The SAVE Right Whales Act (H. R. 1568)

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TABLE OF CONTENTS

I. EXECUTIVE SUMMARY:

The current population of roughly 411 Northern Atlantic right whales is in immediate danger of extinction. Climate change and industries like shipping and fishing have led to a rapid decline in the right whale population over the past decade (Gutbrod and Greene, 445). The species is on pace to become extinct ahead of the original projection of 200 years (Kraus *et al.,* 2). Given human-related threats have led to the North Atlantic right whale population crisis, government action is needed to save the North Atlantic right whale population.

Human whaling was the cause of the original right whale population decline in the 19th and 20th centuries. Despite protection from whaling since 1945, mortality continues due to undesired interactions with human activities such as fishing and shipping. North Atlantic right whales are known as "urban whales" due to their tendency to swim near major cities and busy ports along the Eastern United States and Southern Canada (Annex, figure 1). This leaves right whales susceptible to death from ships and fishing lines, which together account for the majority of recorded right whale deaths in modern times (Pettis *et al.,* 2). High mortality rates, combined with the low fecundity of right whales, means that the population is classified as critically endangered and needs immediate and continued intervention.

In addition, these threats are further compounded by the shifting migratory patterns of North Atlantic right whales, caused by changing populations of their primary food source: zooplankton. North Atlantic right whales are described as "grazers" by scientists, given their tendency to eat large volumes of zooplankton near the surface of the ocean water. A North Atlantic right whale can eat up to 5,000 pounds of zooplankton during its feeding season. As ocean temperatures warm, zooplankton populations are shifting northward to colder waters. The whales' high dependence on zooplankton means that they too are shifting, pushing them into unprotected waters where risks of death from ship strike and fishing line entanglement increase.

The shifting migratory patterns of the right whale population in recent years and continued mortality events require further action. The United States Congress believes that cooperative action must be taken with Canada, as well as the committed engagement of other entities and stakeholders in stabilizing the remaining North Atlantic right whale population.

The Scientific Assistance for Very Endangered North Atlantic Right Whales Act of 2019 (SAVE Right Whales Act) aims to help the conservation and recovery of the North Atlantic right whale population by offering financial support to entities and programs focused on right whale conservation. The Act will also require the surveying of the zooplankton population's abundance and distribution in the North Atlantic, and encourages cooperation between the United States and Canadian governments in pursuing this goal. Understanding the zooplankton populations will help scientists and conservationists understand the shifting migration patterns of right whales and where protections are most needed.

There is not much time left for the North Atlantic right whale species to recover. Potential solutions, some of which are described in the below text, will take years to implement and require political will. Nonetheless, imposing new regulations and implementing innovative technology is worth trying, as it is all we have left to save the North Atlantic right whale from extinction.

II. INTRODUCTION:

The highly endangered North Atlantic right whale population is decreasing at drastic rates. Whaling initially decimated the population until protections were established for the species by the International Convention for the Regulation of Whaling in 1949 (Mullen et al.). Named for being the "right" whale to hunt because they float once dead, North Atlantic right whales continue to be threatened by human impacts (NOAA Fisheries). The situation today is critical: six North Atlantic right whales—more than 1 percent of the entire population—died in June 2019 (Yong). There are approximately only 411 whales left today.

Ship strikes and fishing-line entanglements are the two primary human-driven causes of North Atlantic right whale deaths (NOAA Fisheries). Ocean noise, a secondary problem, increases stress levels for North Atlantic right whales, which ultimately contributes to shorter lifespans (NOAA Fisheries) and may even decrease reproduction rates. The United States Congress believes that cooperative action must be taken between the governments of the U.S. and Canada, as well as the committed engagement of other entities and stakeholders in stabilizing the North Atlantic right whale population.

Deaths from ship strikes and fishing-line entanglement are exacerbated by shifting populations of right whales. The primary driver of the North Atlantic right whales' migration patterns is zooplankton, its main food source. The North Atlantic right whale is heavily reliant on large volumes of zooplankton, eating up to 5,000 pounds every day during feeding season. As the Atlantic Ocean temperature rises, zooplankton populations are shifting northward to cooler waters. North Atlantic right whales are following them into these waters, which is pushing them into unprotected waters.

The SAVE Right Whales Act intends to address these mounting issues with the following proposal:

The Save Right Whales Act

The SAVE Right Whales Act provides $5 million in funding annually for 10 years, with the aim to:

1. "Rebuild healthy populations of the North Atlantic right whale.
2. Assist in the conservation and protection of North Atlantic right whales by supporting North Atlantic right whale conservation programs that minimize conflicts between North Atlantic right whales and human activities.
3. Provide financial resources for those programs." (H.R. 1568, 1)

Though "healthy populations" of right whales is not defined in the bill, pre-whaling numbers reveal that a viable North Atlantic right whale population has between 9,000 and 23,000 individuals (Roman et al.). Achieving this would be impossible from the 10-year long policy, however the SAVE Act is an important step in the right direction. The below paper will address the primary environmental problems facing North Atlantic right whales, outline potential solutions, and define potential metrics for monitoring and evaluating success.

III. THE ENVIRONMENTAL PROBLEMS:

Baleen Biology

Right whales have several unique biological characteristics that allowed them to thrive in the world's oceans before humans began hunting the species (Mayo and Marx, 2214). Right Whales are baleen whales, meaning that they have specialized teeth that allow them to filter feed in the ocean (Mayo and Marx, 2214). Baleen teeth are made from the same proteins as human fingernails (Mayo and Marx, 2214). These specialized baleen teeth are long and comb-like, which allows right whales to strain or filter zooplankton out of the water while intaking hundreds of gallons of water at once (Mayo and Marx, 2214). Baleen whales have become specialists in this sense, and they use baleen feeding in order to eat large quantities of small microorganisms (Mayo and Marx, 2214).

Zooplankton

North Atlantic right whales have developed into specialists that rely on heavy quantities of C. finmarcicius in particular (Mayo and Marx, 2219). The timing of the whale's foraging season is reliant on when the zooplankton the whales rely on are reaching a later stage in their life cycle (Mayo and Marx, 2219). This is advantageous for the whales, for during this time the zooplankton are at their largest, and they also are closer to the surface where whales can easily feed on mass quantities of the plankton (Mayo and Marx, 2219). By taking advantage of the timing and life cycle of C. finmarcicius, right whales can feed during a time of the year when they can maximize their calorie intake (Mayo and Marx, 2217). Conditions are so primed for whales during foraging that some whales have been seen with open mouths filtering feeding plankton for up to 58 minutes out of a given hour, indicating just how crucial this feeding period is for the species (Mayo and Marx, 2217).

In recent years, Zooplankton populations have been shifting northward to colder ocean waters. The whales' high dependence on zooplankton means that they too are shifting, pushing them into unprotected waters where risks of death from ship strike and fishing line entanglement are higher. A right whale cannot simply begin feeding on fish if zooplankton numbers are declining, because its baleen biology has catered it to feeding on plankton. On top of this, the whales' large size and long migration require that it maximize its efficiency in feeding and consume large quantities of plankton continually during this time (Mayo and Marx, 2217).

Reproductive Patterns

In 2018, there were no documented births of North Atlantic right whale calves. This is part of a larger trend in birth-rate that suggests a decreasing reproductive rate for the North Atlantic right whale (Greenhalgh). It takes 8 to 10 years for North Atlantic right whale females to reach sexual maturity (Frasier et al., 5277). Pregnancy takes a year, and females wait 3 to 4 years between pregnancies (Frasier et al., 5279). The lack of sexually mature females in the population has hindered population growth (Fujiwara and Caswell, 3). Given the current environmental problems, the reproductive behavior of the North Atlantic right whale is not favorable to recover it to the pre-whaling population of 9,000 to 23,000 (Roman et al., 1).

Human-related Threats

Fishing Traps

Entanglement with fishing and lobster-pot lines during right whales' migration and feeding seasons has injured up to 80 percent of the right whale population, or caused deaths (Gutbrod and Greene, 445). Several fisheries are located on migratory routes and foraging grounds (Gutbrod and Greene, 445). Investigators discovered that right whales trapped in their breeding and calving grounds were

mostly entangled with vertical and horizontal lines used in fixed-gear fisheries, e.g., gillnets and pot gear (Johnson *et al.,* 636). Whales that are entangled in fixed gillnets can drown, and those entangled in drift gillnets can drag gear for long distances as they migrate and forage, consequently leading to extreme fatigue (Johnson *et al.,* 639). Similarly, ground ropes or vertical ropes connecting lobster pots can entangle whales around their bodies and fins, causing lacerations or broken bones that can result in permanent injury and death (Johnson *et al.,* 638).

Whale Fatalities from Ship Collisions

Vessel strikes with fast-moving ships has been another major agent of mortality (Conn and Silber, 2). Shipping routes directly intersect with right whale migratory paths along the east coast of the United States and Canada (Conn and Silber, 2). Female right whales have to share their migration paths with ships serving the eastern United States and Canada, including hydrofoil ferries, whale-watching vessels and recreational crafts (Keller, *et al.,* 428). Collisions result in adverse outcomes, such as death or severe injuries, including fractured bones, hemorrhaging or propeller lacerations (Conn & Silber, 1). Usually, whales are unable to be detected by ship radar in advance or are found too late to be avoided. North Atlantic right whales primarily suffered fatal or serious injuries from ships that are at least 262 feet in length or that are driven at a speed of at least 16 mph (Laist *et al.,* 36).

Ocean Noise Pollution

North Atlantic right whales communicate using low frequency sounds that travel hundreds of kilometers (Rolland et al., 2363). Areas of heavy shipping traffic have much higher levels of low-frequency (20-200Hz) ocean noise, and several of these areas intersect with critical foraging grounds and migratory routes for North Atlantic right whales (Rolland et al., 2363). High levels of ocean noise have been found to lead to habitat displacement, behavioral changes, and elevated stress hormone levels in North Atlantic right whales (Rolland et al., 2363). While ocean noise is not a direct agent of mortality, it adds stress and disrupts communication for a species that is already under threat (Rolland et al., 2363).

Climate Change

The main food source of the North Atlantic right whale is Calanus finmarchicus, a large-sized genus of zooplankton. Zooplankton are vulnerable to anthropogenic climate change impacts, such as ocean warming, causing the North Atlantic right whales to in turn be negatively affected by such impacts (Gutbrod and Greene, 462). The Gulf of Maine, which is the main feeding ground for right whales, experienced unprecedented ocean warming during recent years (Gutbrod and Greene, 461). Because of this, zooplankton have shifted northward to coastal waters with cooler temperatures (Gutbrod and Greene, 445). Right whales have followed their prey into these new areas where there are no existing protections for right whales (Gutbrod and Greene, 462). As a result, warmer ocean temperatures have ultimately led to increased ship strikes and entanglements of right whales that now forage in unprotected waters (Gutbrod and Greene, 462).

IV. THE PROPOSED SOLUTIONS:

Imposing new regulations to change human behavior and implementing innovative technology are the proposed solutions to the primary drivers of right whale mortality.

Reducing Entanglement

The Atlantic Large Whale Reduction (ALWR) plan prohibits the commercial use of traps and pots at certain months of the year in areas that whales are known to frequent (Rogers, 39157). A current proposed solution to reducing entanglement is a technological one called ropeless fishing. Ropeless fishing is the replacement of permanent vertical fishing lines with inflatable bags, spools, and buoys that are stored at the seafloor until they are acoustically signaled to release to the surface (Baumgartner et al., 3). This technology could effectively prevent entanglement from occurring, as no lines are present. However, it is currently illegal in both the US and Canada and would need to be legalized in order to assist in the recovery of North Atlantic right whales (Baumgartner et al., 5). In addition, there are other controversies to this solution, outlined in the table below.

Entanglement: Controversies to Solutions

Pros of Ropeless Fishing	Cons of Ropeless Fishing

• **No more closed zones:** Ropeless fishing would eliminate the need for the ALWR plan and fishers could once again fish in areas that are currently closed for up to three months every year (Rogers, 39157).
• **Fewer traps lost:** In Maine, 5-10% of traps are lost every year to strong currents and storms that drag surface buoys and their attached traps away (Canfield). Currents would be of no concern with ropeless fishing, as all the equipment sits on the seafloor.
• **Longer soak times:** Not needing to retrieve traps before impending storms allows for longer soak times for the traps which would lead to higher catch yield and lower costs in boat fuel, labor, and time (Desert Star).
	• **Costs:** Ropeless equipment prices are incredibly high. The technology ranges from $1500-$5000 (Bland) (Desert Star). A regular lobster trap with permanent lines costs just $60-$150 and one fisher boat may own up to 800 traps (Venook).
	• **Time consuming:** Retrieval of traps from the time the acoustic signal is sent to release the lines takes up to 10 minutes, whereas it currently takes around 2 minutes to retrieve a trap with a permanent vertical line (Ball and Partan, 150).
	• **Increase in illegal fishing:** Ropeless fishing is illegal in the U.S. and Canada because it could enable unregulated and unreported fishing.
	  ○ No surface buoy makes it difficult for enforcers to regulate fishing and check for permits. Enforcement costs would increase with the need for more boats and bodies patrolling.
	  ○ Illegal fishing costs the fishing industry millions in lost revenue per year and puts marine populations at risk from overfishing (Agnew et al.).
	• **Increased ocean noise:** Acoustic signals transmitted from the boat to the

	trap could alter a whale's hearing from temporary decrease in hearing distance to the very worst-case scenario of permanent hearing loss. Desert Star, a ropeless fishing equipment developer, calculated the safe distance a baleen whale would need to be from the acoustic signal given the intensity of the signal and the hearing threshold of whales, as determined in NOAA's Technical Memorandum (2016). Under constant exposure to the signals, North Atlantic right whales should not be affected if they are at least 1.66 meters from the signal (Desert Star). However, given that one lobster boat could have up to 800 traps in the water at one time (Venook), there is a possibility that the wide use of ropeless fishing could shrink the areas in which whales could freely move with little risk.

Reducing Ship Strikes

In 2008, Seasonal Management Areas (SMAs) were established across the northeast coast of the United States. These areas have a speed limit of 10 knots and the location of these areas are based on known right whale migratory routes. However, the areas in which right whales frequent are changing. Even before migratory shifts, only 36 percent of ship strike deaths prior to 2008 occurred within what became SMAs (van der Hoop et al.). Therefore, the proposed solution is to track the whales using acoustic detection buoys to update the locations of SMAs and to alert ships to slow down when near found whales in zones outside of SMAs. A regulated ship speed reduction may increase costs for the shipping industry. Furthermore, the controversies and issues behind the proposed solutions are exacerbated by the right whale migration shifts, which makes it difficult to understand where SMAs need to be established.

Ship Strikes: Controversies in the Shipping Industry:

The average delay of vessels as a result of reduced speeds in SMAs is 22 minutes, which is translated into $19.6 million of additional costs per year. The shipping industry is so profitable, however, that $19.6 million is only 0.1% of annual profits. The additional costs are from missed and extra fuel costs from changing ships' speeds (Nathan Associates Inc.). Increasing SMAs would therefore not have a significant impact on costs. Although, reducing speeds outside of SMAs when acoustic buoys detect nearby whales would further increase fuel costs.

V. MEASURING SUCCESS:

With new regulations comes the need for monitoring and enforcement. The main intent of the SAVE Act is to decrease human-drivers of North Atlantic right whale death. Therefore, key performance indicators in measuring success of the SAVE Act include female population sizes, birth rates, and average life expectancy.

A monitoring and evaluation strategy will need to answer the below questions:

- Are North Atlantic right whale populations (with a specific focus on females) increasing?
- Is the birth rate for North Atlantic right whales at a sustainable rate (e.g., replacement rate)?
- Are deaths declining from human-induced causes, including ship strikes and entanglement?
- Are new technologies (e.g., ropeless fishing) being adopted?
- Is ocean noise pollution being measured and reduced?
- Are the United States and Canada implementing a joint zooplankton survey?

Measures for Monitoring and Evaluation:

Key Performance Indicator	*Defining Success*	*Challenge(s) in Measuring*
Birth Rates: Another important measure of the North Atlantic right whales' future population trend is birth rates. This indicates both the increase or decrease of future populations, as well as the health of current populations. In 2001, a North Atlantic Right whale was expected to have between one to two calves. This is down from more than six in 1980.	• Positive birth rate for the entirety of the Act (10 years) • Zooplankton population abundance	• Possible challenge if range of North Atlantic right whale shifts (though currently births occur off the coast of Georgia and Florida)
Life expectancy: Decreasing premature deaths from ship strikes and entanglement would be one of the clearest demonstrations of the Act's success.	• Prevention of all deaths from ship strikes and entanglements • Regulations on boat speeds and fishing activity in North Atlantic right whale migration areas (e.g., 10-knot speed limit for vessels in certain restricted areas)	• Costs associated with Atlantic Ocean-wide survey to • Agreement on how to define "death" as not all right whale corpses are found (e.g., one conservation organization states a whale is dead if it has not been seen in six years) • Up to 85% of North Atlantic right whales have entanglement scars; challenge in

		tracking and identifying new scars
Female Population: One important measure in evaluating right whale population recovery is the population size of female whales.	• Preventing the premature deaths of two or more female right whales per year is projected to increase the population growth rate to replacement levels (Fujiwara et al.)	• Costs associated with Atlantic Ocean-wide survey • Will require cooperation with Canada • All deaths are not currently reported (disincentives by shipping and fishing boats to do so) • Requires an understanding of indirect drivers of fertility (e.g., zooplankton abundance, ocean warming, ocean noise)
U.S.-Canadian Cooperation: The Act states that, "to the extent practicable, coordinate with the Government of Canada to develop a transboundary understanding of plankton abundance and distribution." The North Atlantic right whale range extends from the southern tip of the United States to southeast Canada, and zooplankton populations are most abundant in the colder, North Atlantic waters. The United States cannot therefore unilaterally conduct surveys to understand zooplankton migration patterns.	• Cooperation agreements or coordination between the U.S. and Canadian governments in conducting zooplankton surveys	• The range of the North Atlantic right whale may have the potential to extend to international waters, and require further multilateral agreements • Will require cooperation with conservation organizations and local government stakeholders
Creation and Adoption of New Technologies: The Act provides grants and funding for exploration of new technologies to decrease the mortality incidences from ship strikes and entanglement.	• Disbursement of full funding available under the Act ($5 million annually for 10 years) • Technology like ropeless fishing being legalized and adopted in the next ten years	• Ropeless fishing is still illegal in the U.S. • Costs of adopting new technologies will be steep

Reduction of Ocean Noise: Ocean noise interferes with whale communication and is believed to lead to stress and even potentially have negative impacts on reproduction.	• Decrease in overall ocean noise due to shipping traffic, fracking, and	• Challenges of measuring ocean noise across thousands of miles • The implementation of ropeless fishing would increase ocean noise pollution (given the ropeless technology relies on transmitters)

VI. CONCLUSION:

Total extinction of the North Atlantic right whales will bring further ecological impacts. North Atlantic right whales play an important role in the nutrient cycle of their habitat. Right whales produce fecal matter that has high concentrations of two essential nutrients: NH+ and PO3- (Roman et al., 1). Plankton consume the two nutrients in fecal plumes from whales (Roman et al.,1). Thus, North Atlantic right whales provide nitrogen and phosphorous to stimulate plankton growth (Roman et al.,1).

It has also been found that without marine predator species like North Atlantic right whales, prey populations can grow so large that they threaten their own food supply. North Atlantic right whales keep zooplankton populations in check by each consuming more than two thousand pounds of zooplankton every day. In this sense, North Atlantic right whales are key in maintaining the food chain equilibrium in the ocean ecosystem. (Hammershlag et al., 370).

Beyond these ecological considerations, there are ethical and moral ones as well. There is not much time left for the North Atlantic right whale species to recover and extinction is permanent. The Act's solutions would take years to implement and require political will. Nonetheless, imposing new regulations and implementing innovative technology is worth trying, as it is all we have left to save the North Atlantic right whale from extinction.

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ANNEX:

Figure 1. *North Atlantic right whale migration patterns (source: Smithsonian Ocean)*