A Colossal Climate Change Challenge

Adapting to Protect the North Atlantic Right Whale in a Dynamic Marine Environment

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Introduction

Boaters look to the distance in confusion. The large, mottled gray object floats closer as the collective realization begins to sink in; this is a whale. Not a live one, however, and not just any whale. This is a North Atlantic right whale, *Eubalaena glacialis*, one of the planet's most critically endangered marine mammals, with a population of approximately 400 individuals (NMFS, "North Atlantic Right Whale"). Experts are called in and reach the disturbing conclusion that this whale is a calf, born less than a year before. Worse still, this calf is marred by propeller marks and rudder wounds (NMFS, "Dead Right Whale Sighted"). It is an unmistakable and unfortunately common scene: death by vessel strike.

For the past few years, North Atlantic right whale deaths have been rapidly increasing due to vessel strikes and fishing gear entanglement off the East Coast of North America (NMFS, "2017-2020 UME"). The reason behind this startling rise in mortality appears to be a combination of developments that can be linked to climate change, the ultimate threat multiplier. Warming ocean temperatures are causing the whales' zooplanktonic prey to migrate, and as the plankton enter new habitats, so too must the whales (Record et al.). This unprecedented shift in distribution has thrown North Atlantic right whales out of the frying pan and into the fire. These new areas are often less protected than the whales' historical waters, which has resulted in an elevated mortality rate since 2010. The National Marine Fisheries Service (NMFS or NOAA Fisheries) was forced to declare an Unusual Mortality Event in 2017, when an unprecedented 17 whales were found dead in a single year (NMFS, "2017-2020 UME"). In July 2020, the International Union for Conservation of Nature uplisted this species to critically endangered, a dismal milestone that marks being one step away from extinction (IUCN).

North Atlantic right whales spend the bulk of the year feeding and mating in the coastal waters of New England and Canada, with pregnant females migrating to the southeastern U.S. coast to give birth in the winter (NMFS, "North Atlantic Right Whale"). Historically, the whales spent most of their time feeding in the Gulf of Maine and Georges Bank, and this area has been designated as critical habitat by NOAA Fisheries (in addition to the southeastern birthing grounds from North Carolina to Florida) (NMFS, "Critical Habitat Map"). However, as climate change warms these New England waters at a faster rate than anywhere else on the planet, the right whales have dramatically altered their distribution, both geographically and temporally (Poppick; Record et al.).

This latest fatality was the male calf of North Atlantic right whale #3560, a fifteen-year-old mother who represents one of only 95 or so remaining mature females. Her calf was found off the coast of Elberon, New Jersey on June 25, 2020, and had the indicators of two separate vessel strikes on his body, the fresher incident being the likely cause of his death (NMFS, "Dead Right Whale Sighted"). In the past, it would have been unusual for North Atlantic right whales to inhabit these migratory waters in the summer months, which is why vessel speed restrictions are not in place in New Jersey after April 30 (NMFS, "Reducing Vessel Strikes"). This lack of protection is just one example of failure to react to dynamic shifts in the North Atlantic right whale's distribution (Baker et al., "Petition"), and it resulted in the death of an extremely valuable individual that represented hope for the future of the species. This death occurred not long after another calf, only days old, was struck and likely killed by a vessel strike in the southeastern calving grounds (NMFS, "2017-2020 UME").

Another example of regulatory failure is in Canada's Gulf of St. Lawrence, where nearly two thirds of the known right whale deaths have occurred since 2017 (NMFS, "2017-2020

UME"). This area does not have strong protections against vessel strikes, primarily because right whales have not utilized this area historically. Recently however, as warming waters have caused copepods and other zooplankton to leave the coast of New England in search of deeper and colder waters, the Gulf of St. Lawrence has become a feeding hotspot for right whales (Plourde et al.). Since 2017, at least 18 North Atlantic right whales have been killed in the Gulf of St. Lawrence out of a population of only 400 individuals – nearly 5% of the entire species (NMFS, "2017-2020 UME").

Most recently, the region south of Martha's Vineyard and Nantucket, Massachusetts has become another prominent feeding site, and it can be difficult to determine where future prime areas will be (Record et al.). This difficulty underscores the limitations of rigid management strategies that cannot quickly adapt to shifts in the environment. Climate change is an incredibly dynamic threat with variable and unpredictable impacts (Palumbi et al.). Therefore, the protections for species that are being affected by climate change, such as the North Atlantic right whale, must be equally dynamic and allow for all reasonable possibilities if they are to have any chance of success. Adaptive management strategies are the only hope for dealing with climate change in any meaningful long-term way.

Part I of this paper will discuss the threats to this species and how these threats are interconnected. Part II will describe the applicable regulatory frameworks under the Marine Mammal Protection Act and the Endangered Species Act, examine how NOAA Fisheries is implementing the protections under these laws, and assess the weaknesses of this regulatory scheme. Part III will propose adaptation measures the U.S. government can take to ensure the survival of this critically endangered species in the face of climate change, from short-term area

closures to the long-term implementation of expanded vessel speed restrictions and ropeless fishing gear requirements.

I. Background

The relationship between humans and North Atlantic right whales has always been one of exploitation and disregard. Between the 11th and 20th centuries, right whales were hunted indiscriminately for their oil and meat. In fact, they received their name for being considered the "right" whales to hunt, as they lived near shore and floated once killed, allowing for easy whaling from boats of any size. By the early 1900s, there were likely fewer than 100 individuals remaining, leading to a global ban on the hunting of right whales in 1935 (NARWC). Despite subsequent decades of illegal whaling and a naturally slow reproductive rate, the North Atlantic right whale population began to gradually recover (NMFS, "North Atlantic Right Whale"). Unfortunately, new threats surfaced.

As the Atlantic shipping industry grew throughout the 20th century, vessel strikes became the premier threat to right whales. Simultaneously, entanglement in fishing gear emerged as another danger, recently becoming the biggest peril to the species. Other stressors such as plastic and noise pollution are also thought to contribute to the problem, though not as significantly as entanglement and vessel strikes (NMFS, "Right Whale Conservation"). Beginning around 2010, the recovery of the North Atlantic right whale population has reversed into a steep decline due to these threats. Since 2017, there have been 31 confirmed mortalities with an additional 10 whales sustaining unrecoverable injuries, representing 10% of the entire population (NMFS, "2017-2020 UME"). It has become clear that climate change is an underlying factor behind this recent

decline, exacerbating the existing threats and making current regulations increasingly ineffective (Meyer-Gutbrod and Greene, "Uncertain Recovery").

Section A will discuss entanglement in fishing gear, particularly the buoy lines used in the American lobster fishery. Section B will examine the threat from vessel strikes in U.S. and Canadian waters. Section C will analyze the widespread impacts of climate change on the North Atlantic right whale's habitat and how these impacts serve as a threat multiplier for this critically endangered species.

A. Entanglement

Currently, the largest threat to North Atlantic right whales (and all marine mammals globally) is entanglement in fishing gear (NMFS, "Right Whale Conservation"). The vertical ropes that attach buoys to lobster pots (known as buoy lines or endlines) are particularly dangerous to right whales, due to both how long the gear must stay in the water and how prevalent this gear is in their range; around 98% of all fixed endlines along the Atlantic Coast are used for lobsters (NMFS, "Right Whales and Entanglements"). Right whales often get tangled in the buoy lines and are unable to break free, leading to certain death. Even if the whales do break the rope, it generally stays wrapped around the head or fluke of the whale and can cause extensive damage, often leading to death as well (Kershaw, "Cruel Reality of Entanglements"). Groundfish and Jonah crab fisheries also pose a danger to right whales in the waters off New England and Canada, the former utilizing mesh-like gillnets and the latter using buoy lines (NMFS, "Right Whales and Entanglements").

The American lobster fishery is extremely valuable to the coastal economies of the eastern United States, bringing in $630 million in 2018 alone (ASMFC). Furthermore, this

fishery is growing dramatically. From 1950 to 1975, the annual catch was stable, at around 30 million pounds of lobster caught per year. Over the next 30 years, the annual catch tripled to around 90 million pounds. Today, the catch is around 150 million pounds per year (ASMFC). This rapid increase in fishing presence has coincided with the recent increase in whale entanglements (MMC, "Right Whales and Entanglements"). Furthermore, the Trump administration issued a proclamation on June 5, 2020 to open New England's Northeast Canyons and Seamounts Marine National Monument to commercial fishing, which would further threaten the North Atlantic right whale and the ecosystem it depends on (CBD).

There are two primary American lobster fisheries in the North Atlantic right whale's range: the Gulf of Maine/Georges Bank (GOM/GBK) fishery and the Southern New England (SNE) fishery (ASMFC). Lobster populations in these two regions have experienced very different trajectories over the past few decades. The GOM/GBK population has been growing exponentially for years, and is currently at an all-time high, aligning with the dramatic increase in lobster catch. Contrastingly, the SNE lobster population peaked in the late 1990s and has been rapidly declining since, leading to a current all-time low in abundance (ASMFC; Pershing et al.). These shifts are primarily being caused by drastic changes in water temperature. As the Gulf of Maine and Georges Bank warm to the ideal temperature for lobster reproductivity, the already-warmer coastal waters of Southern New England are reaching stressful temperatures that prevent successful reproduction (often exceeding 20°C for an extended period of time). Based on this trend, a similar fate awaits the GOM/GBK stock if water temperatures continue to rise (ASMFC).

Studies show that over 86% of North Atlantic right whales have been entangled in fishing gear at least once, with 35% of these entanglements resulting in moderate or severe injuries

(Knowlton et al.). In the past three years, the majority of confirmed right whale deaths in the United States have been at the hands of fishing gear, with almost all of these mortalities occurring off the coast of Massachusetts (NMFS, "2017-2020 UME"). Still, these deaths do not paint the entire picture of the dangers of fishing gear.

In addition to fatal injuries and drownings, entanglement also leads to a host of sublethal effects that contribute to this species' plight. The impacts of entanglement can be felt for years and even generations after the incident, as reproductive females are disproportionately impacted (MMC, "Entanglement Trends and Impacts"). Studies show that females have a reduced ability to become pregnant once they have been entangled, which may explain the low birth rate in recent years (no calves were reported in the 2018 season). The death rate has exceeded the birth rate in each of the past few years, and this will continue if the whales that survive their entanglements cannot successfully reproduce (NMFS, "2017-2020 UME"). In addition to lowering reproductive success, entanglement also reduces the overall health and long-term survival rates of right whales (MMC, "Entanglement Trends and Impacts").

B. Vessel Strikes

The other main threat to North Atlantic right whales is being struck by ships and other vessels. Shipping traffic in the Atlantic Ocean has increased dramatically over the past few decades, and so have vessel strikes to right whales (Crum et al.; NMFS, "North Atlantic Right Whale"). These collisions are often instantly fatal for the whales, especially those involving large, heavy vessels such as container ships or tankers. These ships can create a "bow null effect," when the noise of the engine is blocked by the front of the boat, making it impossible to hear until after the ship has passed (WDC, "The Threat from Vessel Strikes"). Other times, the

whales are not threatened by the noise of the vessels, as many are used to living in high-traffic areas. However, it is nearly impossible for a large ship to slow down or change direction by the time a whale is visible, meaning the whale must outmaneuver the vessel to avoid a collision, something made extremely difficult by the hydrodynamic suction created by a fast-moving ship. Furthermore, ships have been increasing in both size and speed over the past few decades, presenting an even greater threat to right whales (Laist et al.).

North Atlantic right whales are one of the largest animals on the planet, reaching lengths of over 50 feet and weighing up to 70 tons (NMFS, "North Atlantic Right Whale"). Animals of this size do not have any natural predators, and are therefore not accustomed to avoiding anything else in the water. This has led to a tendency for whales to show seemingly little effort to avoid collisions, as it is part of neither their instinctual nor learned behavior (Pirotta et al.). An individual would need to survive a strike to pass the lesson on to other whales, which is a rare occurrence. Ship strikes can cut part or all of the whale's tail off, sever the spinal cord, puncture organs, fracture the skull, and cause other severe injuries that make survival impossible (Laist et al.).

Small boats also pose a danger to right whales, especially because they are exempt from existing vessel speed regulations. Smaller vessels generally travel faster than larger ships, and a strike at such high speed can be harmful to a whale, no matter the size of the boat. It is also in the boaters' best interest to avoid collisions; small vessels have been heavily damaged and passengers have been severely injured by the impact of striking a whale (WDC, "The Threat from Vessel Strikes").

Vessel strikes are the cause behind a large portion of the most recent right whale deaths, especially those in areas outside of the whales' traditional feeding grounds. Of the 10 deaths

since 2017 in the Gulf of St. Lawrence in which the cause of death was determined, 80% were due to vessel strikes. In the United States, that number is essentially flipped in favor of fishing gear entanglement, with 25% of examined deaths attributed to vessel strikes and 75% to entanglement (NMFS, "2017-2020 UME"). These statistics demonstrate a clear need for Canada to implement stronger vessel speed restrictions and for the United States to continue its historically successful vessel strike prevention strategies while increasing its regulation of fishing practices.

C. Climate Change

Ocean warming is a climate change impact that is more apparent in the waters off New England than anywhere else on the planet (NASA). The Gulf of Maine is heating up at a faster rate than 99% of the world's oceans – seven times faster than average – due to its unique shape and location at the meeting point of the Labrador Current and the Gulf Stream (Poppick). As melting ice from Greenland reduces the concentration of salt in the cold Labrador Current, it is less able to sink below the warm, denser waters of the Gulf Stream and is overpowered, leaving the Gulf of Maine to be increasingly filled with water from this subtropical current. Additionally, the shallow, bathtub-like shape of the Gulf of Maine and Georges Bank holds the water in place and traps heat like few other areas of the ocean, further contributing to this unprecedented warming (Poppick).

In addition to the temperature, the chemistry of these waters is also changing dramatically. The increasing amount of carbon dioxide being emitted by human activities (including shipping) and absorbed by the ocean is decreasing the pH of the water, a process known as ocean acidification (NMFS, "Ocean Acidification"). As the water dissolves this excess

carbon dioxide, carbonic acid is formed. This chemical has made today's oceans around 30% more acidic than in pre-industrial times, from a pH of 8.2 before the Industrial Revolution to 8.1 today (the pH scale is logarithmic, meaning this seemingly small numerical change represents a significant difference in the water's chemistry) (Fisheries and Oceans Canada). More acidic water is detrimental to marine life, particularly species with calcium-based skeletons or shells, such as corals, mollusks, and crustaceans. These organisms experience a variety of impacts from acidification, from lower reproductive success to literally dissolving away (NMFS, "Ocean Acidification"). Of course, these impacts also damage the entire ecosystems that rely on these species.

Along with pH, the ocean's oxygen content is in flux as well. As excessive amounts of nutrients from terrestrial agriculture flow into the sea as runoff, algae populations explode. These enormous algal blooms eventually die and sink to the ocean floor, where they are consumed by bacteria. As the bacteria decompose the algae, they take in vast quantities of oxygen and noticeably reduce the water's oxygen content, making it hypoxic (NOS). This low-oxygen environment is extremely dangerous to species that breathe underwater, such as fish and zooplankton. "Dead zones" can form, causing massive die-offs of animals that cannot escape quickly and of those that rely on these animals. Besides increased mortality, hypoxia can also lead to a variety of sublethal effects that cascade throughout the aquatic food web, such as decreased reproductive success and growth potential in many different species (Vaquer-Sunyer and Duarte).

Unfortunately, hypoxia is greatly exacerbated by climate change. Because bacteria feed on the dead algae after they have reached the sea floor, hypoxic zones begin in this bottom layer of the ocean. In normal conditions, the more oxygen-rich surface water can mix with deeper

water and alleviate the hypoxic conditions. However, as ocean temperatures increase, this mixing occurs less. This lack of mixing creates distinct layers in the water, known as stratification, and prevents dead zones from disappearing (NOS). Climate change-caused ice melting is also likely to increase stratification, as the top layer of water decreases in salinity and loses its ability to sink below denser, saltier water. Furthermore, animal metabolisms increase as temperatures rise, requiring more oxygen than normal and making hypoxia an even graver threat. Lastly, warmer water simply cannot dissolve oxygen as efficiently as colder water, meaning there is less oxygen to begin with in today's warmer North Atlantic Ocean (NOS).

This combination of warming, acidification, and hypoxia creates a perfect storm of climate change impacts, wreaking havoc on the ecosystem right whales rely on (Poppick). The North Atlantic right whale's primary prey species is a copepod known as *Calanus finmarchicus*, a large subarctic zooplankton extremely rich in fat. This keystone species is critical to the survival of right whales, and its movement determines the movement of the whales in a highly predictable way (Grieve et al.). The Gulf of Maine is already at the southern reaches of this crustacean's distribution, so the extreme changes in this area are putting incredible stress on the species. In particular, the deeper waters of the Eastern Gulf of Maine are warming to the point that *Calanus* can no longer hibernate there. The copepods are forced to migrate to more suitable habitat to avoid increased mortality (Record et al.).

This leaves the right whales with no choice but to venture outside of their traditional distribution as well. Historically, the whales followed *Calanus* to the Western Gulf of Maine (especially the Bay of Fundy) in winter and spring and to the deeper waters of the Eastern Gulf of Maine each summer and fall, when the copepods have fattened for hibernation (Bigelow). Now, the plankton are no longer plentiful here due to the unprecedented warming. This has

caused the whales to alter their feeding grounds beginning around 2010, which directly coincides with the rise in right whale deaths and decrease in population. North Atlantic right whales have followed *Calanus* far north to the Gulf of St. Lawrence and to the waters south of Massachusetts, areas with far less protection against the whales' primary threats (Record et al.).

There is evidence that right whales are not feeding as successfully in these new habitats, as birthing rates have decreased in the past decade. Not only does seeking these new habitats increase the risk of vessel strikes and entanglement, it also expends valuable energy, impacting growth and reproductive success (WHOI). Furthermore, as pregnant females feeding in the Gulf of St. Lawrence are forced to commence their migrations from much farther north than before, they are more likely to give birth before reaching the safe, inshore waters of their southeastern calving grounds. If a mother gives birth in the rough, unprotected waters of her migratory route, the newborn calf must expend tremendous amounts of energy just to stay afloat and remain with its mother (Meyer-Gutbrod et al., "Reproductive Dynamics"). The calf is also much more likely to be struck by a vessel; the severely injured newborn found off Georgia earlier this year may have experienced such circumstances (NMFS, "2017-2020 UME").

Climate change is also altering the lobster industry in dangerous ways. Near-shore lobster fishing has been a consistent threat to North Atlantic right whales for years, with a high concentration of both small- and large-scale commercial lobster fishers overlapping with prime right whale habitat (NMFS, "Right Whales and Entanglements"). More recently, however, an offshore lobster fishery has emerged as lobsters seek out the more suitable temperatures of the colder open ocean (ASMFC). To fish in these deeper, rougher waters, much heavier equipment is required, including larger anchors and thicker endlines, and more pots are attached to a single, longer trawl for efficiency. This poses a great risk to whales if they become entangled, as this

heavier gear is more difficult to escape from or drag along and can lead to increased risk of severe injuries or death (NMFS, “Right Whales and Entanglements”).

II. Existing Framework

The North Atlantic right whale was listed as depleted and protected under the Marine Mammal Protection Act (MMPA) in 1972, and the following year was listed as endangered under the Endangered Species Act of 1973 (ESA). In 1975, the species was also added to Appendix I of the Convention on International Trade in Endangered Species (CITES), the highest protection offered by this treaty that is enforced in the United States through the ESA (NMFS, “North Atlantic Right Whale”). These laws have not been effectively implemented in recent years, however, as climate change rapidly shifts the regional dynamic and renders existing regulations inadequate (Record et al.). On July 9, 2020, the IUCN uplisted the North Atlantic right whale to critically endangered, acknowledging that this species will become extinct if no changes are made to existing conservation strategies (IUCN).

The U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NOAA Fisheries), collectively referred to as “the Secretary,” are tasked with enforcement of the ESA and the MMPA. For cetaceans like right whales, responsibility lies with NOAA Fisheries, which is charged with developing and enforcing a recovery plan and preventing the unsustainable take of the whales (NMFS, “Right Whale Conservation”). As discussed in Part I, the threats facing right whales are both severe and dynamic. NOAA Fisheries has not done enough to combat these threats, as evidenced by the dramatic population decline in recent years (NMFS, “2017-2020 UME”).

Section A will discuss the MMPA and its management of the North Atlantic right whale, and Section B will review the legal framework of the ESA and its relevance to this issue. Section C will examine NOAA Fisheries' implementation of these laws and assess the shortcomings of its current regulatory framework.

A. Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) was enacted in 1972 after Congress found that "certain species and population stocks of marine mammals are, or may be, in danger of extinction or depletion as a result of man's activities" (16 U.S.C. § 1361(1)). Due to their "international significance, esthetic and recreational as well as economic" ((16 U.S.C. § 1361(6)), Congress determined that marine mammals "should not be permitted to diminish beyond the point at which they cease to be a significant functioning element in the ecosystem of which they are a part, and, consistent with this major objective, they should not be permitted to diminish below their optimum sustainable population" and that "measures should be immediately taken to replenish any species or population stock which has already diminished below that population" (16 U.S.C. § 1361(2)). The North Atlantic right whale is listed as depleted throughout its entire range, meaning it is below its optimum sustainable level and that measures must be taken to allow its population to recover.

The MMPA prohibits the "take" of any marine mammal, with special protections given to depleted species (16 U.S.C. § 1371). Under the MMPA, take means to "harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal" (16 U.S.C. § 1362(13)). Section 101 of the MMPA allows for incidental take of marine mammals in commercial fisheries if the enforcement agency determines that the take will only have a "negligible impact on such

species" (16 U.S.C. § 1371(a)(2), (5)(E)). To determine the allowable take for a given marine mammal population, NOAA Fisheries is required to conduct a stock assessment and "estimate the potential biological removal" (PBR) that would still allow the species to "maintain its optimal sustainable population" in U.S. waters (16 U.S.C. §§ 1386(a); 1362(20)). In its most recent stock assessment, NOAA Fisheries found the PBR of the North Atlantic right whale to be 0.9 whales per year (NMFS, "Target Letter April 5, 2019"). This means that the death or serious injury of even one whale per year in the commercial fishing industry is unsustainable and in violation of the MMPA (Baker et al. "Petition").

Section 118 of the MMPA mandates the creation of take reduction plans "designed to assist in the recovery or prevent the depletion of each strategic stock which interacts with a commercial fishery [that causes] a high level of mortality and serious injury" to marine mammals (16 U.S.C. § 1387(f)(1)). These plans, which are developed by take reduction teams, are designed to "reduce, within 6 months of the plan's implementation, such mortality and serious injury to a level below the potential biological removal level" (16 U.S.C. § 1387(f)(5)(A)). Additionally, Section 201 establishes the Marine Mammal Commission (MMC) (16 U.S.C. § 1401(a)), an independent government agency tasked with providing science-based oversight of all policies affecting marine mammals and making recommendations to the FWS and NOAA Fisheries on how to better enforce the MMPA (MMC, "About the Commission").

Under the MMPA, the FWS and NOAA Fisheries have the power to declare an Unusual Mortality Event (UME) when there is "a stranding that is unexpected; involves a significant die-off of any marine mammal population; and demands immediate response" (16 U.S.C. §§ 1421c(a)(1)(A), 1421h(6)). Such a declaration authorizes a federal contingency plan that aims to "assist in identifying the cause or causes" of the UME and "minimize death of marine mammals"

(16 U.S.C. § 1421c (b)(2)(D)). An Unusual Mortality Event was declared for the North Atlantic right whale in 2017 due to the startling rise in deaths caused by vessel strikes and fishing gear entanglement, and is still active (NMFS, "2017-2020 UME").

Lastly, the MMPA allows for emergency measures to be taken when necessary. Section 118 grants NOAA Fisheries the ability to prescribe emergency regulations when "incidental mortality and serious injury of marine mammals from commercial fisheries is having, or is likely to have, an immediate and significant adverse impact on a stock or species" (16 U.S.C. § 1387(g)(1)). Furthermore, Section 101 dictates that "if, during the course of the commercial fishing season, the Secretary determines that the level of incidental mortality or serious injury from commercial fisheries […] has resulted or is likely to result in an impact that is more than negligible on the endangered or threatened species or stock, the Secretary shall use [its] emergency authority […] to protect such species or stock, and may modify any permit granted under this paragraph as necessary" (16 U.S.C. § 1371(a)(5)(E)(iii)). These emergency actions to reduce injuries and deaths in a fishery should be "consistent with [the existing take reduction plan]" and may last for up to 270 days (16 U.S.C. § 1387(g)(1)(A), (3)(B), (4)). NOAA Fisheries has failed to utilize this valuable tool effectively to protect right whales from the American lobster fishery (Baker et al., "Petition").

B. Endangered Species Act

The Endangered Species Act of 1973 (ESA) was passed "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, [and] to provide a program for the conservation of such endangered species and threatened species" (16 U.S.C. § 1531(b)). Congress found that many animal and plant species were "in

danger of or threatened with extinction […] as a consequence of economic growth and development untampered by adequate concern" in the United States, and recognized a need to preserve them for their "esthetic, ecological, educational, historical, recreational, and scientific value" (16 U.S.C. § 1531(a)). In *Tennessee Valley Authority v. Hill* (1978), the Supreme Court held that Congress intended to "halt and reverse the trend towards species extinction – whatever the cost" (437 U.S. 153). The ESA has several sections that are highly relevant to the protection of the North Atlantic right whale, particularly Sections 4, 7, 9, 10, and 17.

Section 4 addresses the listing of endangered and threatened species, the designation of critical habitat, the creation of recovery plans, and an emergency action provision. A species is listed as endangered if it is "in danger of extinction throughout all or a significant portion of its range" (16 U.S.C. § 1532(6)), and threatened if it is likely to become endangered "within the foreseeable future" (16 U.S.C. § 1532(20)). In 1970, the North Atlantic right whale, at the time known as the northern right whale, was listed as endangered under the Endangered Species Conservation Act (the precursor to the ESA). In 2008, NOAA Fisheries separated the northern right whale into two different species, the North Pacific right whale and the North Atlantic right whale, both of which are listed as endangered under the ESA (NMFS, "Right Whale Conservation").

Ecosystem protection is an integral aspect of the ESA's conservation model. Once a species is listed, critical habitat must be established (16 U.S.C. § 1533(a)(3)). This designation requires that each federal agency "insure that any action authorized, funded, or carried out […] is not likely to […] result in the destruction or adverse modification of [critical] habitat" (16 U.S.C. § 1536(a)(2)). Critical habitat can be "specific areas occupied by the species [at the time of listing] on which are found those physical or biological features essential to the conservation of

the species and which may require special management considerations or protection; [as well as] specific areas outside the geographical area occupied by the species at the time it is listed […] upon a determination by the Secretary that such areas are essential for the conservation of the species" (16 U.S.C. § 1532(5)).

Unfortunately, a proposed rule by the FWS and NOAA Fisheries on July 31, 2020 aims to redefine "habitat" as areas that are occupied by or currently have the ability to support the species (FWS and NMFS, "Proposed Rule"). This notably excludes areas that could potentially be restored for the species or those that will become essential in the face of climate change. This proposed rule comes in response to the Supreme Court's recognition of the ESA's lack of a clear definition for "habitat" in *Weyerhaeuser Co. v. U.S. Fish and Wildlife Serv.* (2018) (139 S. Ct. 361), and would make protecting the North Atlantic right whale from climate change even more challenging.

Section 4 also mandates the creation of a recovery plan to promote the conservation of endangered or threatened species (16 U.S.C. § 1533(f)(1)). These plans must "give priority to those endangered species or threatened species […] that are most likely to benefit from such plans, particularly those species that are, or may be, in conflict with construction or other development projects or other forms of economic activity" (16 U.S.C. § 1533(f)(1)(A)), and must incorporate a description of actions that are "necessary to achieve the plan's goal for the conservation and survival of the species; objective, measurable criteria which, when met, would result in a determination […] that the species be removed from the list; and estimates of the time required and the cost to carry out those measures needed to achieve the plan's goal" (16 U.S.C. § 1533(f)(1)(B)). Recovery teams comprised of "appropriate public and private agencies and

institutions, and other qualified persons" may be assembled by the enforcement agencies to assist with development and implementation (16 U.S.C. § 1533(f)(2)).

Crucially, Section 4 also includes an emergency provision like that of the MMPA, allowing NOAA Fisheries to bypass standard procedures and take immediate action when an emergency poses a "significant risk to the well-being" of a listed species (16 U.S.C. § 1533(b)(7)). This new regulation can remain in effect for up to 240 days (16 U.S.C. § 1533(b)(7)(B)), and acts as a temporary fix while permanent solutions are developed.

Section 7 addresses consultation and cooperation between federal agencies with the goal of "carrying out programs for the conservation of endangered species and threatened species" (16 U.S.C. § 1536(a)(1)). Federal agencies must consult with the relevant enforcement agency to "insure that any action authorized, funded, or carried out by such agency […] is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of [its] habitat" (16 U.S.C. § 1536(a)(2)). In the case of the North Atlantic right whale, these activities may include commercial fishing, offshore wind development, seismic airgun blasting, and oil drilling, among others. This process generally begins as an informal consultation "designed to assist the Federal agency in determining whether formal consultation or a conference is required" (50 C.F.R. § 402.13(a)).

If the agency determines that its action "may affect listed species or critical habitat" after this discussion, a formal consultation must be conducted (50 C.F.R. § 402.14(a)). Formal consultations must be completed within 90 days (50 C.F.R. § 402.14(e)), and consist of a comprehensive review of the agency's proposed action and its "effects on listed species or designated critical habitat" (50 C.F.R. § 402.14(c), (g)). Within 45 days of the consultation, the enforcement agency must prepare a biological opinion that concludes with a determination of

"whether or not the Federal action is likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat" (50 C.F.R. §§ 402.14(e)(3), 402.02). If the enforcement agency makes such a jeopardy determination, the agency must offer "reasonable and prudent alternatives" to the action that would avoid jeopardy (50 C.F.R. § 402.14(g)(5)).

If incidental take is "reasonably certain to occur," the enforcement agency must also produce an incidental take statement (ITS) (50 C.F.R. § 402.14(g)(7)). However, in the latest biological opinion for the American lobster fishery, NOAA Fisheries neglected to include an ITS, despite acknowledging that a taking would likely occur, claiming that it was unable to produce one without the take being authorized by the MMPA as well. This was held to be illegal in *Center for Biological Diversity v. Ross* (2020), with the court concluding that an ITS must always be completed when a taking is likely, and it must show that the taking will not jeopardize the continued existence of the species or violate the MMPA if the action is to be approved (Document 91).

Section 9 of the ESA prohibits the taking of any listed species (16 U.S.C. § 1538(a)(1)(B)). Under the ESA, take is to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" an endangered or threatened species, or to even attempt to engage in any of these activities (16 U.S.C. § 1532(19)). This section applies to all entities within the United States' jurisdiction, both private and public, and violations are subject to civil and criminal penalties (16 U.S.C. §§ 1538(a), 1540).

Section 10 covers the exceptions to Section 9 as well as habitat conservation plans. This section allows for the incidental taking of listed species by otherwise lawful non-federal actions (federal actions are covered by Section 7), "if such taking is incidental to, and not the purpose of,

the carrying out of an otherwise lawful activity" ((16 U.S.C. § 1539(a)(1)(B)). Taking permits may only be issued if the actor in question develops a habitat conservation plan that "specifies the impact which will likely result from such taking; what steps the applicant will take to minimize and mitigate such impacts, and the funding that will be available to implement such steps; what alternative actions to such taking the applicant considered and the reasons why such alternatives are not being utilized; and such other measures that the Secretary may require as being necessary or appropriate for purposes of the plan." (16 U.S.C. § 1539(a)(2)(A)).

Section 17 states that "no provision of [the ESA] shall take precedence over any more restrictive conflicting provision of the Marine Mammal Protection Act" (16 U.S.C. § 1543), which means that incidental take of marine mammals must also be in accordance with Section 101 of the MMPA. Furthermore, NOAA Fisheries does not authorize any take due to vessel strikes, which means that every ship strike to a North Atlantic right whale is a violation of both the MMPA and the ESA. Unfortunately, this mandate is generally not enforced (Monsell).

On June 17, 2016, NOAA Fisheries published internal guidelines with seven policy considerations for dealing with climate change under the ESA (NMFS, "Revised Guidance"). The new guidance emphasizes the importance of using the best available science to make informed decisions regarding climate change impacts. It also highlights the need to follow the principle of institutionalized caution (precautionary principle) when consulting and planning in light of climate change. This means that when making decisions beyond the timeframe or realm of credible scientific knowledge, the worst-case scenario must be presumed and addressed (NMFS, "Revised Guidance").

Furthermore, the guidelines state that NOAA Fisheries must consider proactive designation of critical habitat in areas that are likely to become essential, even if they are not yet

occupied by or suitable for the species (NMFS, "Revised Guidance"). This is a valuable tool for protecting the North Atlantic right whale as its habitat shifts due to climate change, though the recently proposed definition of habitat could make such designations impossible (FWS and NMFS, "Proposed Rule"). Finally, the guidelines suggest that an adaptive management approach should be taken when making decisions under the ESA, including the monitoring of climate and biological variables, the identification of relevant triggers, and the identification of long-term protective measures that can be taken without the need to reinitiate each time a trigger is reached (NMFS, "Revised Guidance"). This allows for more thorough protection of the species regardless of how it will be affected by climate change, an inherently unpredictable threat.

C. Implementing the MMPA and ESA: NOAA's Management Strategies

Pursuant to the ESA, NOAA Fisheries created a recovery plan for the North Atlantic right whale in 1991 and updated it in 2005 (NMFS, "Recovery Plan"). The ultimate goal of the plan is to "promote the recovery of North Atlantic right whales to a level sufficient to warrant their removal" from the ESA list of endangered and threatened species, though the agency admits that such a delisting is completely unrealistic any time in the foreseeable future. Instead, it aims to downlist this species from endangered to threatened. For this to occur, the North Atlantic right whale population would need to increase by at least 2% per year for a period of 35 years, with no known threats limiting this growth rate, and have at most a 1% chance of reaching the quasi-extinction threshold within 100 years (NMFS, "Recovery Plan"). Based on current trends and protections, this is virtually impossible. Nevertheless, the enforcement of the ESA and MMPA through NOAA Fisheries' management plan is the most important mechanism available to reverse the current decline of the North Atlantic right whale and must be at the center of any

policy discussion related to the conservation of this species (NMFS, "Right Whale Conservation").

To achieve its objectives of reducing human-caused threats and protecting important right whale habitats, NOAA Fisheries' recovery plan focuses on the following actions: reducing injuries and mortalities from vessel strikes and fishing gear entanglement, protecting essential habitats, minimizing vessel disturbance, continuing the ban on whaling, monitoring population trends, and rescuing entangled or stranded right whales while obtaining scientific data from dead specimens (NMFS, "Recovery Plan"). The ESA authorizes the appointment of recovery teams to help develop and implement these actions (16 U.S.C. § 1533(f)(2)). For this species, both a Northeast Implementation Team (NEIT) and Southeast Implementation Team (SEIT) were assembled, comprised primarily of scientists and managers (NMFS, "Northeast U.S. Implementation Team").

As required by Section 4 of the ESA (16 U.S.C. § 1533(a)(3)), NOAA Fisheries has designated two large areas as critical habitat for the North Atlantic right whale. Unit 1 is the species' traditional feeding grounds in the Gulf of Maine and Georges Bank, from Cape Cod, Massachusetts north to the Maine-Canada border (Canada is outside NOAA's jurisdiction). Unit 2 is the right whale's coastal birthing grounds from Cape Fear, North Carolina to Cape Canaveral, Florida. Together, these two areas total 29,763 square nautical miles, covering what was historically the right whale's most important non-migratory habitat (NMFS, "Critical Habitat Map").

Critical habitat designation requires federal agencies to consult with NOAA Fisheries when authorizing, funding, or carrying out any activities in these areas to ensure that they do not damage the habitat. It does not apply to citizen activities or private land, however (16 U.S.C. §

1536). Furthermore, the two critical habitat areas established for the North Atlantic right whale do not cover the entirety of its range, especially now that climate change is rapidly altering its distribution. Besides Canada's Gulf of St. Lawrence, the entire region south of Cape Cod has recently become a feeding hotspot (Record et al.), and the migratory route between New England and the whales' southern calving grounds has also become an important habitat for an increasingly large portion of the year, as evidenced by the New Jersey fatality in mid-summer (NMFS, "Dead Right Whale Sighted"). Federal activities and development in these areas could be devastating to a species already on the brink of extinction, and NOAA Fisheries has the power to prevent this by expanding the current critical habitat boundaries.

NOAA Fisheries has also designated several Seasonal Management Areas pursuant to the ESA in an effort to reduce vessel strikes (NMFS, "Right Whale Conservation"). Seasonal Management Areas (SMAs) are locations where all vessels 65 feet (19.8 meters) or longer must travel at 10 knots or less during a specified season. There is one such area east of Massachusetts, broken into three sections, each with different seasons (Cape Cod Bay from January 1 to May 15, Off Race Point from March 1 to April 30, and Great South Channel from April 1 to July 31). There are an additional six SMAs spaced out along the right whale's migratory path, all of which are active from November 1 through April 30. Finally, there is a calving ground SMA off the Florida and Georgia coast that is active from November 15 to April 15 (NMFS, "Reducing Vessel Strikes").

All of these SMAs are concentrated around major shipping ports, as these are the areas with the highest vessel traffic. However, there is a vast expanse of right whale habitat left unprotected by these SMAs, much of which experiences substantial shipping presence throughout the year (Pirotta et al.). Furthermore, even areas that are covered are not active for the

entire time whales are present, particularly in recent years as climate change drastically alters the North Atlantic right whale's seasonal distribution. If the migratory SMAs had been extended past April, the calf found dead in New Jersey would likely still be swimming alongside his mother. The current SMAs also leave all of August, September, and October devoid of mandatory vessel speed restrictions and leave all vessels under 65 feet long permanently free of regulation (NMFS, "Reducing Vessel Strikes"). Of the methods used, civil fines are the most effective way to improve vessel compliance within SMAs, though there is still a high degree of noncompliance with NOAA Fisheries' mandates (Silber et al.).

Dynamic Management Areas (DMAs) are similar to SMAs, with the critical distinction of being enforced exclusively through voluntary compliance. They are established for 15 days when three or more right whales are sighted within 75 nautical miles of each other and serve as a suggestion to either reduce vessel speed or avoid this area altogether (NMFS, "Reducing Vessel Strikes"). Not surprisingly, this suggestion is frequently ignored. Right Whale Slow Zones are identical to DMAs, but can also be triggered when right whales are detected by acoustic receivers. Additionally, ships of 300 gross tons or greater are required to report their information to shore when they are in either of two reporting locations, a year-round area off New England and a winter area off Florida and Georgia. In exchange, they receive information about right whales and vessel strikes. Unfortunately, this system excludes a large portion of vessels and important right whale habitat (NMFS, "Reducing Vessel Strikes").

It is illegal to approach within 500 yards of a North Atlantic right whale, though this is primarily directed towards whale watching vessels and personal boats intentionally viewing whales (NMFS, "Right Whale Conservation"). By the time a fast-moving ship is close enough to see a whale, it is generally impossible to steer away in time. In the past, critical habitat, SMAs,

and DMAs, combined with recommended alternative shipping routes and modified international shipping lanes, were relatively effective at reducing vessel strikes to North Atlantic right whales (Crum et al.). This is no longer the case, as many right whales have been killed by ships in recent years, especially outside of protected waters as their distribution shifts due to climate change and the vessel traffic in Atlantic waters increases (Pirotta et al.).

NOAA Fisheries' efforts to reduce fishing gear entanglement have been even less successful, as entanglement has become the primary threat to North Atlantic right whales in U.S. waters (NMFS, "2017-2020 UME"). Pursuant to the MMPA, NOAA Fisheries formed the Atlantic Large Whale Take Reduction Team (ALWTRT or the Team) in 1996, comprised of members of the fishing community, state and federal officials, scientists, and conservationists (NMFS, "Right Whale Conservation"). Together, they formed the Atlantic Large Whale Take Reduction Plan (ALWTRP or the Plan) the following year in an effort to reduce mortalities and serious entanglement injuries to minke, fin, humpback, and North Atlantic right whales. The Plan has been updated multiple times, most recently in 2015, and the Team has regular meetings to discuss the latest developments and future measures, sharing conservation responsibilities with the ESA-appointed recovery teams (NMFS, "Take Reduction Plan").

Currently, the Plan's fishing requirements include mandatory weak points in buoy lines, sinking groundlines, gear marking, a minimum number of pots per trawl, and seasonal area closures, all varying based on the location and type of fishing gear (NMFS, "Take Reduction Plan"). Additionally, NOAA funds an Atlantic Large Whale Disentanglement Network that is charged with responding to calls of entanglement (NMFS, "Right Whale Conservation"). Most of these mandates are reactive rather than proactive, and are designed to reduce the mortality rate of whales once they have been entangled. This approach ignores the serious long-term sublethal

effects of fishing gear entanglement, particularly on reproductive females (MMC, "Entanglement Trends and Impacts"). As long as there are vertical ropes in the water column when whales are present, the population will struggle to recover.

The Team is currently in the rulemaking process in light of the recent Unusual Mortality Event, though the release of the Plan has been delayed multiple times, with the final ruling already being pushed from July 2020 to May 31, 2021. It is unlikely that even this deadline will be met, as NOAA Fisheries has a troubling history of delaying such regulatory procedures (Baker et al., "Petition"). Even once this update of the Plan is eventually released, the mandates will likely not go into effect for at least another year afterwards, which is time that the North Atlantic right whale simply does not have given its increasingly dire circumstances.

III. Proposal

The current measures that NOAA Fisheries is taking to conserve the North Atlantic right whale are insufficient in the face of a rapidly changing marine environment and below the level of protection mandated by existing U.S. environmental law. Over 10% of this critically endangered species' population has been lost to human activity since 2017, and birth rates have been decreasing (NMFS, "2017-2020 UME"; "North Atlantic Right Whale"). The right whale's primary food source has drastically shifted its distribution due to unprecedented warming in the Gulf of Maine and Georges Bank, forcing the whales to follow into troubled waters (Plourde et al.). Increased vessel strikes and fishing gear entanglements are posing an existential threat to the North Atlantic right whale in these unprotected areas (such as the Gulf of St. Lawrence and south of Martha's Vineyard and Nantucket, Massachusetts), with the possibility of new habitats arising any given season (Record et al.). Both immediate short-term relief and long-term adaptive management strategies are essential to the survival of this unique and highly intelligent species.

Section A will recommend immediate short-term area closures to protect right whales from harmful fishing practices as mandated by U.S. environmental law while long-term measures are developed. Section B will propose two adaptive management strategies – ropeless fishing gear and expanded vessel speed reductions – which would protect right whales from entanglement and vessel strikes wherever they are found in the years and decades ahead.

A. Short-term Area Closures

NOAA Fisheries must immediately close down vertical line lobster fishing in areas where North Atlantic right whales are present. Both the MMPA and the ESA mandate that NOAA Fisheries declare emergency measures when there is a significant risk to the continued survival of an endangered marine mammal (16 U.S.C. §§ 1387(g)(1); 1533(b)(7)). This is clearly the case for the North Atlantic right whale, based on both quantitative data and NOAA Fisheries' own findings. In a letter released on April 5, 2019, the Atlantic Large Whale Take Reduction Team (the Team) estimated that the annual injury and mortality of right whales caused by U.S. fisheries was at least 4.3 whales per year (taking into consideration that only around 60% of serious injuries and deaths from entanglement are detected) (NMFS, "Target Letter April 5, 2019"). This number is nearly five times the allowed PBR of 0.9, meaning that take must be reduced by approximately 80% to reach this legally required target.

Under Section 101 of the MMPA, NOAA Fisheries is required to take emergency action to modify a fishery that is having a "significant adverse impact" on an endangered marine mammal such as the North Atlantic right whale (16 U.S.C. § 1387(g)(1)). Section 4 of the ESA also allows for emergency measures to be enacted when take presents a significant risk to the wellbeing of an endangered species (16 U.S.C. § 1533(b)(7)). The current serious injury and

mortality rate of 4.3 whales per year in U.S. fisheries clearly poses such a risk. Additionally, NOAA Fisheries' failure to include an incidental take statement in their latest assessment of the American lobster fishery causes every single taking of the North Atlantic right whale in this fishery to be in violation of Section 9 of the ESA (*CBD et al. v. Ross et al.*, Document 91, 2020). Therefore, NOAA Fisheries is required to prevent this take by removing the risk of entanglement to right whales.

To meet the legal mandates of both the MMPA and the ESA, NOAA Fisheries must immediately implement emergency fisheries closures in U.S. waters, bypassing the traditional regulatory process (Baker et al., "Petition"). The American lobster fishery is responsible for around 98% of fixed endlines along the U.S. Atlantic Coast, and should therefore be the focus of these closures (NMFS, "Right Whales and Entanglements"). Since 2017, nearly every entanglement-caused death and serious injury to right whales has occurred in the waters off Massachusetts (NMFS, "2017-2020 UME"). Therefore, the emergency closures should be focused in this area, particularly the recent feeding hotspot south of Martha's Vineyard and Nantucket, Massachusetts. There is also a need to close the area north and east of Cape Cod, Massachusetts, as North Atlantic right whales occur here in high concentrations throughout most of the year (Baker et al., "Petition"), and the emerging offshore lobster fishery poses an even higher risk of serious injury and death due to the heavier equipment needed (NMFS, "Right Whales and Entanglements).

Overall, the closure of these two areas would only impact a relatively small percentage of the lobster fishery (ASMFC). The SNE American lobster stock is already decreasing rapidly due to climate change, so a partial closure of this fishery would reduce the stress being placed on this population and make its recovery more feasible. Furthermore, this closure could serve as catalyst

for lobster fishers to transition to more sustainable and viable fisheries in the region, something that is already becoming necessary in light of the drastic changes to the region's climate (ASMFC).

Under the MMPA, the emergency measures may last up to 270 days (16 U.S.C. § 1387(g)(3)(B), (4)). This period would serve as a crucial reprieve for the whale population while long-term protection measures are developed that would benefit both right whales and the fishing community in the rapidly changing marine environment of New England.

B. Long-Term Adaptive Management

Climate change has dramatically altered the marine ecosystem of the North Atlantic right whale. As the copepods that right whales prey upon leave their traditional habitats due to ocean warming, the whales must venture into new areas as well (Record et al.). This shift has resulted in an increase in whale mortality and demonstrated a desperate need for adaptive management strategies. Adaptive management is the process of continuously monitoring the variables of a system while simultaneously integrating these findings into the management model (NMFS, "Revised Guidance"). This framework enables managers to reduce uncertainty over time, and is ideal when dealing with a threat as unpredictable and dynamic as climate change. More broadly, climate change adaptation is the act of reducing the negative effects caused by climate change. In 2016, NOAA Fisheries released internal guidelines for dealing with climate change under the ESA, emphasizing the importance of utilizing the best available science as well as an adaptive management approach (NMFS, "Revised Guidance").

The short-term closure of certain fisheries in U.S. waters is a necessary measure to protect the North Atlantic right whale from extinction. However, this is not a permanent solution,

as the closures will expire and the whales will shift their distribution again (Kershaw, "Make Fishing Safe for Whales"). For NOAA Fisheries to ensure the continued existence of this extraordinary species for generations to come, the agency and its regulations must understand and adapt to the evolving realities of climate change. Fortunately for both the whales and the fishing community, ropeless fishing offers and enduring solution that would allow lobster and crab fishing to safely occur even when whales are present (Baker and Baumwell, "Ropeless Fishing"). Furthermore, a valuable framework is already in place to prevent vessel strikes to right whales. With some simple modifications, it can serve as an effective long-term conservation tool for this species (NMFS, "Reducing Vessel Strikes").

1. Ropeless Fishing Gear

Due to both sublethal and lethal effects, entanglement in vertical buoy lines is the most severe threat to the North Atlantic right whale in U.S. waters (Van der Hoop et al., "Entanglement"; NMFS, "2017-2020 UME"). If these ropes continue to be present in the water column at the same time whales are, the long-term survival of this species is unlikely (Baker, "Saving Right Whale Demands New Approach"). Furthermore, with the distribution of right whales dramatically shifting both spatially and temporally due to climate change, rigid seasonal fisheries closures will not protect the entire population from entanglement (Record et al.). Therefore, NOAA Fisheries must mandate the further development and implementation of ropeless fishing gear in all Atlantic Coast trap and pot fisheries, especially the American lobster fishery.

Traditional lobster traps utilize a fixed endline that anchors a buoy to the traps and allows fishers to locate and haul in their catch upon returning. These ropes sit in the water column for

hours or days (and much longer if the trap is lost), and present an unsustainable risk to right whales and other marine species (Kershaw, "Cruel Reality of Entanglements"). Fortunately, ropeless fishing gear has been developed. The ropeless gear involves a GPS that allows fishers to reliably locate their traps, as well as an acoustic modem system that triggers an inflatable bag which then lifts the traps to the surface for easy access (Baker and Baumwell, "Ropeless Fishing"). This method removes virtually all risk of entanglement to right whales, and has shown promise in preliminary testing. Not only would it protect the whales, it would also reduce the risks posed to fishers by hauling heavy traps up from the seabed. Furthermore, the GPS system could reduce the amount of lost gear and give managers better data to ensure more sustainable fisheries. Critically, it would allow fishers to access fishing areas that are otherwise closed, which is a strong economic incentive to utilize ropeless gear (Ropeless Consortium).

As with any novel technology, there are still some issues that need to be addressed before large-scale implementation can be carried out responsibly. The GPS system must be further developed to allow enforcement agencies as well as fishers to accurately locate and identify traps, which would also help them avoid placing their traps on top of other fishers' (Baker and Baumwell, "Ropeless Fishing"). Furthermore, this technology is currently in its early stages and therefore extremely expensive, though the price will decrease over time. Another obstacle is that this system is illegal to use in New England's waters, as current provisions mandate that lobster fishers use buoys as a way to identify their traps.

Ropeless fishing gear has already been successfully tested in California's Dungeness crab fishery, and new regulations from the California Department of Fish and Wildlife include provisions that allow for the development and use of this gear as a way to protect humpback whales from entanglement (Kershaw, "California Takes the Lead"). NOAA Fisheries must

immediately implement a similar provision that allows for the development and use of this gear in areas where North Atlantic right whales are present. As previously discussed, the Atlantic Large Whale Take Reduction Team is currently in its rulemaking process as required by the MMPA (Baker et al., "Petition"). On September 28, 2018, the Team published an advance notice of this process that solicited comments on a proposal to allow ropeless fishing in the two areas that are seasonally closed to vertical line fishing (Massachusetts from February 1 to April 30 and the Great South Channel from April 1 to June 30) (NMFS, "Advance Notice"). However, this rulemaking process has been continuously delayed by NOAA Fisheries, and the North Atlantic right whale is running out of time.

Under the MMPA and the ESA, NOAA Fisheries is required to immediately reduce serious injury and mortality to an endangered marine mammal whenever there is a significant risk to the species (16 U.S.C. §§ 1387(g)(1); 1533(b)(7)). Therefore, it must immediately authorize the development, testing, and implementation of ropeless fishing gear in New England, particularly in areas that are closed to vertical line fishing. Input from the fishing community is critical to the success of such a program, and they must be given the opportunity to work with managers during this process.

The implementation of ropeless fishing gear will be expensive, but there are solutions. In 2019, members of the U.S. House and Senate introduced a bipartisan bill called the Scientific Assistance for Very Endangered (SAVE) Right Whales Act (S.2453, 116th Congress). If passed, the SAVE Right Whales Act would authorize $5 million each year over the next decade to fund the development, testing, and implementation of technologies such as ropeless fishing gear to protect the North Atlantic right whale (Fuller). This money could help subsidize the use of this technology, as individual cost is currently one of the largest hurdles for the fishing community.

Non-governmental organizations have also committed to fund ropeless fishing and create a sustainable fishery that benefits both whales and the fishing community for generations to come (Ropeless Consortium). NOAA Fisheries must act quickly and decisively to make this vision a reality.

2. Expanded Vessel Speed Reductions

Along with fishing gear entanglement, vessel strikes are a severe threat to the continued existence of the North Atlantic right whale (NMFS, "2017-2020 UME"). This threat is only increasing as right whales are forced to venture into areas where vessel speed restrictions are not in place. In addition to new areas, the whales are also inhabiting traditional areas at times of the year that they have not in the past, leading to increased mortality due to the seasonal nature of existing management areas (Record et al.). Currently, NOAA Fisheries utilizes Seasonal Management Areas (SMAs) and Dynamic Management Areas (DMAs) to prevent vessel strikes in U.S. waters (NMFS, "Reducing Vessel Strikes"). These tools are valuable, but are no longer adequately protecting the North Atlantic right whale as environmental conditions change.

There are SMAs in areas that right whales have historically inhabited during specific seasons. Yet this model leaves vast areas of ocean free of vessel speed restrictions for much of the year, and right whales are now occupying these areas with increasing frequency (Record et al.). The recent Unusual Mortality Event caused by both entanglement and vessel strikes indicates a significant risk to the North Atlantic right whale population (NMFS, "2017-2020 UME"). Under both the ESA and the MMPA, NOAA Fisheries has the authority to remove the threat presented by vessel strikes (16 U.S.C. §§ 1387(g)(1); 1533(b)(7)). Using its internal climate change guidelines, NOAA Fisheries should employ the precautionary principle to expand

SMAs in both timeframe and size, as there is uncertainty as to when and where the whales will occur in the distant future (NMFS, "Revised Guidance"). As for the near future, the best scientific data on water temperatures and plankton movement must be used to anticipate upcoming critical areas, which evidence shows can be done quite reliably (Pendleton et al.). This data should then be incorporated into the management plan on a continuous basis to allow for optimal protection for right whales.

Currently, there are no SMAs north of Massachusetts or directly south of Martha's Vineyard and Nantucket, Massachusetts, two regions of recent importance to right whales as they search for and occupy new feeding grounds (NMFS, "Reducing Vessel Strikes"). Year-round SMAs must be immediately implemented in these areas to reduce the threat of vessel strikes. Furthermore, the SMAs along the North Atlantic right whale's migratory route are sparsely located and only in effect from November 1 to April 30 (NMFS, "Reducing Vessel Strikes"). Right whales now frequently occupy these waters outside of this timeframe, particularly at the northernmost portion near New York and New Jersey (Baker et al., "Petition"). This entire high-traffic area must be regulated for a longer period, ideally through June. Finally, the entire coastal migratory route should be consolidated into one unbroken SMA that leaves no important habitat unprotected.

DMAs (and the functionally identical Right Whale Slow Zones) offer an opportunity to reduce vessel strikes in a dynamic marine environment. When at least three right whales are detected in close proximity to each other, the area becomes a DMA for 15 days and all nearby vessels are recommended to slow down or avoid the zone completely (NMFS, "Reducing Vessel Strikes"). This model is effective at responding to rapid shifts in distribution, but ineffective at protecting right whales due to its optional nature. NOAA Fisheries must therefore immediately

make DMAs and Right Whale Slow Zones mandatory for all vessels. Such a measure would greatly reduce the risk posed to right whales by vessel strikes in U.S. waters for the foreseeable future.

Conclusion

The North Atlantic right whale is one of the most endangered marine mammals on the planet, and a recent influx of vessel strikes and fishing gear entanglements has pushed this species to the brink of extinction (IUCN). These threats have been exacerbated by climate change impacts, which have altered the distribution of the zooplankton that right whales feed on and force the whales into unprotected waters (Record et al.).

Under the Endangered Species Act and the Marine Mammal Protection Act, NOAA Fisheries is required to protect this species and remove any threats to its continued existence (16 U.S.C. §§ 1387(g)(1); 1533(b)(7)). Currently, fishing gear modifications and vessel speed reduction areas are in place, but these are not enough to protect right whales from the sublethal and lethal effects currently being amplified by climate change (Meyer-Gutbrod and Greene, "Uncertain Recovery").

NOAA Fisheries must implement immediate short-term closures of the American lobster fisheries operating in the North Atlantic right whale's current habitat. This emergency measure will reduce the stress being placed on the right whale's population while long-term adaptive management strategies can be put in place (Baker et al., "Petition"). These strategies must include the further development, testing, and implementation of ropeless fishing gear, which will allow the lobster fishery to continue without threatening the right whale's continued existence (Myers et al.). NOAA Fisheries must also modify its existing vessel speed reduction strategies to

include areas and seasons that have recently become essential, while also making Dynamic Management Areas mandatory. These long-term adaptations, in conjunction with short-term area closures, would fulfill NOAA Fisheries' duty to protect the North Atlantic right whale for years to come, even as climate change dramatically alters this dynamic marine environment.

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