NOAA FISHERIES

Northeast Fisheries Science Center

Draft Ropeless Roadmap

A Strategy to Develop On-Demand Fishing

About This Document

This document describes the current state of on-demand, or "ropeless," fishing and outlines a path for increasing adoption of this technology in U.S. East Coast commercial fisheries. We discuss this developing technology and forecast its future path based on the status of gear development, ongoing regulatory changes, and the need to decrease whale entanglements and associated mortality under the Endangered Species Act and Marine Mammal Protection Act (Figure 1). The need for on-demand fishing is driven by the urgent conservation crisis facing the endangered North Atlantic right whale (*Eubalaena glacialis*), hereafter referred to as the right whale. The species has been in decline for over a decade and is approaching extinction due to human impacts, including entanglement in fishing lines (Figure 2).[1] As the need for larger and longer seasonal restricted areas increases to protect right whales, on-demand fishing represents the best solution to separate rope and right whales in areas of highest risk. The following sections explore the potential for on-demand fishing gear to provide substantial reductions in entanglement risk for fixed gear trap/pot fisheries in a rapidly changing Atlantic ecosystem.

This document is intended for a broad audience to serve as a roadmap for future research, engagement, and policy change to enable the continued development of on-demand fishing. Each of the components of this roadmap provide a broad overview of the steps forward. We recognize that there are many partners who are key to this process and strategy, particularly state fishery managers and fishery management councils and commissions. Our intent is to share this plan for input and move forward in close collaboration with our partners. We welcome continued feedback on this document via https://bit.ly/3GHOIdE to incorporate the perspectives of all stakeholders involved in these processes and to ensure that all voices are heard to help guide our next steps. We intend to revise this roadmap over time and would like it to serve as a living document to provide our vision for proceeding through this rapidly evolving landscape.

[1] Pace, R. M., P. J. Corkeron, and S. D. Kraus. 2017. State–space mark–recapture estimates reveal a recent decline in abundance of North Atlantic right whales. Ecology and Evolution, 7:2045-7758.
Pettis, H.M., R.M. Pace, and P.K. Hamilton. 2022. North Atlantic Right Whale Consortium 2021 Annual Report Card. Report to the North Atlantic Right Whale Consortium.

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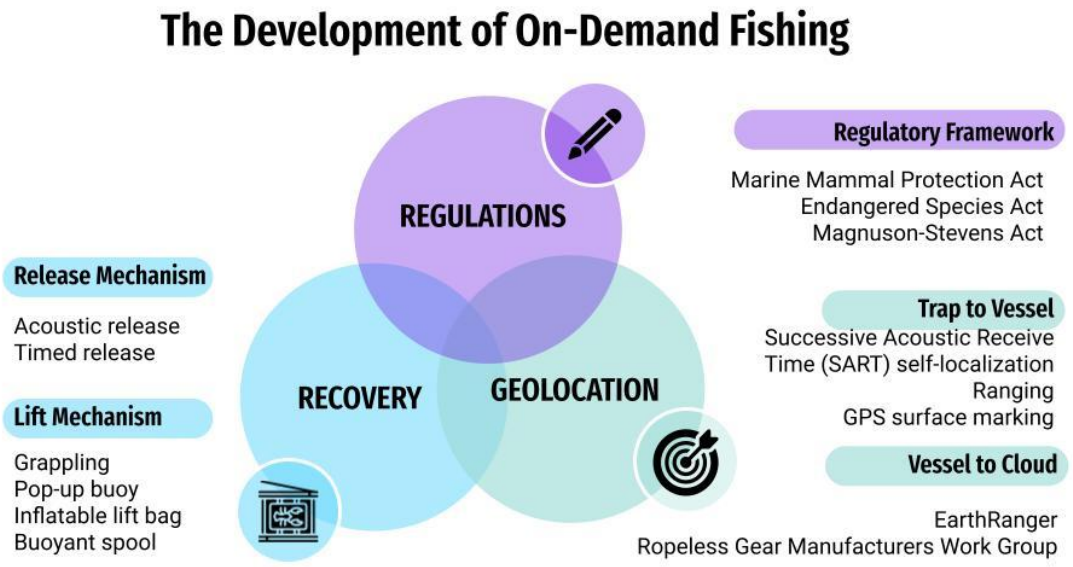

Figure 1. Gear recovery, geolocation, and regulatory components of on-demand fishing technology

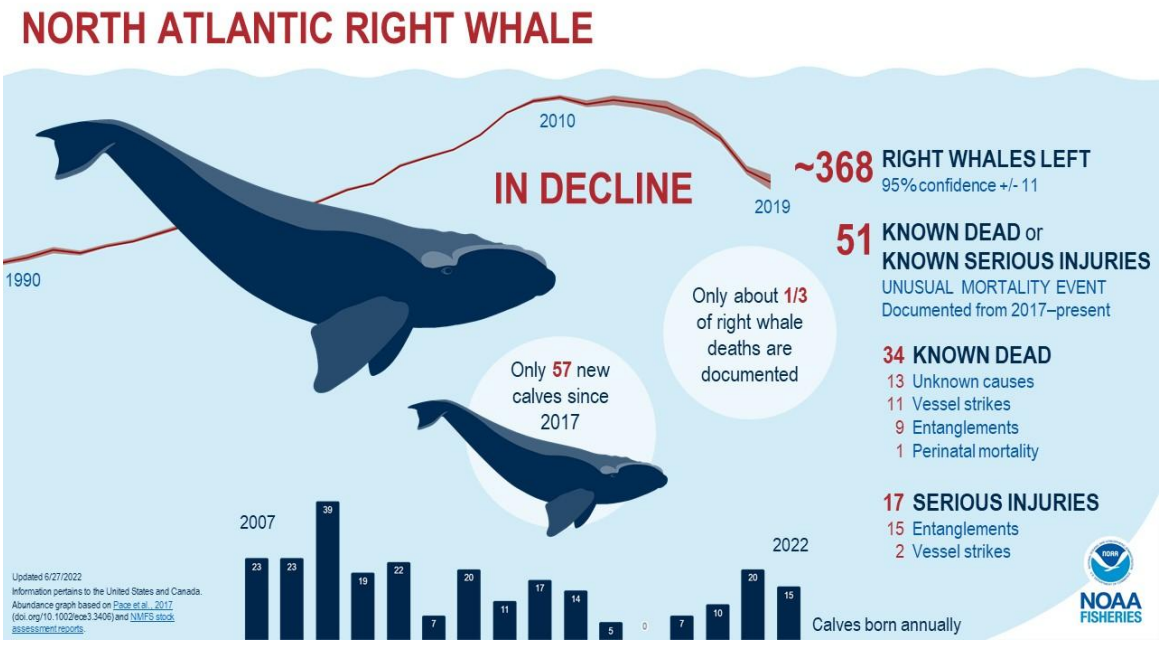

Figure 2. Infographic describing the decline in abundance of the North Atlantic right whale as well as details about observed right whale mortalities and serious injuries since the Unusual Mortality Event began in 2017.

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On-Demand Fishing Gear

What is On-Demand Fishing Gear?

Currently, fishermen use rope to connect surface buoys to fixed gear on the seafloor, which allows them to mark the location of and retrieve deployed gear. On-demand fishing removes these static vertical buoy lines from the water column while allowing fishermen to continue to fish their current gear. The term "on-demand" fishing, as used in this document, is also referred to as "buoyless", "ropeless", or "on-call" fishing. On-demand fishing encompasses a number of technologies and options. It is considered on-demand because in most systems, following gear deployment to the seafloor, a remote retrieval system is used to trigger the release of a buoy line, or other mechanism (such as an inflatable float), allowing fishermen to haul the gear to the surface when needed (Figure 3). The retrieval system is based on acoustic technology that has been in use by the U.S. Navy, oil and gas industry, and the oceanographic research community for 50 years.[2] In this way, on-demand fishing gear does not actually eliminate the use of rope in fishing gear, but minimizes how long the rope is in the water column and therefore reduces entanglement risk. Fishermen may continue to use sinking groundlines between pots/traps and on-demand rope for gear retrieval.

[2] Myers, H.J., M.J. Moore, M.F. Baumgartner, S.W. Brillant, S.K. Katona, A. R. Knowlton, L. Morissette, H.M. Pettis, G. Shester, and T.B.Werner. 2019. Ropeless fishing to prevent large whale entanglements: Ropeless Consortium report. Marine Policy, Vol. 107.

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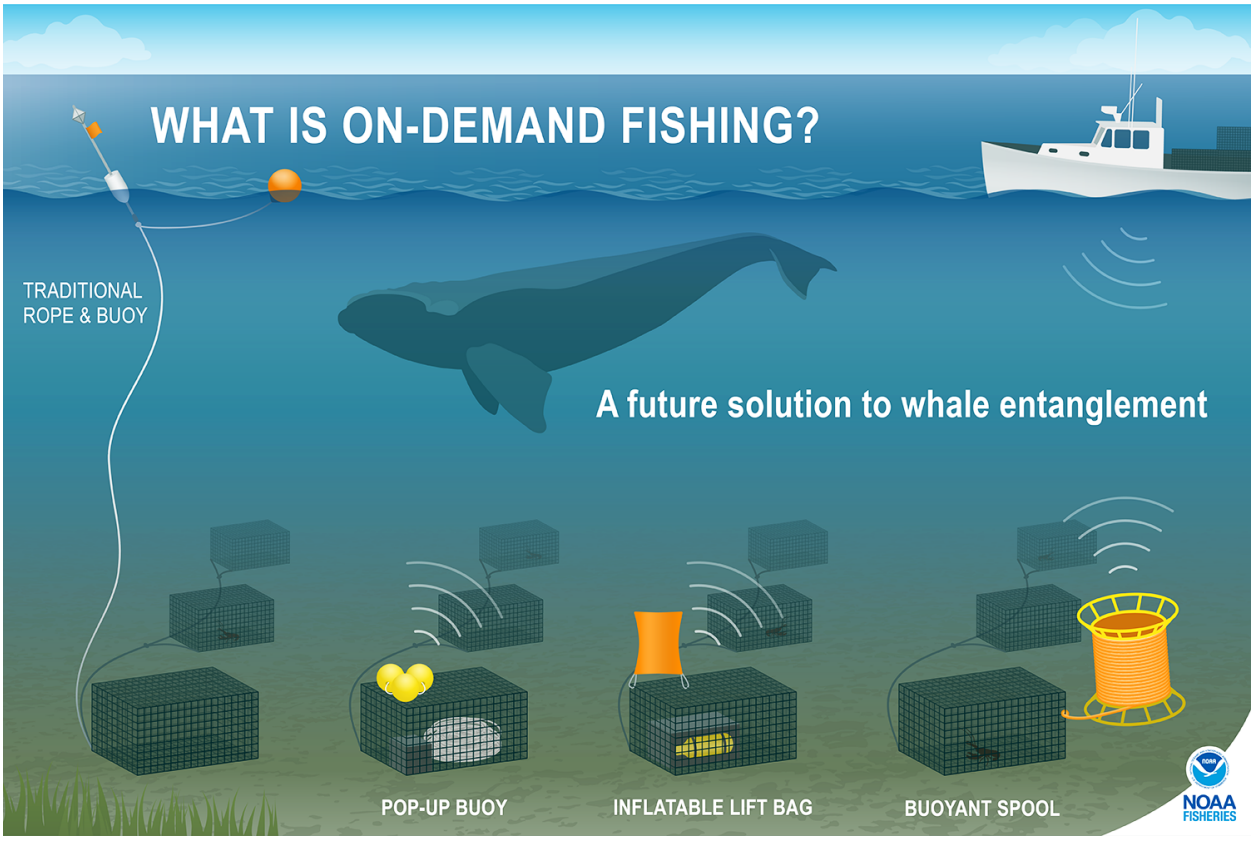

Figure 3. Fishing traps using a traditional lobster trap, lines, and buoys (left), and three on-demand fishing systems (right).

Less expensive alternatives to acoustic releases may be feasible in some fisheries. For example, the use of a grappling hook to recover tended gear has potential, especially as fishermen in many areas are proficient with this method. This technique would be most conducive in situations where trawls of traps are used and the grappling hook can be used to snag a ground line between traps. Alternatively, the use of a timed buoy release may be feasible in some regions where there is lower risk to whales and/or where the gear is tended at regular intervals. Both alternatives would likely still need to be paired with a gear geolocation system, as discussed below.

Why On-Demand Fishing Gear?

New England is home to the largest and most lucrative pot/trap fishery in the United States, primarily targeting lobster and crab. The fishery deploys strings (or trawls) of pots and traps along the seafloor connected by groundlines; at each end of the string, a static vertical buoy line is attached to mark the gear's position at the surface. Along the East Coast, there are also smaller trap/pot fisheries targeting whelk, conch, crab, and finfish. Other fishermen target a variety of finfish by deploying mesh gillnets anchored to the seafloor that are similarly marked with buoys at the surface.

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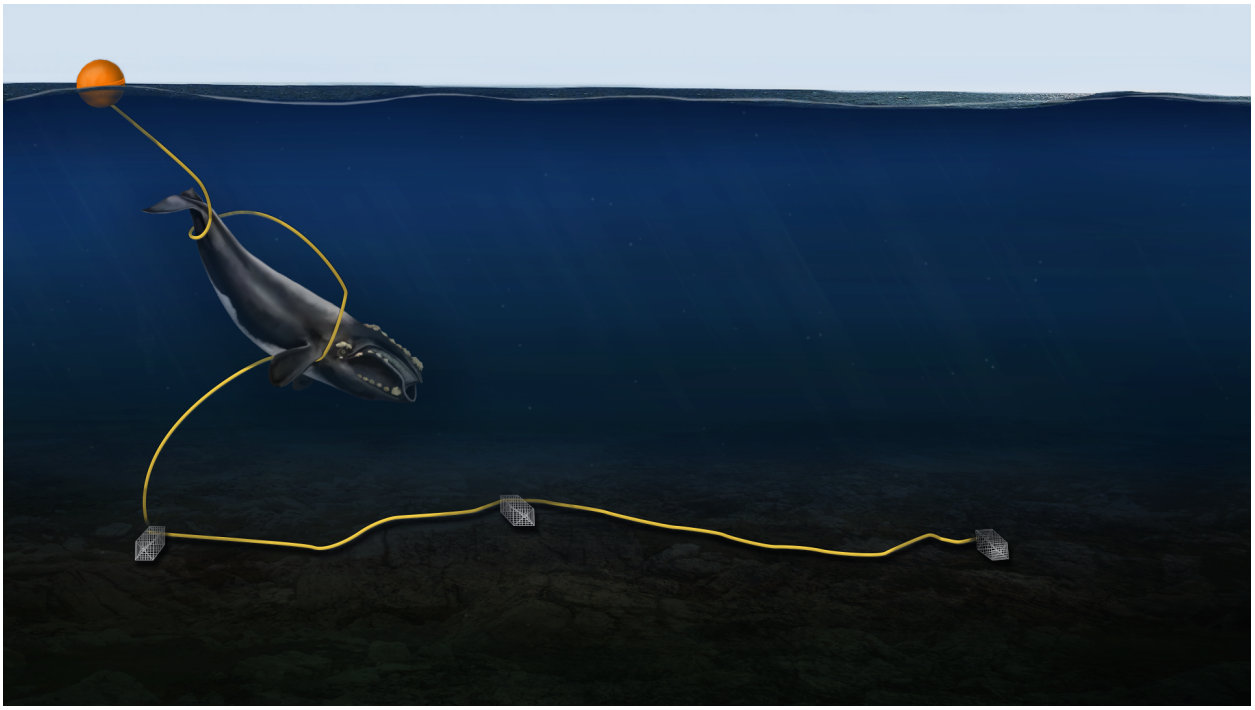

Figure 4. Illustration of whale entangled in a conventional trap/pot fishing gear buoy line.

All these fishing methods use stationary buoy lines or nets suspended in the ocean that incidentally entangle a variety of non-target species including marine mammals, sharks, and sea turtles (Figure 4). Entanglements can range from minor, temporary interactions to serious events resulting in lethal injuries or drowning. Entanglement of large marine vertebrates, particularly endangered right whales, remains a pressing and ongoing challenge that, in some cases, poses a threat to species survival. This is a global problem, with entanglement happening wherever fixed gear fisheries occur.

In an effort to mitigate whale entanglement, scientists, fishermen, conservationists, and resource managers are increasingly looking to new gear systems and technologies that may offer a more enduring solution for both reducing entanglements and decreasing fishery closures. On-demand fishing offers the greatest potential for a lasting solution to this challenge by allowing fishing to occur within habitats used by whales, sharks, and sea turtles with minimal risk of entanglement.[3]

On-demand fisheries are emerging around the world, both as a solution to entanglement issues and for other reasons, such as to reduce poaching and gear loss. Due to the extinction risk facing right whales, technology

[3] Moore, M.J, 2019, How we can all stop killing whales: A proposal to avoid whale entanglement in fishing gear. ICES Journal of Marine Science, Vol 76(4):781-786.
Baumgartner, M.F., T.B. Werner, and M.J. Moore. 2019. Urgent Need for ropeless fishing: Removing endlines to protect right whales, Sea Technology 60(3):23-27

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development efforts are being accelerated along the U.S. East Coast. On the U.S. West Coast, entanglement of large whales in fixed gear such as Dungeness crab pot gear remains a persistent problem, and the State of California has recently modified their regulations to allow use and testing of on-demand fishing gear. On-demand fishing gear is also gaining traction as a viable option to prevent entanglement globally. Canada has an active on-demand fishing gear research program to prevent right whale entanglements, particularly in the Gulf of St. Lawrence snow crab fishery and in the broader Canadian lobster fishery.

On-demand fishing gear has been operationalized in at least two commercial fisheries internationally: the Australian New South Wales rock lobster fishery and the South African octopus fishery. As on-demand fishing systems are developed, these systems will be adopted by many countries around the world as a means to reduce entanglement of protected species, prevent poaching of target catch, and reduce gear loss.

Availability of On-Demand Fishing Gear

Currently, on the U.S. East Coast, most on-demand fishing gear and training is made available through NOAA's Northeast Fisheries Science Center (NEFSC). The NEFSC is initially engaging with fisheries along the eastern seaboard that are subject to regulations for reducing right whale entanglement risk. The NEFSC manages a Collaborative Gear Lending Library (Gear Library) with approximately 160 on-demand units available[4] for testing both inshore and offshore, with additional units expected to be delivered later in 2022 (Figure 5). Since 2018, the NEFSC has worked with 24 vessels from multiple fisheries in New England and is currently expanding training efforts to support fishermen in the Gulf of Maine, Mid-Atlantic, and Southeast regions.

[4] The Gear library includes units from Ashored, DBV Technologies, Desert Star, EdgeTech, Fiomarine, SMELTS, Sub Sea Sonics, and Woods Hole Oceanographic Institution.

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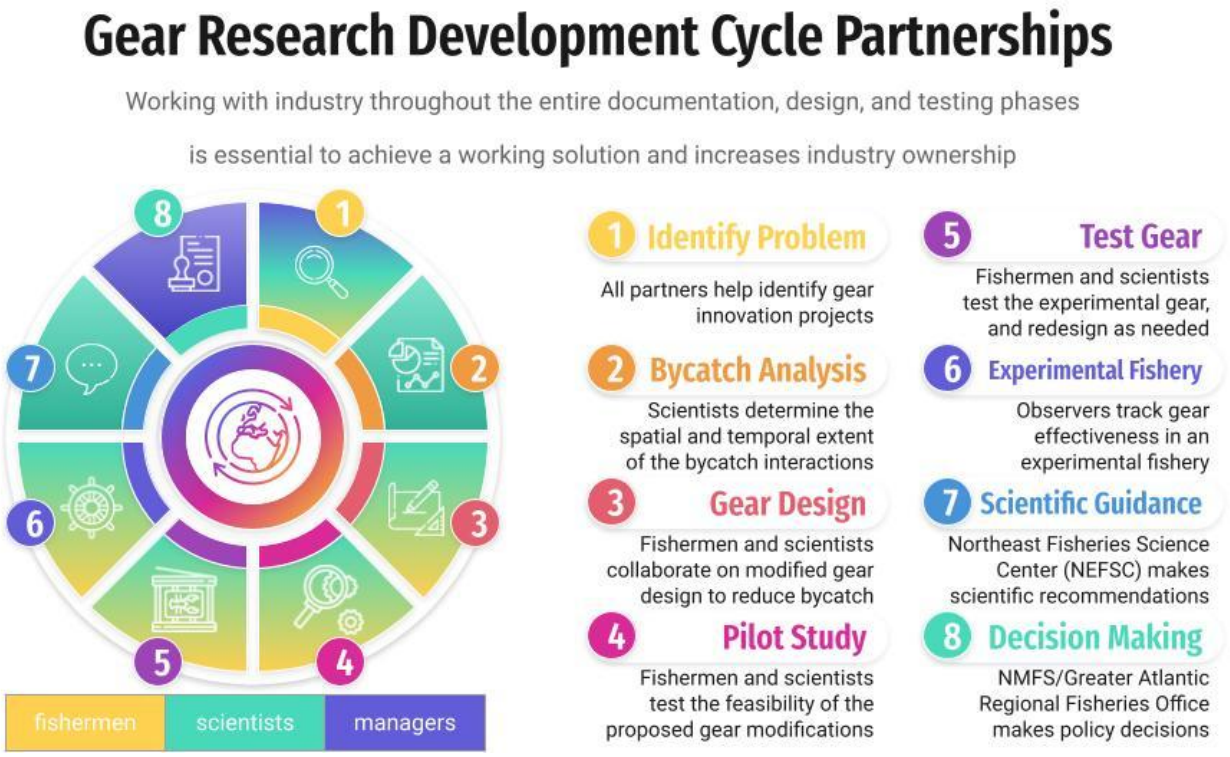

Figure 5. Diagram of the Northeast Fisheries Science Center's fishing gear research, development, and testing process.

Federal funding, including NOAA's Bycatch Reduction Engineering Program and Saltonstall-Kennedy grant programs, as well as contributions from non-governmental organizations and on-demand fishing gear developers, support the Gear Library and technology development. These include SeaWorld & Busch Gardens Conservation Fund, International Fund for Animal Welfare, The Pew Charitable Trusts, Conservation Law Foundation, Whale and Dolphin Conservation, Island Foundation, National Fish and Wildlife Foundation (NFWF), Shell Oil Company as well as the system manufacturers SMELTS, EdgeTech, and Sub Sea Sonics. Federal funding is also provided to the Atlantic States Marine Fisheries Commission (ASMFC), who reimburse fishermen for costs associated with trialing the systems and providing feedback.

The Gear Library continues to advance the development and use of on-demand systems. Given the high cost of available on-demand fishing gear systems at this time, the Gear Library is currently the best option for fishermen to access, train with, and further refine the technology. The current capacity of the Gear Library program is sufficient to support small-scale gear testing, commercial deployments, and training. The NEFSC's goal is to expand capacity to support all fishermen wishing to trial on-demand gear and, eventually, an experimental fishery encompassing many more participants.

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On-demand fishing gear is available from seven developers for purchase by fishermen who wish to use their own systems independent of the Gear Library. The initial cost of these systems may be an impediment for trap/pot fishermen without financial incentives and/or supplemental funding. We expect the cost of these systems to decline as demand, production, and innovation increases in the future. Federal funding programs are available (e.g., NOAA's Fisheries Finance Program), and there is also precedent for financial assistance from government and other entities to assist those affected by regulations to protect marine species. At this time, the use of this gear requires an Exempted Fishing Permit (EFP), discussed in more detail below.

In the future, as growth in on-demand fishing surpasses levels that may be supported by the Gear Library, significant investment will be needed to transition to a fully operationalized on-demand fishery. This will result in a shift away from NOAA-purchased gear toward industry, third-party, or other investment in gear for larger-scale operational commercial fisheries. NOAA will continue to perform economic analyses to forecast rates of production of on-demand gear to inform how costs will decrease through increasing economies of scale. The goal of this research is to identify key transition points, where challenges or opportunities may arise, in the progress toward a fully operationalized and self-supported on-demand fishery.

Using On-Demand Gear

Regulatory Requirements

Multiple laws govern commercial fishing in federal waters, including the Magnuson-Stevens Fishery Conservation and Management Act (MSA), Atlantic Coastal Fisheries Cooperative Management Act (ACA), Marine Mammal Protection Act (MMPA), Endangered Species Act (ESA), and National Environmental Policy Act (NEPA). When fishing in state waters, there are regulations from the states, regional fishery management councils (prescribed by MSA) and interstate commissions, as well as federal regulations under the MMPA and ESA. This includes regulations under the Atlantic Large Whale Take Reduction Plan (ALWTRP) under the MMPA. When implementing these laws, there are various regulatory frameworks for specific fisheries and gear types. The broader implementation of on-demand fishing gear will require engagement with all of the above.

In the Northeast U.S., on-demand fishing gear and other gear without persistent buoy lines are allowed for research with appropriate federal and state permits, including in some MMPA/ALWTRP restricted areas (effective October 18, 2021[5]). Federal and state authorization is needed to exempt fixed gear fishermen from regulatory requirements to mark bottom gear or the terminal ends of long sets of bottom fishing gear with buoys. One purpose of the buoy is to notify other harvesters and mariners of the location of fishing gear on the bottom in order to prevent gear or other use conflicts. An EFP, issued by the NOAA Fisheries Greater Atlantic Regional Fisheries Office (GARFO), authorizes a federally permitted fishing vessel to conduct fishing activities

[5] National Oceanic and Atmospheric Administration. 2021 (September 17). Taking of Marine Mammals Incidental to Commercial Fishing Operations, Final Rule, 86 FR 51970 et seq.

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that Federal regulations would otherwise be prohibited;[6] in this case, to fish without surface marking systems. Operators of vessels permitted to fish in state waters may have similar requirements and should contact their state about applicable requirements for using on-demand fishing gear.

A programmatic NEPA analysis that identifies and analyzes on-demand fishing impacts on the natural and human environment would assist with anticipating and analyzing alternative trajectories of ropeless fishing authorizations from short term EFP issuance through longer term regulatory and FMP amendments. Currently, this consideration includes the issuance of EFPs but could be expanded to accommodate regulatory changes needed to transition to larger-scale deployment of on-demand gear. A programmatic NEPA analysis would facilitate development of EFP requests and, for each proposed EFP, reduce the need for separate environmental analyses thereby expediting the EFP process.[7]

Ultimately, for on-demand fishing gear to meet the needed conservation goals and support fishing at large scales, it must move beyond an experimental stage that relies upon EFPs. NOAA Fisheries is committed to working with the New England Fishery Management Council (NEFMC), Mid-Atlantic Fishery Management Council (MAFMC), South Atlantic Fishery Management Council (SAFMC), and the ASMFC to consider regulatory changes that are needed to allow on-demand fishing gear without an EFP.[8] A management action to support these changes could take several years for development and rulemaking. Our goal in the near future is to enable the industry to deploy such technology in circumstances that minimize the potential for gear conflict while allowing fishing to continue, and we are committed to working with members and representatives of the fishing industry and other stakeholders to achieve such a result. An additional challenge for implementing on-demand fishing gear is understanding the behavioral, regulatory, or technological changes to all, including mobile gear, fisheries because all fisheries rely on the use of buoys to identify the presence of fixed fishing gear and avoid gear conflicts.

Most regulatory actions to reduce bycatch of large whale species in fixed gear (i.e., pot/trap or gillnet) fisheries in the Greater Atlantic Region are taken under the ALWTRP. Ultimately, to operationalize on-demand fishing gear in this region, amendments to fishery management plans (FMPs) overseen by NEFMC, MAFMC, SAFMC, ASMFC and NOAA Fisheries under the MSA and ACA will be needed. Specifically, amendments to the FMPs could include: 1) removing the regulatory requirement to mark fixed fishing gear with buoys at one or both ends of set gear; 2) a mechanism for centralized sharing of information on gear locations or gear setting practices across all fleets working in a region; and, 3) possibly developing area management protocols that further reduce the likelihood of gear conflict. An important point to note is that undertaking regulatory modifications to FMPs managed under the ALWTRP can impact mobile, bottom tending fisheries not responsible for incidental takes of right whales and not managed under the Plan. All fishing vessels in an area

[6] National Oceanic and Atmospheric Administration. 2022. Scientific Research and Exempted Fishing Permits | NOAA Fisheries.
[7] National Oceanic and Atmospheric Administration. 2021, September 17. Taking of Marine Mammals Incidental to Commercial Fishing Operations, Final Rule, 86 FR 51970 et seq.
[8] National Oceanic and Atmospheric Administration. 2021, September 17. Taking of Marine Mammals Incidental to Commercial Fishing Operations, Final Rule, 86 FR 51970 et seq.

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where on-demand fishing is allowed as an alternative to closures would be required to operate and navigate in areas with on-demand gear, requiring near-real-time information on the location of gear on the seafloor as described below (Resolving Gear Conflict). To do this, we envision a series of technology development and testing steps, followed by experimental fisheries, and then regulatory action(s) as the fishing community adapts to new harvest practice options. Because these types of changes have the potential to affect all vessels, early and frequent engagement with industry and management partners is important. The development of broader adoption of on-demand fishing gear may follow the following four-step process (Figure 6).

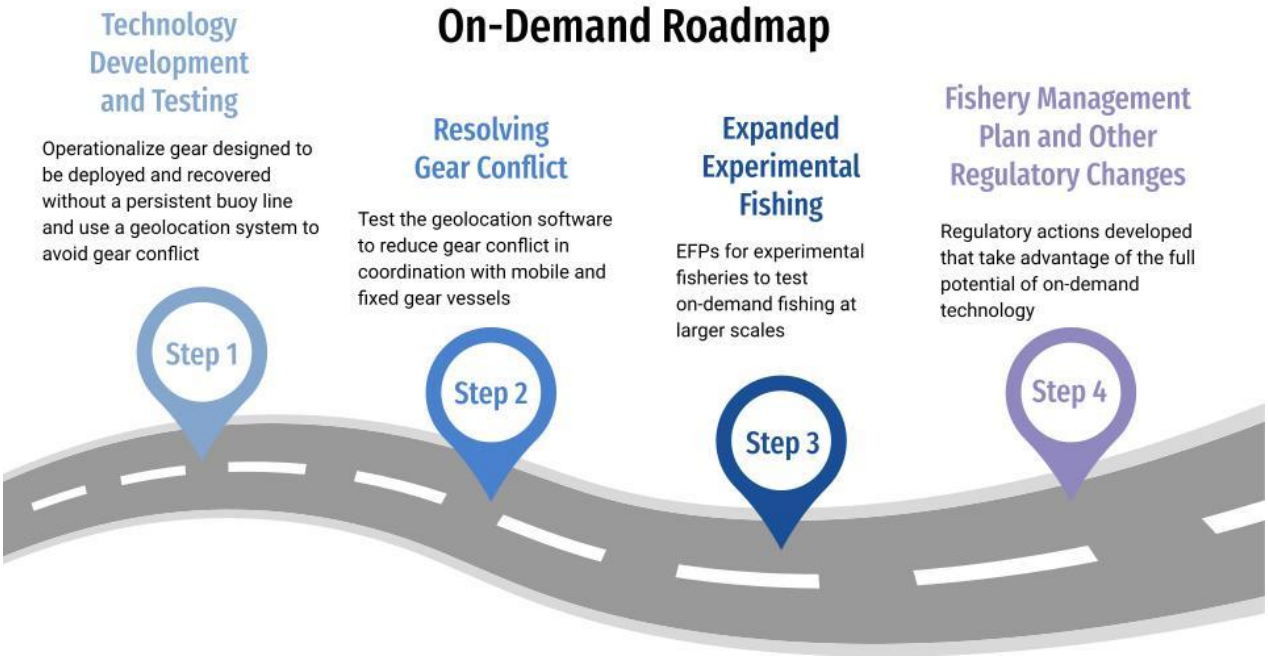

Figure 6. The four-step process described in this on-demand roadmap.

Step 1. Technology Development and Testing: Ongoing in 2022

Step 1 has two technology testing goals: 1) continue to operationalize gear designed to be deployed and recovered without the continuous presence of a buoy line in the water column; and, 2) report and track the gear's position through a geolocation software data system to prevent unintentional gear conflicts.

When operating in state waters, NEFSC operates under Letters of Authorization (LOAs) from Massachusetts and Maine; currently these letters have no restrictions on number of participants, on-demand trap trawls, or trips. When operating in federal waters, NEFSC and collaborators must operate under EFPs. Three EFPs have been issued to support testing on-demand fishing gear; these EFPs allow vessels to fish with exemptions from fishery regulations, in this case surface marking requirements. The NEFSC EFP includes commercial trap/pot fishing

vessels. An EFP could include more than 30 vessels as long as only 30 vessels are trialing on-demand gear at a given time. We are currently working to develop a new EFP to increase our effort in federal waters to include up to 100 vessels with no more than 30 individual vessels fishing simultaneously in closed areas and no more than 10 on-demand trawls deployed from each vessel.

The main focus in Step 1 has been and continues to be for NEFSC scientists to work with fixed gear fishermen to trial on-demand fishing systems and evaluate their ability to deploy and retrieve gear under a range of fishing conditions, with the twofold purpose of providing feedback to technology developers while giving fisherman experience using this technology. This effort has included 17 vessels with a maximum of 30 trawls trialing on-demand systems in federal waters and an additional 25 trips in state waters covered by state LOAs or within the regulations and with state support. Acceleration of this research and development of operationally feasible systems is anticipated to continue, concurrent with other steps below, refining various elements for on-demand technology. A smaller-scale EFP (fewer than 10 vessels) has been issued to Blue Planet Strategies who, in collaboration with the NEFSC, is introducing the use of on-demand fishing systems with Maine gillnet and lobster trap/pot vessels.

While the recovery technology has become quite advanced and undergone modifications to withstand the rigors of commercial fishing operations, geolocation technologies are still in development. They currently rely on latitude and longitude coordinates recorded at the surface when gear is deployed. Eventually, gear may be acoustically marked on the ocean bottom with locations updated in near-real-time by approaching vessels once an interoperable acoustic system is developed.

Step 2. Resolving Gear Conflict: Beginning in 2022

The NEFSC is beginning to test the effectiveness of geolocation software to reduce gear conflict in coordination with mobile and fixed gear vessels operating in the same area. There are three projects planned for spring and summer of 2022 to carry out tests of the software and systems to assess and improve the systems' effectiveness in mitigating conflicts: 1) NFWF funding to the Commercial Fishing Research Foundation; 2) TownDock Squid fleet members and several fishermen; and 3) Pioneers for Thoughtful Coexistence in the Massachusetts Restricted Area.[9] These three projects, in conjunction with ongoing gear testing from Step 1, constitute most of the commercial fishing covered by the current EFP. In both Steps 1 and 2, participating fishermen are compensated for data collection and submission. We anticipate that additional researchers or investigators will request EFPs to fish within ALWTRP restricted areas using on-demand systems.

Additional efforts under discussion include formalizing existing local fishing practices, informal agreements set up between harvesters to reduce gear conflicts, such as agreeing to gear separation areas or seasons or setting fixed gear in a set direction or along navigational lines so that mobile gear fishermen seeing a buoy know how

[9] Pursuant to the ALWTRP, the Massachusetts Restricted Area is an area in Massachusetts Bay closed seasonally to the use of buoy lines. Refer to the ALWTRP for additional information.

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the gear is set along the bottom. Such practices could accelerate reduced use of surface buoys before geolocation schemes are perfected by allowing fixed gear fishermen to mark only one end of a trawl or gillnet set.

The Maine Department of Marine Resources is pursuing an alternative geolocation approach that relies primarily on underwater acoustic signaling between vessels and gear. This approach focuses on real time notifications. Ultimately, the best, most universal system would have both interoperable acoustics and a centralized database system that could provide real-time locations to approaching and passing vessels to support use of any non-acoustic gear such as GPS surface marking of grappled gear.

Step 3. Expanded Experimental Fishing: 2023 and Beyond

Building off of Steps 1 and 2 results, NOAA could authorize EFPs for experimental fisheries to test on-demand fishing technologies and practices at larger scales with increasing complexity and refined research goals (e.g., increased gear volume or advanced geolocation testing). While not necessarily required, operating under an expanded EFP could help mitigate gear conflicts and coordination of fishing activities and data collection. As such, this may actually speed the transition to a fully implementable program in the long run. However, creating a broader EFP process would likely involve significant challenges in administering and managing EFPs and could in the short term potentially limit participation and access to fishing opportunities. Substantial resources, planning, and oversight would be needed to ensure successful mitigation of gear conflicts, coordination of fishing activities, and data collection occurring under either multiple or broader programmatic EFPs.

Potential Step 3 scenarios include:

- Allowing fixed gear fisheries to operate with on-demand gear in ALWTRP restricted areas currently closed to persistent buoy lines and coordinating with mobile fisheries in those areas. This would likely require using geolocation systems to inform other fixed and mobile gear fishermen operating in the area of the location of all on-demand gear.
- Allowing the offshore lobster fishery to operate with trawls marked by only one buoy line per trap trawl, using collaborative area management agreements with other harvesters, and/or geolocation solutions to inform other fixed and mobile gear fisherman operating in the area of the length and directional orientation of the trawl that might otherwise be informed by the second buoy.

In these scenarios, slightly different economic incentives could exist. In the first, fixed gear fishermen could gain access to fishing grounds with reduced competition. This could be an attractive option, particularly if area-based restrictions are otherwise required to protect right whales. Additional investment may be needed to afford the on-demand fishing technology, otherwise fishermen would be relying on the value of their landings rather than being compensated for labor and vessel operations cost as may be done during a federal or third-party funded gear testing phase. Additional investment in mobile fisheries operating in the area could facilitate engagement in testing geolocation systems, offset the cost of lost or damaged gear due to gear

conflict, and/or increase level of participation. In the second scenario, the experimental fishery would have a lower cost as fishermen would not need on-demand recovery hardware, yet would still reduce entanglement risk by decreasing the number of buoy lines in a region.

In both scenarios, we are optimistic that participating fishermen will gain a greater appreciation for the feasibility of on-demand fishing. We expect that they will see advantages and find economic opportunities. A centralized cloud geolocation system would provide fishermen with much more information to make navigational and gear setting decisions. For example, fishermen rely on locating buoys either visually or using radar reflectors, which is limited in both poor weather conditions and nighttime operations for visual detections, while geolocation allows for detecting gear 24/7 regardless of conditions. Once buoys are detected using traditional visual methods, fishermen depend on local knowledge to decipher the orientation of trawls, which can be over a mile long. When multiple buoys are present there can be significant uncertainty as to how gear is connected. Geolocation provides an 'underwater' map view that could address these challenges. This system could make it easier to navigate and set gear while reducing time and gear conflict.

Advancing this step would require NOAA Fisheries to develop multiple and/or larger EFPs (e.g., 100-500 vessels), including ensuring consistent standards and data collection across projects, compliance with program participation requirements, and compliance with other applicable laws. However, given that substantial right whale entanglement risk reduction needs will exist for some time, alternatives to the processes identified within this step will continue to emerge. This includes a scenario in which the commercial fishing industry is faced with increased implementation of spatially and temporally restricted fishing areas for which on-demand fishing gear may be the only option to continue fishing.

Step 4. Fishery Management Plan Regulatory Changes: 2023 and Beyond

While the intent will be to engage the NEFMC, MAFMC, SAFMC, and ASMFC early and often to advance on-demand fishing, positive results from the above actions reported to and communicated throughout the fleet are likely to increase buy in and adoption of on-demand technologies. Engagement and coordination with the mobile fisheries will also be helpful to address and potentially facilitate the mitigation of indirect effects of regulatory changes to fixed gear FMPs on the mobile fleet. However, the path forward in the coming years is greatly subject to change. Ongoing and planned on-demand fishing research and development is highly fluid, so the vision for future regulatory adaptation must be adaptable as well. This process will require frequent and sustained input from all stakeholders involved in these processes. We commit to engaging throughout this development period to account for all perspectives affected, and to communicating frequently how this vision evolves.

Together with the NEFMC, MAFMC, SAFMC, and ASMFC, we could consider a stepwise approach to making changes to support on-demand fishing by first requiring surface marking on only one end of set fixed gear

where gear density is low enough to navigate with a GPS recording of where the trawl was deployed from the vessel (e.g., second scenario of Step 3 above). This could have multiple advantages:

- More fishermen would gain experience working with geolocation data;
- It moves us closer to an ALWTRP conservation goal of removing more lines without trap reductions and/or closures;
- It provides more time for on-demand technology, especially interoperable underwater acoustic communication, to evolve and for prices to decrease; and
- It provides time for current management actions to be evaluated, while gaining more data on areas most in need of risk reduction.

Regulatory actions should be developed that take advantage of the full potential of on-demand technology, including on-demand systems that are geopositioned by acoustic technology from passing vessels. The timeline and spatial extent of this action are not defined at this time, although it will take several years. Regardless, fishery management bodies should begin working toward these goals immediately.

Where is On-Demand Fishing Needed?

Given the continued critical decline in right whale populations caused in large part by entanglement in buoy lines, on-demand gear would be the most effective means of modifying gear to reduce risk of right whale entanglement (and mortality) in commercial fishing gear set in and around habitat used by right whales. To achieve necessary risk reduction goals, on-demand fishing gear will not need to be required everywhere in the future. Rather, it poses a solution to access areas where entanglement risk is currently highest. Comparing the relationship between fixed gear (trap/pot and gillnet fisheries, measured by buoy lines) and entanglement risk in federal vs. state waters on the U.S. east coast, 20% of fixed gear effort occurs in federal waters but are estimated to represent 70% of entanglement risk.[10] Conversely, 80% of the fixed gear operates in state waters but represents 30% of entanglement risk. This suggests that, in general, vessels operating in federal waters represent a disproportionate amount of entanglement risk and might be candidates for early adoption of on-demand gear in appropriate, high risk locations.

To identify how many buoy lines would need to be converted to on-demand gear to attain the maximum risk reduction benefit (given the higher cost of on-demand gear), we calculate which lines are most “risky.” This is largely driven by the overlap of lines in areas with high densities of right whales, but also by expected line strength, our current proxy for entanglement lethality.[11] Calculating cumulative risk and identifying the

[10] This is calculated using NOAA Fisheries’ Decision Support Tool preliminary estimates of approximately 3.3 million “vertical line months” (one vertical line for one month) in state waters and 800,000 line months in federal waters; 4.1 million total

[11] This is assuming the risk maps as they were prior to Phase I ALWTRP management measures and does not account for the new closures and gear configuration modifications.

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minimum sets of lines that represent some proportion of risk (e.g., the fewest lines which, together, comprise 10% of risk) provide the relationship between cumulative proportion of risk and line months. These analyses are shown in Figure 6. The x-axis units in Figure 6 are “line months”, where a line month represents one vertical line in the water for a given month during the year. These calculations indicate that 50% of entanglement risk can be attributed to approximately 25,000 line months, or 0.6% of the estimated 4.1 million total line months (Figure 7). In other words, converting on the order of 25,000 line months in targeted locations to on-demand gear would reduce the risk of right whale entanglement by around half. Further risk reduction would entail converting a greater proportion of lines to on-demand gear. For example, a 90% risk reduction would require converting an additional 320,000 line months to on-demand gear, or approximately 7.8% of the estimated 4.1 million total line months. This suggests conversion to on-demand fishing will likely be unnecessary for much of the fishing effort from a right whale conservation perspective.

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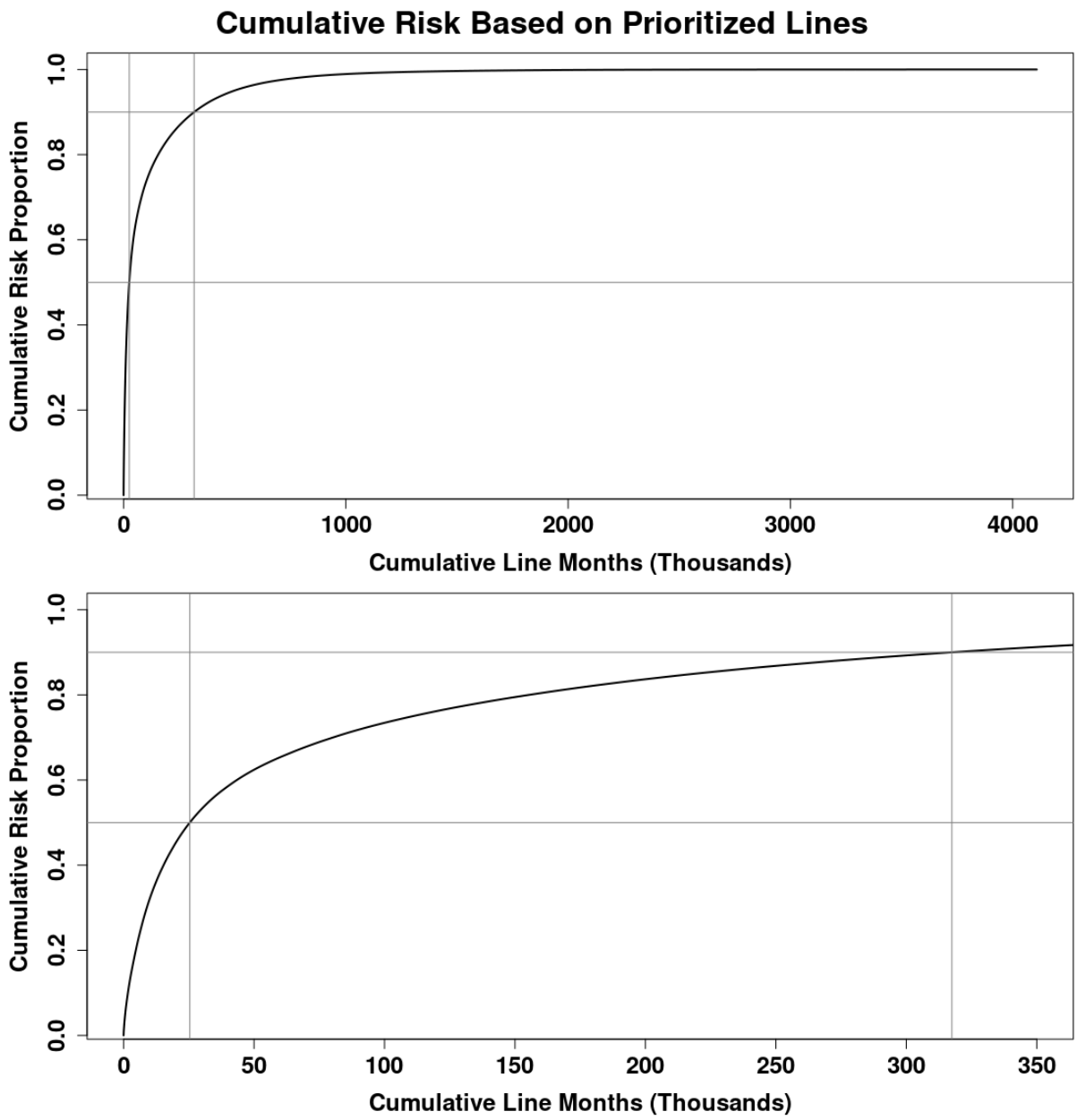

Figure 7. The relationship between the cumulative proportion of right whale entanglement risk and line months, determined by calculating cumulative risk and identifying the minimum sets of lines that represent some proportion of risk (i.e., the fewest lines which, together, comprise 10% of risk). The upper graph is for the entire fishery, the lower graph shows the cumulative risk for up to approximately 350,000 line months.

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Locating Deployed On-Demand Fishing Gear

Wider adoption of on-demand fishing gear relies on developing an effective and affordable system to locate and track gear deployments in the ocean and making their locations known to mobile and fixed gear fishermen, nearby vessels, and enforcement officials. It is critical that this geolocation system rely on open-source rather than proprietary technology. Fixed gear fishermen have gear marking requirements to help mobile gear fishermen avoid gear conflicts, among other reasons. However, the system is limited, and there are many existing challenges – including inattentiveness, poor visibility (e.g., night, weather), and uncertainty about the direction in which the gear below the surface is set (e.g., north-south, east-west) – all leading to currently existing conflicts. Implementing new gear location technology allows for expanded use of on-demand fishing systems while providing more accurate information to both fishermen and enforcement officials.

A likely solution to the geolocation challenge is to enable a fisherman to 'see' the location of gear on a platform such as a website, app, or chartplotter. To protect sensitive business information, this information can be 'geofenced' so that other fishermen and marine resource users will only be able to 'see' such gear within a certain radius (such as 5 nautical miles), but these users will not have access to specific information about that gear (e.g., owner name, registration number) unless they own the gear. On-demand fishing systems will need to be enforceable to the same standards as current fishing operations and enforcement officials will need to have access to all data in real-time.

NOAA Fisheries has partnered with the EarthRanger program at the Allen Institute for Artificial Intelligence and is testing the feasibility of their platform to solve the problem of geolocating underwater deployments of on-demand fishing gear. The goal is to create a common framework for interoperability between multiple different manufacturers' devices for gear marking to enable wide-scale adoption of on-demand fishing gear. The project specifically aims to tackle above-water gear communication so that gear locations from different manufacturers can be sent to a common secure cloud database where information can be exported to users with appropriate controls. The challenge of getting this information from the seafloor to the vessel remains significant and requires the development of an interoperable acoustic system.

The NOAA-EarthRanger pilot project to create a ropeless geolocation system to support on-demand fishing began in 2022. A NOAA application of the EarthRanger platform has been set up and is being tested on the water with a limited number of participants to send and receive gear location information. Initial goals of the project are to send and receive gear information from several different systems. NEFSC, project partners[12] and other interested parties are trialing the system on the water and testing database integrations with federally-permitted fishing vessels outfitted with the required hardware and communications systems. Researchers with access to the database are monitoring the data and ensuring proper functionality. NOAA Fisheries and the development team are identifying and logging challenges for further development.

[12] Ropeless Manufacturers Workgroup, SMELTS, Blue Ocean Gear, Ashored, and EdgeTech.

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If initial trials are successful, the system could be integrated with chartplotters and expanded to include enforcement officials and fishery managers for input into the process. Further steps of this research are contingent upon initial findings and the availability of funds in future years. Improving this technology will contribute to wider geographic implementation of on-demand fishing gear. In the meantime, the two vendors that currently produce commercially available on-demand fishing gear both provide a fairly simple gear location app that can work on a tablet, which allows on-demand fishing gear to be used in seasonally restricted or closed areas among users of the same gear type.

On-Demand Fishing Summary, Benefits, and Next Steps

The adoption of on-demand fishing technology by lobster and other fixed gear fishermen is one of many management strategies needed to reduce entanglement of many marine species. In the Northeastern U.S., we anticipate on-demand fishing will reduce entanglement risk thereby promoting the recovery of right whales and the continuation of profitable fishing communities. Further, this technology is applicable to other regions where fixed gear fisheries encounter endangered and protected marine mammals and sea turtles. NOAA Fisheries and its partners continue to provide the resources and support necessary to advance the transition to on-demand fishing as an alternative to traditional gear where best suited to reduce entanglement risk.[13] While on-demand fishing gear will require both time and investment to fully develop, once operational it could provide many opportunities including:

- Reducing the risk of entanglement of whales, sea turtles, and other marine animals in vertical lines.
- Providing a spatially-resilient management solution as both large marine vertebrates and fisheries shift movement patterns in response to climate change.
- Supporting market demand for sustainable seafood products, including green seafood labeling, sustainability certification, NGO endorsement, and increased marketing opportunities.
- Providing a new “Blue” technology opportunity in the marine sector.
- Reducing gear conflicts by allowing gear to be visualized at night and in inclement weather.
- Reducing ghost-gear as displaced gear can be relocated using acoustics.
- Providing sophisticated, innovative options for lobster management with geolocation technology.

As the processes outlined in this roadmap progress, we see the following critical next steps necessary in the short-term regarding the issuance of EFPs for on-demand fishing:

- Clarify EFP application process.
- Create best practices guidance and associated programmatic environmental analyses to accelerate EFP issuance.
- Develop and standardize data collection and submission procedures and data sharing practices.

[13] For example, the recently published *Assessing the Feasibility of On-Demand Gear in New England Lobster Fisheries*, from Massachusetts DMF, evaluates challenges and provides recommendations for integrating on-demand gear technology into the region’s lobster fisheries.

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- Identify research priorities to guide EFP applicants.
- Recruit mobile gear fleet participants to assist in assessing geolocation technologies or to develop gear separation schemes.
- Engage NEFMC, MAFMC, SAFMC, and ASMFC in modifying FMPs to allow alternatives that do not require surface marking of fixed bottom gear.

Summary

NOAA Fisheries is defined by its mission to maintain sustainable fisheries and protect and recover marine mammals and endangered species. Increasingly, these elements are being combined as NOAA Fisheries works towards ecosystem based approaches to management. The urgency of the right whale decline has forced the rapid evolution of new fishing approaches to reduce vertical line entanglement. Initially referred to as 'ropeless' and more recently 'on-demand', a range of related solutions have emerged that all work to reduce the number of vertical lines in the water column:

- On-demand gear - a device that returns the trap/trawl or gillnet end to the surface upon receipt of an acoustic signal from a fishing vessel.
- Timed-release (for tended fisheries) - a device that returns the trap/trawl or gillnet end to the surface (typically a buoy with rope) at a preset time (reduces the amount of time rope is in the water column).
- Grappling - recovering a trawl end of gear (without buoy lines) by deploying a grappling hook from a fishing vessel and dragging it along the seafloor to 'hook' and recover the trawl.
- One buoy line trawls - deploying a trawl of traps with just one buoy line. The opposite end of trawl may be recovered with any of the above mechanisms.

All of these solutions reduce buoy lines in the water column and therefore, require the need for a geolocation technology to inform nearby vessels of the presence of gear on the seafloor. To that end, we are adopting a modified label of "on-demand" for the collective solution set. On-demand fishing will have implications to both fixed and mobile fishing fleets, either directly or indirectly, so NOAA Fisheries, the NEFMC, MAFMC, SAFMC, ASMFC, and the states will need to work together to identify and implement any necessary regulatory changes.

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