the Aquarium supports using weak ropes and/or contrivances outside of closed areas. If weak rope or contrivances can't be implemented (e.g. offshore in water depths of more than 300 feet), then the Aquarium strongly recommends that those fisheries be closed except to ropeless fishing gear.

Applying weak rope and/or contrivances as described in NOAA's Proposed Rule is unacceptable if the goal is to prevent serious injuries and mortalities to NARWs and other whale species.

Using weak rope or insertions at the top half or top third of the endline reduces risk less than the calculations suggest. In Howle et al. (2019), the authors conducted simulations using the Virtual Whale Entanglement Simulator and determined that, "*For these middle and lower water column interactions, we found that the encounter was more likely to result in a lasting entanglement.*" In these scenarios, if the rope does not part, the whale could potentially drown in the gear or develop a complex entanglement that is more likely to lead to death. Therefore, requiring that 1700 lbf rope be integrated throughout the entirety of an endline will provide the greatest benefit to reduce the severity of any entanglements.

To accommodate 1700 lbf breaking strength rope through the entire endline and not have it lead to greater gear loss, integrating a groundline extension between the first and second (or more) pots is an option. The Aquarium's work with load cell testing compared the tensions when hauling the endline of a five-pot trawl with the groundline length between the first and second pot at 90 feet and 210 feet in 200-foot water depth. In these tests, the tension was reduced by more than half when the groundline extension was added (Knowlton et al. 2018).

South Shore Sleeves with 1700 lbf breaking strength have been tested successfully in waters up to 300 feet without reconfiguring gear. Based on the map below (Figure 2), this suggests that 1700 lbf breaking strength rope could be used out to at least 12 nautical miles (nm) offshore in Maine and New Hampshire and even further offshore in Massachusetts and Rhode Island. In deeper waters, a groundline extension

that reduces the number of pots in the water column until the first pot is brought on board could be used as an approach that supports using 1700 lbf breaking strength rope.

Because rope diameters greater than 7/16 inch represent the deadliest gear to NARWs of all ages and is typically used in offshore waters, wherever the industry is unable to use 1700 lbf breaking strength rope and/or approved contrivances, we strongly recommend that those fisheries be closed indefinitely except to ropeless fishing gear.

Knowlton et al. (2016) showed that the breaking strength of ropes between adult and young juvenile NARWs was significantly different with all adults found in ropes ranging from ~4,300 to 11,400 lbf breaking strength and between ~1/2-3/4 inch diameter and 0-2 year olds in ~1,900 to 4,100 lbf ropes between ~5/16-7/16 inch diameter. Deploying ropes with strengths at or below 1,700 lbf will help all age groups.

If a whale becomes entangled, 1700 lbf breaking strength rope and/or contrivances will help ensure that the heavy bottom gear parts from the endline before a complex entanglement develops. In their North Atlantic Right Whale Consortium presentation in October 2020[8], Knowlton et al. used OrcaFlex software simulations to show that tension on the endline near the seafloor will reach 1700 lbf the quickest. This is encouraging as it would reduce the risk of complex entanglements noted by Howle et al. (2018) if the entanglements occur at depth.

In addition, applying multiple weak insertions throughout an endline is likely to reduce the risk of trailing gear. Ocean engineers have noted that the endline reaches 1700 lbf tension closest to and below the point of impact as the whale starts towing the gear. If any remaining gear is below the point where the whale strikes, the buoy above the impact point should be able to pull the rope through the mouth or other part of the body involved in the entanglement and allow the whale to shed the gear more easily.

Using weak insertions may be a cheaper option for the fishery and could potentially be more effective than fully formed weak rope if breaks occur in a more predictable fashion, although this should be evaluated by reviewing all large whale entanglements as 1700 lbf ropes and/or contrivances are integrated into the fishery. To ensure that there is an understanding of what kind of rope remains on an entangled whale, fully formed 1700 lbf breaking strength ropes should be uniquely colored (as proposed by the Massachusetts Department of Marine Fisheries[9]). If this Proposed Rule goes forward as is, which the Aquarium does not recommend or support, then any endline with one or two weak insertions at the top half or top third of an endline should be marked to show it is different than the lower part of the endline. Otherwise, it will be difficult to assess whether or not the modification has helped in the event of an entanglement.

[8] https://drive.google.com/file/d/1IEF6w-4yGUG5EMTVjO2mqo8k5jX8-UmC/view
[9] https://www.mass.gov/doc/january-28-2021-mfac-meeting-summary/download

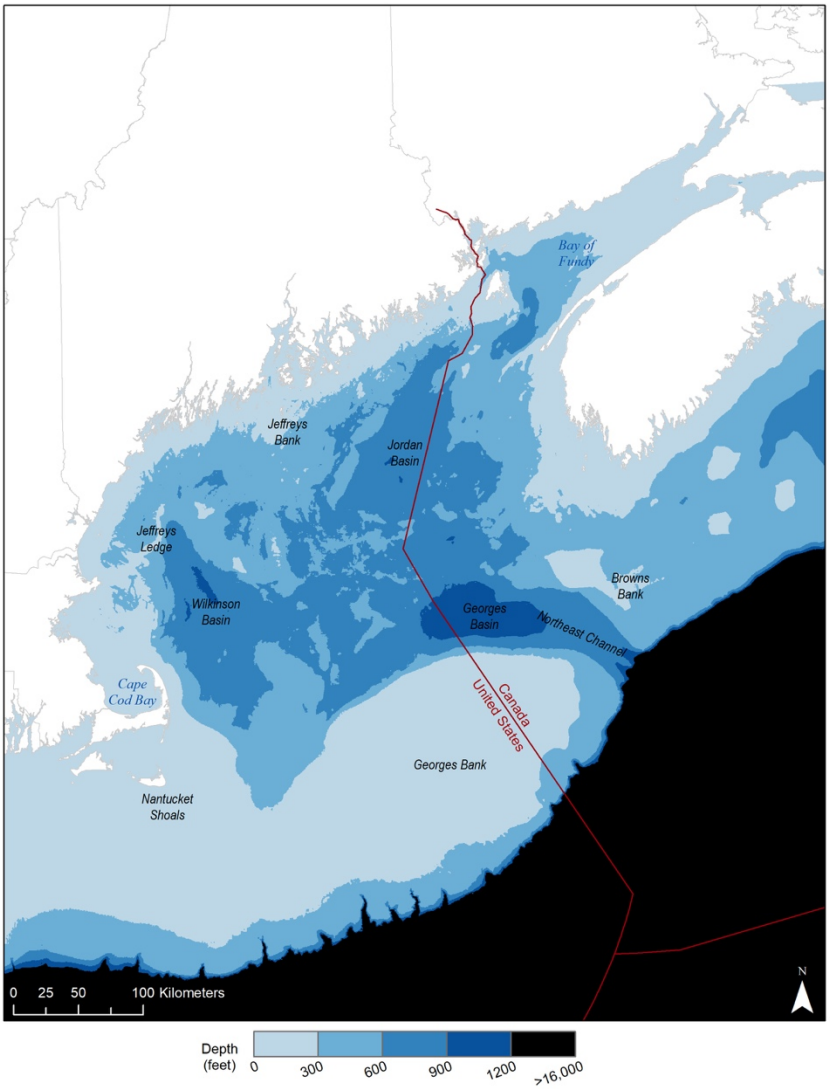

Figure 2: Bathymetric map of New England and the Gulf of Maine. Colors represent ocean depth in feet.

Additional benefits to using 1700 lbf breaking strength ropes and/or contrivances are that they may reduce the chance of a trawl being shifted by a whale or a vessel and they give the fisherman or woman a better chance of grappling for the trawl.

The intervals proposed in NOAA's rules are inadequate to reduce serious injuries and mortality resulting from entanglements in 1700 lbf breaking strength rope in any meaningful way. For fishermen and women, law enforcement efforts, and the whales, it is critical that weak rope and/or insertions be used consistently, are easy to identify, and actually prevent lethal and sub-lethal entanglements. ***Because of this, the Aquarium strongly advocates that the insertions be required every 40 feet throughout the entirety of the endline.***

In Knowlton et al.'s 2020 North Atlantic Right Whale Consortium presentation[10], collaborators showed that if weak links or weak rope weren't used in an endline, seven out of 12 scenarios (58 percent) failed to reach the standard rope breaking strength of 3720 or 7950 lbf (inshore/offshore, respectively) when pulled at four or eight knots. With weak links, only two of 12 scenarios (17 percent) failed to reach the 1700 lbf breaking strength (five-pot trawl pulled at four knots). The time to line parting with weak links (1700 lbf) integrated every 40 feet was considerably lower (five to 72 seconds) than the time to parting the stronger rope with no weak links (12 to 94 seconds), but this threshold was only reached in five of the 12 scenarios indicating some bottom gear would likely remain attached in entanglements with no weak rope or insertions. Studies suggest that this will greatly increase drag and expedite a whale's decline due to energetic impacts (van der Hoop et al. 2016 and 2017; Pettis et al. 2017). This type of scenario has been most recently observed with the entangled NARW Cottontail (Catalog No. 3920, an eleven-year-old male) who was first observed entangled in October 2020 off southern New England, resighted off the coast of Florida on February 18, 2021 in severely emaciated condition, and discovered dead off the coast of South Carolina on February 27, 2021. He apparently had weight attached to the entangling rope and was not able to be disentangled despite two attempts. It is not yet known where or in what kind of gear this entanglement occurred.

Although weak ropes and/or contrivances will not prevent entanglements from occurring, the reduced time to parting of the line and the increased likelihood that the line will part at all suggests that this is a viable interim option and should be used in all areas outside of closures and in water depths where it can be accommodated. Offshore waters where industry deems it infeasible to integrate weak rope and/or contrivances due to potential gear loss or safety concerns should be transitioned to ropeless fishing to ensure that the stronger ropes are removed from the fishery as quickly as possible.

The Aquarium notes that trailing gear even without attached bottom gear is a concern due to energetic impacts to NARWs. Maine's Department of Marine Resources conservation equivalency proposal[11] noted that line lengths ranging from 50-200 feet might be left on an entangled NARW, which they suggest that is not a concern. Research published by van der Hoop et al. (2016) demonstrates that rope drag itself has a significant effect on energetics. This impact also continues to be observed on the water. For example, NARW #2310 (a male more than 25-years old) was observed with a single line through the mouth and trailing one to two body lengths of line December 20, 2018. Subsequent sightings show the whale carrying this gear for at least 126 days while his condition continued to decline. Since he has been unable to be disentangled, he may very likely die from an entanglement that does not appear complex but is clearly being influenced by trailing gear.

Gear Marking

RECOMMENDATION 4: While the Aquarium supports the Proposed Rule regarding gear marking, gear marking itself does not reduce the risk to NARWs of entanglements in fishing gear; however, in the rare case where gear is closely observed or retrieved, knowing the location and fishery that caused the entanglement will provide valuable information to managers.

[10] https://drive.google.com/file/d/1IEF6w-4yGUG5EMTVjO2mqo8k5jX8-UmC/view
[11] https://www.maine.gov/dmr/news-details.html?id=1933868

While marking gear in itself will not reduce the risk that whales will become entangled or reduce the severity of entanglements, as stated in the Proposed Rule, *"…the markings would increase the information available regarding the fishery and state of origin of large whale entanglements to aid the efforts of NMFS and the ALWTRT…*"

The Aquarium agrees that gear marking could provide some valuable information in the small subset of entanglement cases with attached gear, but not as currently proposed. Of the 1625 entanglement events documented since 1980, only 124 cases (7.6 percent) had attached gear and only a subset of those could be traced back to origin. Because such a small fraction of detected entanglements have gear closely observed or retrieved, it is likely that many serious injuries and mortalities resulting from entanglements will remain unattributed despite the new gear marking requirements.

Alternatively, if gear marking or rope coloration focused on showing whether a rope was 1700 lbf, this would help inform whether weaker ropes are showing up on entangled whales and having the intended benefit (i.e. resulting in a lower risk entanglement). If weak insertions are integrated into endlines, they could also serve as a weak rope gear mark.

Long-term entanglements can lead to weight and fat loss causing the animals to sink after death (any heavy gear being dragged by the whale can also cause it to sink). Reducing and eliminating the risk of entanglements to NARWs in fixed fishing gear must be NOAA's priority so that identifying the origin of fishing gear becomes obsolete and unnecessary.

Effort Reduction

RECOMMENDATION 5: While NOAA's Proposed Rule does not address effort reduction as a potential tool to reduce risks of entanglements to NARWs, limiting the number of traps fished and reducing the number of licenses over time will help reduce the number of vertical lines in the water, which can decrease the likelihood of NARWs becoming entangled in fishing gear. The Aquarium encourages NOAA to include effort reduction as a tool to reduce risk in the Final Rule, including support for fishermen and women to transition out of the fishery if needed.

The Aquarium was disappointed to see that the Proposed Rule did not include any measures to reduce effort in the fishery. Recently published research suggests that effort reduction will not necessarily have a negative economic impact and, in fact, is likely to generate higher profits while enabling the industry to operate with less gear in the water and over a shorter season (Myers and Moore 2020). The results from this work showed that, "*The U.S. lobster fishery in Maine expends approximately 7.5 times as much effort as the Canadian fishery in Lobster Fishing Area 34, where Canadian fishers catch about 3.7 times more per trap than their counterparts in Maine*." In addition, "*The state of Massachusetts has achieved record high landings since trap/pot seasonal closures have been implemented to protect right whales, especially within the Statistical Reporting Areas most affected by closures*" (Myers and Moore 2020).

The Aquarium is also concerned that trawling up is not the best approach to achieving vertical line reduction as it introduces safety concerns and does not address gear conflicts that will likely arise from longer trawls. The DEIS also notes that potential catch reduction from trawling up is the main economic concern for Alternative 2, although when considering the variability of the lobster resource, this calculation seems hypothetical. Because fishing with less gear over a shorter season appears to

correspond with higher landings and higher profits while also reducing the risk of entanglements to NARWs by removing vertical lines from the water column, the Aquarium recommends that NOAA seriously consider including effort reduction measures in its Final Rule such as the 50 percent endline cap discussed in Alternative 3 to address safety concerns and potentially improve catch levels (Myers and Moore 2020).

The Aquarium also recommends that NOAA consider reducing the number of licenses it issues and offering support for fishermen and women to transition out of the fishery as another mechanism to reduce effort in the fishery.

Economic Considerations

RECOMMENDATION 6: The Aquarium recommends that NOAA promulgate rules that reduce the risk of entanglements in fishing gear by 80 percent to prevent the fishery from incurring incremental effort and expense resulting from multiple rulemakings. In addition, the Aquarium recommends that NOAA's economic analysis consider the economic benefits of protecting whales to other sectors of the economy.

While the Aquarium recognizes the cost of complying with the Final Rule will not be insignificant for the fishery, after reviewing the Proposed Rule and DEIS, we are concerned that the least-cost alternative is being promoted at the expense of the long-term survival of NARWs. Rather than prioritizing a more conservative risk reduction target of 80 percent, which has a greater probability of conserving NARWs as required by law, the 60 percent target was chosen primarily due to economic considerations (as detailed on page 22 of the DEIS, Alternative 3, which also achieved the 60 percent target would be a more effective approach to reduce NARW mortality, but would cost two to three times more per unit of risk reduction than the preferred alternative).
We note that while NMFS must take economic considerations into account, the least-cost alternative is not required to be selected. Steps can and should be taken to reduce the cost burden on fishermen and women that would be affected, as well as to increase regulatory compliance, another stated concern (DEIS, p. 25). That said, promulgating stronger rules and measures now is not only necessary for the survival of the species, but may also serve as a future cost-saving measure: If the lesser risk reduction target (60 percent) does not sufficiently reduce take below PBR, both fishermen/women and NOAA will be forced to incur additional effort and expense to redo this same process. These incremental costs may potentially be avoided by applying a more aggressive risk reduction target of 80 percent in this rulemaking, which has the added benefit of preventing unnecessary deaths of NARWs in the interim. We also note in the Effort Reduction section of this comment that reducing effort is likely to have a positive economic impact on the industry as a whole in addition to individual fishermen and women.

Furthermore, the Aquarium notes that the economic analysis focuses on impacts to a single sector of the economy (fishing industry), without simultaneously considering the potential benefits of increased NARW protection to other sectors (these benefits are loosely discussed in the Initial Regulatory Flexibility Analysis section of the DEIS, but are not integrated into the main Economic and Social Impacts discussion). For example, in Hancock County, identified as one of the more vulnerable communities in Maine, living resources extraction, which includes commercial fisheries, fish hatcheries, seafood processing, and seafood markets, contributed $64.5 million in Gross Domestic Product (GDP) to the total ocean economy of the county in 2017. In contrast, ocean-based tourism and recreation, a sector likely to

benefit from an increased population of NARWs and other large whales through improved opportunities such as whale watching, contributed more than three times that amount—$211.6 million in GDP—for the same time period (NOAA 2017). These numbers are not unique to Maine. Similar trends are observed in Massachusetts and Rhode Island, as well.

The economic and social impact sections of the DEIS should explicitly consider the potential economic and social benefits of the Proposed Rule (e.g. by supporting an increase in the NARW population), including considering how these benefits may offset costs incurred through the proposed action (i.e. through economic diversification, opportunities for alternative livelihoods, etc.).

Finally, we note that the economic and social impacts analysis fails to consider the impact that the ongoing COVID-19 pandemic has had on demand for the fisheries impacted by this Proposed Rule; for example, in the first six months of 2020, U.S. exports of lobster declined by 44.6 percent (FAO Globefish 2021) and that significant uncertainty regarding the duration and extent of these impacts remains.

Ropeless Fishing Gear

RECOMMENDATION 7: The Aquarium considers ropeless fishing gear as the key to a future in which fishing and NARWs can coexist and recommends that NOAA should explore every opportunity to subsidize and otherwise reduce direct costs to fishermen and women related to this action, including increased funding and grant programs for industry-led trials of ropeless fishing gear.

As described in the Aquarium's comment regarding closures, testing, evaluation, and deployment of ropeless gear should be permitted in closed areas (with caveats) and anywhere offshore where 1700 lbf breaking strength ropes can't be used. NOAA should work closely with scientists, fishermen/women, and engineers who are presently developing and testing ropeless gear to develop a detailed timeline, strategy, and cost details for transitioning the fishery.

Furthermore, government investment to develop and evaluate ropeless fishing is urgently needed. Any federal investments must consider the use of subsidies to help shift all members of the industry affected by closures, and we encourage NOAA to work with Congress to request the needed appropriations to facilitate this transition as quickly as possible. These goals should be endorsed by NOAA to signal the agency's support of ropeless fishing and to encourage investment and development by commercial manufacturers. Ropeless retrieval systems are functional today, but a universal solution to monitor a fishery without buoys marking endlines and address gear conflict issues does not yet exist and must be developed with the support of NOAA quickly. These investments will benefit fishermen/women and whales, and should be a top priority (modified from "Scientist Letter," Appendix 1).

Reporting, Monitoring, and Enforcement

RECOMMENDATION 8: NOAA should work with states to continue improving compliance and reporting in the crab and lobster fisheries, including accurate trip reporting, and increased gear checks to ensure that the proposed gear changes are being enacted correctly and in a timely manner.

Specific to weak ropes, contrivances, and gear marking, the Aquarium recognizes that it is important to develop a monitoring strategy to inform managers whether or not regulations are benefitting NARWs. We suggest the following approaches:

1. Continue annual scar coding efforts (conducted by the New England Aquarium) to determine the frequency of events and the proportion of sighted individuals with scars. As closures, endline reductions, and ropeless fishing gear are implemented into the fishery, the frequency of entanglements needs to be quantified to assess how effective the rules are;

2. For a given year of entanglements documented from scarring assessments, determine the proportion resulting in minor, moderate, and severe injuries. If weak rope works as intended, entanglement scarring should be less severe but may not be less frequent;

3. For those cases where the gear can be observed, assess the number of whales with attached gear by year. Any entanglement configurations need to be evaluated carefully to determine if trailing line levels have been reduced, entanglement complexity is high or low risk, and gear marks are evident. In addition, the rope diameter, what part of the gear is involved in the entanglement, and if the gear on the whale is weak rope or used contrivances should also be evaluated. Case studies should continue to be created[12]; and

4. Entanglement events of each individual need to be reviewed to determine the timeframe and potential country of origin of entanglement.

The Aquarium notes that a lack of scientific certainty is sometimes used to suggest that more information is needed to inform decision making, which then causes further delays in needed action. We disagree with this. The body of scientific research on NARWs and entanglements is both established and clear in its conclusions: Entanglements in fixed fishing gear are causing serious injuries and mortalities to the critically endangered NARW at a rate that the species can't sustain if it is to survive. While we encourage NOAA to invest in increasing surveillance and monitoring efforts throughout the U.S. range of the NARW, we recommend that those efforts be focused on assessing the health and well-being of the individuals and the population. As noted earlier, in the near-term, these efforts can and should be used to inform management decisions regarding the extent and timing of closures and provide information about any entanglements that do occur in weak rope, but once the fishery transitions to ropeless gear, surveillance and monitoring efforts for entanglements should no longer be necessary.

Decision Support Tool

In response to NOAA's *Draft Biological Opinion on 10 Fishery Management Plans*, the Aquarium submitted an extensive comment regarding NOAA's finding of no jeopardy for NARWs, which we disagreed with. As part of that comment, the Aquarium provided an extensive discussion about our concerns with the Decision Support Tool, including the appropriate use of uncertainty in models for conservation. The Aquarium's comment on the Biological Opinion is provided as Appendix 2 of this document.

[12] https://www.bycatch.org/project/case-studies-north-atlantic-right-whale-fishing-gear-entanglements

Conclusion

The Aquarium thanks NOAA for the opportunity to comment on this Proposed Rule and DEIS. Our comments are provided with the intent that they be used to inform changes in the Final Rule that will significantly reduce the risk of entanglements in fixed gear to NARWs and other whales. As a member of the ALWTRT since its inception, the Aquarium has participated in the process in good faith that NOAA will take the necessary steps to manage this species as required by the Marine Mammal Protection Act and the Endangered Species Act. The Aquarium recognizes that all of the measures detailed in the Aquarium's comments are just part of many that are needed to prevent this species from going extinct. In addition to making necessary changes to the fisheries where entanglement is a risk, other risks, including those from vessel strikes, ocean noise, pollution, and climate change must also be addressed aggressively and expeditiously. The Aquarium looks forward to continuing work in partnership with federal and state governments and other members of the ALWTRT to ensure the survival of this species.

The Aquarium's scientists and experts are available to answer any questions or provide additional information should it be needed.

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APPENDIX 1:

Scientist Letter

Docket No. 201221–0351
Proposed Rule: Taking of Marine Mammals Incidental to Commercial Fishing Operations; Atlantic Large Whale Take Reduction Plan Regulations; Atlantic Coastal Fisheries Cooperative Management Act Provisions; American Lobster Fishery

To: Mr. Ben Friedman (Deputy Under Secretary for Operations, performing the duties of Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator)

Cc: NOAA Fisheries - Paul Doremus (Acting Assistant Administrator for Fisheries), Sam Rauch (Deputy Assistant Administrator for Regulatory Programs), Cisco Werner (Director of Scientific Programs and Chief Science Advisor), Donna Wieting (Director of NOAA Fisheries Office of Protected Resources), Evan Howell (Director of NOAA Fisheries' Office of Science and Technology), Karen Hyun (NOAA Chief of Staff), and Colleen Coogan (Marine Mammal and Sea Turtle Branch Chief, Greater Atlantic Regional Fisheries Office)

February 25, 2021

Dear Mr. Friedman:

We represent a group of scientists with extensive expertise in the biology of large whales, oceanography, and fisheries. We are writing to express our serious concerns about the proposed rule titled *Taking of Marine Mammals Incidental to Commercial Fishing Operations; Atlantic Large Whale Take Reduction Plan Regulations; Atlantic Coastal Fisheries Cooperative Management Act Provisions; American Lobster Fishery* put forward by NOAA Fisheries to reduce entanglement risk to North Atlantic right whales (NARW) caused by Northeast crab and lobster trap/pot fisheries (https://www.govinfo.gov/content/pkg/FR-2020-12-31/pdf/2020-28775.pdf). Whales continue to be impacted by entanglement and NARWs are known to be dying at an increasing and unsustainable rate. Just since October 2020 there have been three NARW observed in U.S. waters with serious entanglements - none could be disentangled, and all are likely to die. The proposed rule represents a dramatic weakening of the recommendations made by the Atlantic Large Whale Take Reduction Team (ALWTRT) in April 2019 as a path towards achieving reduction in entanglement risk.

This weakening of the proposed take reduction strategy runs counter to all scientific analysis, particularly in light of the well documented and ongoing reduction in the population size of this critically endangered species (https://www.narwc.org/report-cards.html). Furthermore, entanglement mortality continues at unsustainable levels and much of it goes undetected. For every right whale carcass observed, almost three more deaths go undocumented

(https://conbio.onlinelibrary.wiley.com/doi/full/10.1111/csp2.346). Finally, NOAA's report on the increasing frequency of serious injuries from entanglements (https://repository.library.noaa.gov/view/noaa/21249) demonstrates that the problem is getting worse, not better. If the current rate of population decline does not change (approximately 20 whales per year over the last 5 years), the North Atlantic right whale will be functionally extinct in less than two decades. In light of this scientific information, we strongly urge NOAA leadership to revisit and considerably strengthen the proposed rule.

We specifically suggest the following:

1) **The 60% target of reduced risk outlined in the proposed rule should be increased to 80%**

   Rapid and effective management action is critical to turn the trajectory of this species around. We recommend increasing the risk reduction in the U.S. lobster and crab fishery to 80%, applying additional measures in other U.S. fixed gear fisheries, and working closely with the Canadian government to implement similar risk reduction goals in their fisheries. These actions will provide the best chance of achieving the risk reduction targets mandated by the Endangered Species Act and the Marine Mammal Protection Act (MMPA). The recent Biological Opinion (https://www.fisheries.noaa.gov/bulletin/draft-biological-opinion-10-fishery-management-plans-released) estimates the current proposed rule will not reduce U.S. entanglements below the Potential Biological Removal level of 0.8 individuals annually as mandated by the MMPA. Only rapid and sustained actions such as those described herein can change the trajectory of the NARW population.

2) **Endline reductions, closures, and 1700 lb ropes should be considered as interim measures as ropeless gear becomes a more viable option**
   The concerns about ropes and entanglements of large whales is a long standing problem. As Johnson et al. stated in 2005, "…any line rising into the water column poses a significant entanglement risk" (https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1748-7692.2005.tb01256.x). In recent years, a tremendous amount of effort by engineers, fishers, and scientists has led to promising options to address this threat with gear technology. We ask NOAA leadership to acknowledge that ropeless gear may nearly eliminate the risk of large whale entanglements and support an economically viable fishing industry. Government investment to accelerate the development and evaluation of ropeless fishing is urgently needed, which should include plans for experimental fisheries in closed areas by January 2022. Support for these investments must consider the use of subsidies to help shift all members of the industry affected by closures to this option by January 2024. These goals should be endorsed by NOAA Fisheries

to signal the agency's support of ropeless fishing and to encourage investment and development by commercial manufacturers. Ropeless retrieval systems are functional today, but a universal solution to monitor a fishery without buoys marking endlines and address gear conflict issues does not yet exist and must be developed with the support of NOAA Fisheries quickly. ***These investments will benefit fishermen and whales, and should be a top priority.*** In the meantime, scaled-up efforts to reduce the total number of endlines, to implement closures and to use 1700 lb ropes/weak insertions should be considered the best interim options for reducing risk and impact.

3) **Where vertical lines continue to be necessary, endline strength should be reduced to 1700 lbs throughout the entire length, not just the upper portion**
Rope strength plays a critical role in entanglement risk and injury severity (see https://conbio.onlinelibrary.wiley.com/doi/10.1111/cobi.12590), and the ALWTRT came to near consensus in April 2019 in requesting that vertical lines with a breaking strength of 1700 lb, either entirely or with weak links inserted every 40 feet, be used throughout the lobster and crab industry to reduce risk. This recommendation has been weakened in the proposed rule such that weak rope/weak insertions are now only being proposed for the top half or top third of an endline with only one to two weak insertions required independent of endline length. The original ALWTRT agreement as it pertains to weakened vertical lines, which would require use of 1,700 lb rope or sleeves through the entire endline length, should be reinstated and applied throughout lobster and crab fisheries as a part of this rulemaking and expanded to other fixed gear fisheries in the near future.

4) **A mechanism should be developed to allow vertical line closures to expeditiously be extended spatially or temporally based on scientific observations that include computer modeling**
Fisheries closures that eliminate vertical lines in the water column are the most effective tool for mitigating risk of entanglements of right whales where the two overlap in space and time. Right whales have shifted their distribution dramatically in the past 10 years and their movements have become more difficult to predict as a result of climate change. As new aggregation areas are identified from direct observations, acoustic detections, and/or modelling, it is important to have a rapid regulatory response method to change, expand, or extend closures as needed and allow ropeless fishing in these closed areas. A network of closures should occur throughout the species range, and protect a sufficiently large enough area to help recover the population.

As academic members of the Atlantic Large Whale Take Reduction Team and scientists who study large whales, oceanography, and fisheries issues, we recognize the tremendous challenge facing NOAA Fisheries to prevent the extinction of the NARW while minimizing the economic impact upon fisheries. We believe that, for the fishing industry and NARWs to coexist, the transition to fully weak rope and ropeless gear requires immediate government support to help fishers procure new gear. No further delays or concessions that undermine the ability of proposed measures to prevent NARWs from going extinct should be allowed in implementing strong, effective and enforceable rules. If an 80% reduction in risk cannot be accomplished in this rulemaking effort, NOAA Fisheries should request the Atlantic Large Whale Take Reduction team to immediately consider additional measures for these fisheries during 2021 discussions.

Thank you for considering our request. We will each be providing more detailed comments to the proposed rule.

Sincerely,

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APPENDIX 2:

New England Aquarium February 22, 2021 comment on NOAA's *Draft Biological Opinion on 10 Fishery Management Plans in the Greater Atlantic Region and the New England Fishery Management Council's Omnibus Habitat Amendment 2*

New England Aquarium

Protecting the blue planet

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NOAA Fisheries Service
Gloucester, MA 01930

Re: **Draft Biological Opinion on 10 Fishery Management Plans in the Greater Atlantic Region and the New England Fishery Management Council's Omnibus Habitat Amendment 2**

In response to the *Draft Biological Opinion on 10 Fishery Management Plans*, the New England Aquarium (Aquarium) submits this comment strongly urging the National Oceanic and Atmospheric Administration (NOAA) to reconsider its finding of no jeopardy for North Atlantic right whales (NARW).

Founded in 1969, the Aquarium is a global leader in marine conservation and a catalyst for global change through public engagement, commitment to marine animal conservation, leadership in education, innovative scientific research, and effective advocacy for vital and vibrant oceans. For decades, the Aquarium has been working to protect marine and freshwater ecosystems from human impacts and conserve threatened and endangered animals and habitats. The Aquarium's scientists conduct cutting-edge research to understand, quantify, and reduce the consequences of human activities on the health of marine species and ecosystems by developing science-based solutions and advocating for policies that balance human use of the ocean with the need for a healthy, thriving ocean now and in the future.

Scientists at the Aquarium have been researching NARWs for more than 40 years with the goal of preventing this species from going extinct. In addition, representatives from the Aquarium have served on the Atlantic Large Whale Take Reduction Team since it was formed in 1996. The Aquarium is pleased to see that published research by our scientists was used to inform aspects of these measures.

Here we provide comments and recommendations on the Draft Biological Opinion (BiOp) and the Conservation Framework associated with it. This comment focuses on findings in the Draft BiOp pertaining to NARWs based on our long-standing scientific expertise and commitment to conserving this species. In addition, as the most endangered species reviewed in the Draft BiOp, it is critical to the conservation plan, pending rulemaking, and draft environmental impact statement that the findings in the Final BiOp are accurate and based on the best-available science.

First, we wish to compliment NOAA staff on aspects of this work. The review of the NARW in the Status of the Species section of the Draft BiOp is well written and cites the appropriate and best-available scientific literature. The modeling work conducted by Dr. Daniel Linden of Greater Atlantic Regional Fisheries Office (GARFO) presented in the document "*Population projections of North Atlantic right whales under varying human-caused mortality risk and future uncertainty*" (Appendix 3) is excellent, and we compliment his analysis. While it is possible to argue some of the detail of the models (as we do below), the work is of a very high standard. We see that the reviews of this work, conducted by expert reviewers for the Center for Independent Experts (CIE) were supportive, offering only a few suggestions for possible improvement to the science[1]. We also note that, although it is not part of the Draft BiOp or Conservation Framework, the recent paper led by Dr. Richard Pace of the Northeast Fisheries Science Center (NEFSC), which we cite several times below, is a very important contribution that informs our

[1] https://www.st.nmfs.noaa.gov/science-quality-assurance/cie-peer-reviews/cie-review-2020

comments. Dr. Pace is to be complimented for his excellent analyses that have advanced our understanding of the current situation of NARWs.

Although we are impressed by these aspects of the work, we have significant concerns with other aspects of the Draft BiOp and Conservation Framework. While we concentrate our comment on the scientific content of the Draft BiOp, we also take this opportunity to raise one initial, yet critical, concern.

No Jeopardy Finding

The Draft BiOp finds no jeopardy based on the assumption that, in the first phase of the Conservation Framework, regulations still in draft form are sufficient enough to reduce fisheries-induced mortality and morbidity of NARWs to the extent that they will recover. As these regulations are still in draft form, there is no guarantee that they will be promulgated, implemented, and/or enforced. Whether or not they are sufficient is another question entirely, which the Aquarium will address in its response to the *Proposed Rule to Amend the Atlantic Large Whale Take Reduction Plan to Reduce Risk of Serious Injury and Mortality to North Atlantic Right Whales Caused by Entanglement in Northeast Crab and Lobster Trap/Pot Fisheries* and Draft Environmental Impact Statement.

Recommendation 1: In the absence of a final rule, the Aquarium does not think it is appropriate to make a "no jeopardy" finding.

Furthermore, as detailed below, the Aquarium has significant issues of concern with the Draft BiOp and Conservation Framework and strongly asserts that the science supports a jeopardy finding.

Risk reduction and the time required to implement changes

North Atlantic right whales have been in decline for a decade. In the absence of strong rules preventing entanglements and vessel strikes, we have come to expect the abundance of the species to continue to decline. Because it takes time to finalize regulations (and Biological Opinions) and even longer for those to result in action on the water, we understand that while these processes are ongoing, it is likely that the species' abundance will continue declining. The Draft BiOp does not account for this time delay, despite having a strong model that indicates the trajectory of the species' abundance while the BiOp and regulations were being drafted (see also Meyer-Gutbrod et al. 2018 on this topic in the Canadian management setting). This is not well thought through and should be.

It was clear after the Atlantic Large Whale Take Reduction Team (ALWTRT) meeting in 2017 that NARW Serious Injury and Mortality (SI/M) had exceeded the "jeopardy" threshold identified, thus initiating the need for a new BiOp. Despite this, it took almost four years for this Draft BiOp to be released, during which time the number of NARWs kept declining. The redrafted BiOp needs to account for this continuing decline and must account for the time in which it takes NOAA to implement changes on the water. Corkeron et al.'s (2018) matrix model [disclosure: Aquarium employees are authors of Corkeron et al. 2018], as applied by Linden 2021 and suitably corrected for uncertainty (see below), can be used to project what the abundance of NARWs is likely to be, and from that, appropriate measures reconsidered.

To give a concrete example, the Draft BiOp and Conservation Framework are predicated on the idea that a 60% reduction in anthropogenic mortality will be sufficient to take NARWs from jeopardy. While 60% risk reduction may have been satisfactory when this process started in 2017, in 2021 60% risk reduction is

no longer sufficient as there are now substantially (16%) fewer NARWs than there were in 2017. An 80% risk reduction target initially is now more appropriate and should be used in the redrafted BiOp.

Recommendation 2: We recommend that the redrafted BiOp be based on an 80% risk reduction target.

Incorporating Uncertainty

There are several instances where the modeling that informs the Draft BiOp and Conservation Framework does not incorporate uncertainty in the data sufficiently, especially given the scale of the conservation challenges facing NARWs.

We note the significant paper on this topic by Dr. Barb Taylor and coauthors, "*Incorporating Uncertainty into Management Models for Marine Mammals,*" published in Conservation Biology in 2000 (Taylor et al. 2000). As Taylor et al. (2000) discuss in their paper, "The history of marine mammal management clearly demonstrates the need to incorporate uncertainty into management models" (p.1250); and "The simulations clearly show that accounting for uncertainty by using a lower percentile is precautionary, whereas the typical practice of the best estimate is not" (p.1248)—in this quote, the "best estimate" is generally considered the mean.

For example, the matrix modeling in Linden (2021) uses the mean estimates of posterior distributions of survival from the re-run mark-recapture model of Pace et al. 2017 as matrix model inputs. A more appropriate approach for conservation, following the findings of Taylor et al. (2000), would be to use the 80th percentile of these posterior distributions to account for the substantial uncertainty in them. To be clear, this is not a criticism of the model used, but of how the model is applied *for conservation* to inform a Section 7 decision under the Endangered Species Act. We note parenthetically that better allowing for uncertainty was raised as a concern by Dr. New in her CIE review[2] of the Linden 2021 paper.

Likewise, the data used for the Decision Support Tool (DST, see, e.g., page 220 of the Draft BiOp) includes substantial uncertainties in both the models of whales' distribution and the data on fisheries. The DST should be re-run using appropriate percentiles rather than means or medians to estimate overlap of fisheries and the whales' distributions.

Recommendation 3: We recommend that the redrafted BiOp re-run the analyses using appropriate uncertainty parameters and that the conservation implications of the revised models be reassessed in the revised Section 7 assessment.

Cryptic mortality and its implications

A recent 2021 paper by Dr. Richard Pace and coauthors [disclosure: Aquarium employees are authors of this paper] estimates the unobserved ("cryptic") mortality of NARWs (Pace et al. 2021). In this paper, the authors show that for the period 2010-2017 (which is most relevant to the Draft BiOp), the probability of detecting a whale carcass was 29% (with two standard errors of 2.8%). In addition, during the 2019 North Atlantic Right Whale Consortium meeting, Dr. Pace gave a talk entitled, "*Estimating latent mortality of North Atlantic right whales*" that summarized the earlier stages of this analysis. Because the manuscript was submitted on July 2, 2020, we presume that it was reviewed and cleared by NOAA's NEFSC prior to submission based on Dr. Pace's affiliation with NEFSC. As these scientific results were available to

[2] https://www.st.nmfs.noaa.gov/Assets/Quality-Assurance/documents/peer-review-reports/2020/2020_05%20New%20NARW%20Pop%20Model%20Review%20Report.pdf

NOAA prior to publication of the paper, they should have been considered in the Draft BiOp. To ensure that the final BiOp findings are based on the best-available science, we contend that the results presented in Pace et al. 2021 should now be considered in the forthcoming redrafted BiOp.

Important inferences drawn from the work published in Pace et al. 2021 are summarized in the discussion including (1) "There is a striking mismatch between the causes of serious injuries observed in living whales and the causes of mortality revealed in necropsies of dead whales;" and (2) "…the disparity in observed rates of serious injury by cause suggests that cryptic deaths due to entanglements significantly outnumbers cryptic deaths from vessel collisions or other causes." The relevance of the analyses presented in section 7.2.1.3 (e.g., Table 56) needs to be revisited in the redraft of the BiOp.

We are gratified to see the Draft BiOp's authors state "Although the observed entanglement data include non-SI/M events, these observed events are considered a minimum estimate, and the actual entanglement rate is likely higher. To account for this underrepresentation of non-SI/M events in the observed entanglement data, our annual entanglement estimate for this Opinion is based on the scarring analysis presented in Hamilton et al. (2019). We, however, suggest that the apportioning of SI/M proportions on pages 223-225 of the Draft BiOp needs to be reviewed in light of the findings of Pace et al. (2021).

Recommendation 4: We recommend that the redrafted BiOp include this review of apportioning SI/M in light of the findings of Pace et al. (2021).

Timing of conservation actions and their evaluation

The timeline for implementing the Conservation Framework (Table 2 of the Draft BiOp) is insufficient. For example, it is not clear if Phase 1 will even be fully implemented by the start of 2023. Since it has already been at least four years since the 2017 Atlantic Large Whale Take Reduction Team (ALWTRT) meeting during which it was determined that the number of deaths were over jeopardy to initiate Phase 1, we do not reasonably expect that an ALWTRT meeting in 2021 will result in implementation of Phase 2 by 2023.

In addition, the timing allowed to evaluate the efficacy of actions is inappropriately short. Although some evaluations can be based on analysis of scarring rates on individually identified whales, these analyses invariably have a lag of a year or so, as it takes time to obtain and process these data. As Pace et al. (2021) note in their Conclusion, "Annual counts of right whale carcasses do a poor job of indicating the total mortality for that year." This demonstrates that it is inappropriate to use one or two years of SI/M observations to make a definitive inference on whether a management action (or actions) is (are) reducing deleterious anthropogenic impacts on NARWs.

Recommendation 5: We recommend that the redrafted BiOp include a revised Section 10.3.1 Large Whale Monitoring that addresses the timeline of conservation actions and includes simulation modeling to demonstrate the efficacy of the monitoring program developed.

Reporting SI/M when there is an expectation that SI/M will fall to less than 0.2/year

NOAA Fisheries reports SI/M data on rolling five-year averages, as discussed in Section 10.3.1 of the Draft BiOp. The expectation in the Draft BiOp is that Phase 4 of the Conservation Framework (p.232) will result in an average annual SI/M of 0.11/year. Assuming this optimistic projection is realized, for NOAA staff to calculate SI/M, NOAA will need to revise the timing over which SI/M is calculated. If the

expectation is that there will be one SI/M every nine years, then using rolling five-year averages is, from very basic mathematics, inappropriate. The rolling average will need to be longer. We note parenthetically that this is already a problem for the Gulf of Mexico Whale (*Balaenoptera ricei*)— another very-low abundance species managed by NOAA (also Red Listed as Critically Endangered).

Recommendation 6: We recommend that the redrafted BiOp discuss how NOAA will change its practices for reporting SI/M to account for low annual rates of this measure, should they arise.

Essential physical or biological features

There is a very salient point missing in the Draft BiOp discussion of "essential physical or biological features" of NARW Critical Habitat, Section 4.1.10 (pp. 83-88). Of the four physical states of matter (gas, liquid, solid, and plasma), both liquid and solid forms are relevant in this context. Seawater is a liquid and fishing gear is a solid. By introducing numerous solid objects (i.e. fishing gear) into seawater, it is inevitable that the physical features of NARW Critical Habitat (liquid) are fundamentally altered by those activities.

Recommendation 7: We recommend that the redrafted BiOp recognize that fishing using vertical lines alters the essential physical features of the ocean in areas where gear is introduced.

Climate change

Section 6.2. of the Draft BiOp, which addresses "Species Specific Information on Climate Change Effects," for whales is weak. It glosses over the fact that NARWs are already impacted by climate change as demonstrated by recent literature cited in the Draft BiOp (e.g. Meyer-Gutbrod et al 2014 and 2017). It also fails to recognize the changes in distribution of other baleen whales from work led by NOAA's NEFSC scientists (Davis et al. 2020 [disclosure: an Aquarium employee is an author on this paper]). Without argument, the current decline of NARWs is exacerbated by ecosystem changes driven by climate.

The Draft BiOp also lacks discussion of what can be done to ameliorate the impacts of climate change on NARWs despite a substantial body of literature focused on applying resilience-based management to address climate change in marine environments (for an introduction, see Bellwood et al. 2004; Hughes et al. 2005) and examples of using these approaches for on-water management (e.g., Fernandes 2005). There has not, to our knowledge, been any work that embeds managing climate impacts on a whale population explicitly into a resilience framework. We recommend that NOAA consider this approach in the revised BiOp as it offers a way forward for this challenging problem. Notwithstanding this existing body of research, all citations in the final paragraph of Section 6.2 on whales are based on NOAA's work, much of which is not peer-reviewed, and should be remedied in subsequent versions.

Briefly, we suggest that managing for resilience, rather than managing to avoid extinction, will give greater likelihood that NARWs will avoid extinction in the face of our current climate emergency. For a whale species, managing for resilience would include ensuring that their abundance is sufficiently large to buffer against climate-induced deleterious changes, such as those we have seen in NARWs. Comparative work on other right whales that do have this buffer (Corkeron et al. 2018 [disclosure: Aquarium employees are authors of this paper]) shows that adult female mortality from anthropogenic sources has been the primary cause of NARW's lack of recovery. Further, at an individual level, NARWs lack the energy buffer that other right whales have to increase calving rates (Christiansen et al. 2020 [disclosure:

an Aquarium employee is an author of this paper]). For example, entanglements can have substantial impacts on individual NARW's energy budgets (van der Hoop et al. 2017 [disclosure: an Aquarium employee is an author of this paper]), and the energy stores of NARWs can be measured reliably with drone-based photogrammetry (Christiansen et al. 2020). Monitoring the relationships between entanglement scarring and energy stores can provide a way to manage for resilience of individuals' energy stores, as one example.

Recommendation 8: We recommend that the redrafted BiOp include a discussion of managing for resilience in the face of climate change and that that consideration is reflected throughout the redrafted document.

Minor issues

We raise a couple of minor points, one of which requires correction, and the other is a suggestion for further research.

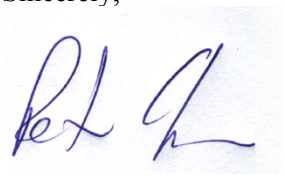
First, on page 220 of the Draft BiOp, the statement "However, at this time, there is no further evidence to make the conclusion that sublethal effects from fishing gear entanglement alone causes a decline in large whale health" is incorrect. See van der Hoop's work on morbidity from entanglement, particularly van der Hoop et al. 2017 where the models demonstrate that entanglement alone is sufficient to cause a decline in reproductive output.

Second, as a suggestion for an area of future research, we note that the mark-recapture model that NOAA is using for NARWs still defines adults as whales over five years of age. This was a reasonable assumption when the model was developed. Now, however, the age at first reproduction of female NARWs is substantially greater than five. This year's calving cohort included five first-time mothers whose ages are 12, 12, 13, 14, and 19, respectively. The cutoff for adults in NOAA's model should be revised to take into account recent changes in age at first reproduction.

The Aquarium thanks NOAA for the opportunity to review and comment on the Draft Biological Opinion. As part of the management strategy and conservation plan to recover NARWs, the Aquarium submits our recommendations to improve and strengthen the scientific basis under which NOAA determined a "no jeopardy" finding for this species and respectfully requests that this finding be revisited in light of information shared in this submission.

Our scientists are available to answer any questions or provide additional information.

Sincerely,



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