

On-Demand Interoperability Workshop Report



NOVEMBER 28-30, 2023

Consensus Building Institute
March 2024

Table of Contents

<i>Executive Summary</i>	2	Approach 3: Ropeless Riser: An Interoperable, Acoustic Only Solution for On-Demand Fishing	23
Workshop Objectives.....	3	Approach 4: FONTUS Open Standard	24
Workshop Dates and Location	3	Approach 5: EdgeTech Ropeless Fishing System24
Materials and Resources.....	3	Discussion: Strengths and Weaknesses of Presented Approaches	25
<i>Day One: November 28, 2023</i>	4	Commonalities	25
Drivers for On-Demand Interoperability.....	4	Key Emerging Questions and Concerns	25
Atlantic Large Whale Take Reduction Planning: Where On-Demand Fits In the U.S.	4	Advancing the Discussion: What is Needed? ..	27
A Strategy for Whalesafe Gear in Canadian Fisheries	5	Lessons Learned from NOAA Fisheries Implementing Technology.....	28
Traditional Gear Marking Requirements in the US	6	Closing: Creating a Shared System Across Different Sectors.....	29
Developing Functional Needs and Requirements	8	<i>Day Three: November 30, 2023 State and Federal Agencies Only</i>	30
Requirements for a Gear Location Marking System	9	Overview.....	30
Discussion: The Needs and Perspectives of Fishermen.....	10	Recap of Two Day Multi-Sector Workshop	30
Discussion: The Needs and Perspectives of Enforcement.....	11	Fisheries and Enforcement Panel Discussions ..	30
Developing Draft On-Demand Data Specifications	12	Presentation on Data Specifications and Discussions	31
Conceptual Approaches to On-Demand Systems	14	Presentation on Acoustic Technology and Standards Feedback	32
Concept One: Multiple Acoustic Standards	15	New England Gear Innovation Fund.....	36
Concept Two: Open-Source Single Acoustic Standard	17	Lessons Learned from NOAA Fisheries Implementing Technology.....	36
Concept Three: Acoustic Gear Positioning Only	19	Discussion: Data Management and Storage....	37
<i>Day Two: November 29, 2023</i>	21	Charting Next Steps: Small Group Breakouts ..	39
Existing Approaches to On-demand Systems ..	21	Creating a Roadmap and Establishing Milestones	39
Approach 1: Points on a Spectrum	21	Exempted Fishing Permits	40
Approach 2: Draft Interoperability and Enforcement Guidelines for On-Demand Fishing Systems	22	Establishing Regulations for Ropeless Fishing Acoustics and Marine Mammals	42
		Final Comments and Closing	43

Executive Summary

North Atlantic right whales are endangered large whales distributed along the East Coast of the United States and Canada. Despite international protection since 1935, right whales have been slow to recover from whaling due to entanglement in fishing gear and ship collisions. Conservation efforts, include but are not limited to, restrictions on and modifications to commercial fishing operations, vessel speed restrictions, modification of international shipping lanes, aircraft and vessel monitoring surveys, right whale alerts to mariners, the Mandatory Ship Reporting system, stranding response, and outreach efforts. Despite these efforts, North Atlantic right whales are in decline with only an estimated 360 individuals remaining, including fewer than 70 reproductively active females and the species has been experiencing an Unusual Mortality Event from 2017 through the present. Entanglement in vertical line fishing gear, and vessel strikes are the species' primary causes of mortality and serious injury. Reducing entanglements in fishing gear is necessary to mitigate risk and recover the species. One of the solutions to doing so, while still supporting coastal communities to continue fishing is the development of on-demand fishing technology to remove the threat posed by entanglements in vertical lines. A major obstacle to moving this effort forward is the development of an affordable system to locate and track gear deployments in the ocean, and make their locations known to the fishers, law enforcement, and nearby vessels.

NOAA 's National Marine Fisheries Service (NMFS or NOAA Fisheries) is collaborating with gear manufacturers, fishermen, and other partners to develop solutions for implementing on-demand fishing (also known as ropeless or pop-up) in fixed-gear fisheries. On-demand fishing replaces traditional vertical lines and surface buoys with an acoustic release and virtual gear marks (i.e., no persistent vertical line or surface buoy). Collecting, transmitting, and visualizing on-demand gear location information in near real-time is challenging for many reasons. Fishing vessels have different onboard technology, most lack internet connectivity, and there are many companies offering different approaches for deploying, tracking, and retrieving on-demand fishing gear. It is necessary to implement an interoperable system for deploying and retrieving on-demand fishing gear and sharing geolocation data across fisheries (both mobile and fixed-gear vessels) to minimize disruption to existing fishing and law enforcement practices, mitigate gear conflicts, and support management needs across jurisdictions (e.g., Northeast vs. Mid-Atlantic).

As part of the ongoing research and development of on-demand fishing as described in the [Draft Ropeless Roadmap](#), in November 2023, NOAA Fisheries convened an On-Demand Interoperability Workshop, composed of experts from NOAA Fisheries, Fisheries and Oceans Canada (DFO), U.S. state agencies and other key stakeholders to host a workshop to facilitate the development of standards for acoustic communications and data standards to support on-demand fishing. Invited participants included on-demand gear manufacturers, underwater acoustics experts, fishermen and other fishing industry leaders, federal and state fishery managers, and other relevant partners. The workshop was

held on November 28-30, 2023, with the first two days technical discussions open to all invitees, while the third day was limited to State and Federal fishery managers to discuss the implementation of on-demand fishing in the future.

The workshop was hosted by NOAA Fisheries and held at the Hilton in Woburn, Massachusetts, with a virtual participation option available. This workshop report was prepared by the Consensus Building Institute (CBI) to facilitate discussions. CBI is a non-partisan, non-profit entity retained by NOAA through a master contract with Lynn Carbone Associates. This report is not intended to be a meeting transcript. Rather, it focuses on the main points covered during the meetings.

Workshop Objectives

The purpose of the workshop was to gather information and viewpoints from individual attendees on the challenges with implementing on-demand fishing systems, specifically focusing on the objectives below:

Objectives

Inform

Provide participants with an understanding of the important fishery management drivers and regulatory requirements of traditional gear-marking systems.

Educate

Develop a shared understanding of the functional needs of fishermen, enforcement, and managers in an operational commercial scale on-demand fishing program.

Deliberate

Discuss possible technical approaches to implementing acoustic and data interoperability standards of commercial scale on-demand fishing systems.

Coordinate

Identify future technical and regulatory steps to implement on-demand fishing and establish opportunities for continued communication and collaboration across all stakeholders.

Workshop Dates and Location

The workshop was held over three days in November 2023 at the Hilton Woburn Hotel at 2 Forbes Road, Woburn MA.

- November 28-29: All Invited Participants
- November 30: State and Federal (U.S. and Canada) Agencies only

Materials and Resources

- All presentations and handouts referenced in this report are available at the [NOAA Fisheries website](#), at the link titled [Workshop Resources](#).
- The URL for the workshop website is: <https://www.fisheries.noaa.gov/event/demand-interoperability-workshop>

Day One: November 28, 2023

The first day began with welcome remarks from Sean Hayes, NOAA Fisheries, and Brett Gilchrist, Fisheries and Oceans, Canada. Brett Alger, NOAA Fisheries, described the workshop's purpose and objectives. Following this introduction, the workshop began with two presentations focused on drivers for on-demand interoperability in the US and Canada¹. In the afternoon, conversations focused on the development of various interoperable on-demand systems, management actions and possible approaches for the future.

All presentations and handouts referenced below are available through the [NOAA Fisheries website](#), at the link titled [Workshop Resources](#).

Drivers for On-Demand Interoperability

Atlantic Large Whale Take Reduction Planning: Where On-Demand Fits In the U.S.

- **Objective:** To share the work of the Atlantic Large Whale Take Reduction Team (ALWTRT) and its recommendations for reducing risk to whale populations
- **Speaker:** Jennifer Goebel, NOAA Fisheries

North Atlantic right whales (*Eubalena glacialis*) are approaching extinction, and experiencing an Unusual Mortality Event². There are approximately 360 individuals remaining, including fewer than 70 reproductively active females. During the past decade, right whales have changed their distribution patterns, likely in response to changes in prey location and availability due to warming oceans. As their prey moved, the whales began spending more time in areas with fewer protections from entanglements and vessel strikes, which are the leading causes of North Atlantic right whale mortality.

The work of the Atlantic Large Whale Take Reduction Team (ALWTRT) falls under the Marine Mammal Protection Act (MMPA). The program has a 59-member team working to develop recommendations and best practices that are implemented across fixed gear gillnet and trap/pot fisheries along the U.S. East Coast. For risk evaluation, the program uses a decision support tool that considers whale habitat, gear density, and severity. There are three tools in the risk reduction toolbox:

¹ Note, NOAA's jurisdiction extends from 3 miles to 200 miles from shore with States having jurisdiction within 3 miles of their coast. DFO's jurisdiction extends from the coast to the 200 mile line.

² See <https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2024-north-atlantic-right-whale-unusual-mortality-event>

-
1. Use of weak ropes or links, allowing whales to break free if they are entangled
 2. Reduction of rope used by trawling up, limiting lines
 3. Closing high risk areas to persistent buoy lines

The session discussed the pros and cons of each of the above tools. It is important to note that closures are very effective in reducing risk to right whales, and an alternative such as on-demand fishing will allow fishermen to regain access to fishing grounds while still benefiting whales.

The Atlantic Large Whale Take Reduction Team met in November and December of 2022, and made non-consensus recommendations to NOAA Fisheries on how to further reduce risk of entanglement to North Atlantic right whales to reach the risk reduction goals necessary to meet the mandates of the Marine Mammal Protection Act. Possible next steps may include exploring different methods of rope reduction and expansion of seasonal closures to vertical buoy lines. The session also highlighted recent updates to regulations and funding, including the investment of over \$18M to support on-demand fishing gear technology under the Inflation Reduction Act (IRA).

A Strategy for Whalesafe Gear in Canadian Fisheries

- **Objective:** To highlight the approach and strategies of Canada’s Department of Fisheries and Oceans for North Atlantic right whale (NARW) recovery and on-demand fishing gear usage
- **Speaker:** Cathy Merriman, Department of Fisheries and Oceans Canada

The North Atlantic right whale (NARW) is listed under Canada’s Species at Risk Act (SARA). Canada uses a suite of regulatory and management measures to prevent whale death due to vessel strikes and entanglement risks. This includes fishery closures upon detection of North Atlantic right whales. DFO is committed to protecting right whale populations while sustaining modern fisheries, and has committed to implementing low-breaking strength “whalesafe” gear and on-demand fishing gear, according to the suitability in specific fishery conditions.

In 2021, Canada’s Whalesafe Gear Adoption Fund provided \$20m to 34 projects in eastern Canada for the testing of whalesafe low-breaking strength and on-demand gear. On-demand gear trials have yielded some positive results. For example, snow crab fisheries in the Gulf of St Lawrence harvested 820,000 lbs using on-demand gear in 2022. However, there have been challenges at some fisheries around gear loss, safety concerns and technology use. DFO is assessing these results, and trials are ongoing. DFO is preparing a National Whalesafe Gear Strategy in consultation with indigenous groups, whale experts, and industry participants. This will be finalized in 2024.

The audience asked questions about interoperability concerns, where seasonal and short term closures typically occur, incorporation of trawling up and sinking ground lines in the proposed

strategy, and whether new requirements also apply to indigenous fishers. It was noted that West coast closure tools tend to be centered on protecting killer whale prey, and that while DFO is mostly tracking what happens on the East coast, on-demand gear use will be expected on both coasts, and interoperability challenges will be addressed nationally. To support the range of potential on-demand gear use, the national Fisheries Act regulations were amended in 2023. Overall, DFO expressed that it is in the learning and development stages of its strategy, and that being at the workshop to learn was important to the Department.

Traditional Gear Marking Requirements in the US

- **Objective:** Provide an overview of existing fishery management practices and Take Reduction Team requirements to demonstrate the needs that an on-demand system must fulfill.
- **Speaker:** Colleen Coogan, NOAA Fisheries

Current regulations that require buoys or buoy marking include the Atlantic Coastal Act lobster regulations ((50 CFR 697.21(b)(1) & (2)), Magnuson-Stevens Act (MSA) groundfish and monkfish regulations (50 CFR 648.84(b)), MSA red crab (50 CFR 648.264(a)(5) and ALWTRP regulations (50 CFR 229.32(b)(2)(iv)), and MSA black sea bass regulations (50 CFR 648.144(b)(1)). Under these regulations, an exemption is needed to fish without a buoy, which is currently being done through the Exempted Fishing Permit (EFP) process. EFPs authorize a fishing vessel to conduct fishing activities that would otherwise be prohibited under the regulations. It is recommended that fishermen and other partners consider organizing into a collaborative group with a Principal Investigator to apply for an EFP, if necessary, because there is an application and review process that can take considerable time.

There are currently three active EFPs for trap/pot and gillnet fishing in the Greater Atlantic Region. In 2023, the New England Gear Innovation Fund was established by the National Fish and Wildlife Foundation (NFWF), in partnership with NOAA, and awarded nearly \$18.3 million to 18 projects working to develop or trial innovative fishing gears and engage fishermen in the use of innovative gear.

There are anticipated changes to the Atlantic Large Whale Take Reduction Plan, by December 31, 2028, including a reduction in rope and expanded seasonal closures. On-demand fishing could provide fishermen with a tool to fish with less rope or to fish during a buoy line closure. However buoys fill a number of requirements - they allow owners and other ocean users to detect and avoid gear, determine its deployment direction, and allow the retrieval and reset of gear either by owners or law enforcement. Modifications to buoy requirements ideally should identify minimum performance standards that all on-demand gear must fulfill before it can be approved. The standards should describe everything that buoys currently do. It was suggested that future modifications to the regulations describe performance standards rather than specific technological solutions because modifying regulations is not an agile process, they are difficult to change once

implemented. Performance standard based regulations that identify what must be achieved before it can be approved is prescriptive enough to guide development but supports innovation by not foreclosing future solutions.

What a Surface Buoy Does	What On-Demand System as Alternative Should Do	What On-Demand System Could Do (Extras)
Make Bottom Gear Detectable: <ul style="list-style-type: none"> • Allow owner and all ocean users to find gear upon approach. • Understand likely subsurface gear location. • Up to 4-6 miles away In Federal waters through the use of high flyers/radar reflectors and markings. 	Alert all ocean users at least ½ mile away from gear, on chartplotter or to vessel.	Alert ocean users or enforcement at any distances - could be based on user type.
	Inform ocean users of on-demand gear location via chartplotter or through other platform.	Alert gear owners of lost or moved gear and display/share associated information about the gear with other vessels on chartplotters.
	In Federal waters, alert ocean users 4-6 miles away in real time, may include set configuration (e.g. direction)	Alert ocean users at different distances depending on need for access.
Standardized non-proprietary identification device that allows everyone equal access to information that gear is below.	Equal access on the water to “see” the buoy within a limited radius and display subsurface gear on chartplotter or other existing platforms.	Provide detailed information regarding the gear, vessel, and permit information. Automatically mark gear deployments and recoveries via RFID or other technologies.
Owner Identification: Requirements vary, but buoys often include fishery and ownership information such as state/federal permit/license number, owner identity, gear type. Requires buoy retrieval or being very close to read it.	Display required ownership/permit information on chartplotter or other device within a comparable distance of information provided by buoy.	Allow the collection (and sharing if requested and legally permissible) of additional info including set time, fishery, environmental data like depth, temperature, salinity, ambient noise, whale calls, etc.
Haul Gear: Surface connection for owner to haul gear from the bottom and for enforcement to inspect gear. Gear can be hauled from the buoy.	Provide a way to communicate with submerged gear and enable hauling for both the owner and enforcement.	

The presentation concluded with updates on opportunities to develop proposals for Fishery Management Plan (FMP) modifications via proceedings in the New England Fishery Management Council (NEFMC) On-Demand Fishing Gear Conflict Working Group and through the South Atlantic Fishery Management Council (SAFMC).

The presentation recommended establishing minimum interoperability standards, which generated interest from participants on how such technical standards might be modified over the long term. It remains to be seen what and if any standards would be developed, but there would be opportunities for public engagement during that process. Some participants raised concern on whether underwater acoustic positioning would be a requirement of any minimum standards, and it was clarified that all available options would be considered based on specific fishery needs. Other questions were raised about the role of fishery management councils, and where testing of on-demand fishing gear has occurred. Roles of different entities are still being outlined and this workshop provided valuable input into that process. On-demand gear is currently being tested in waters offshore of more than 5 US

states, and in Canada. This includes gear testing in the mid-Atlantic ocean off the US coast, in the north Atlantic in Canada, and in the Pacific ocean off the coast of California.

Developing Functional Needs and Requirements

- **Objective:** To summarize the Northeast Fisheries Science Center (NEFSC) Protected Species Division (PSD) Gear Research Team’s stakeholder engagement workshops held between April 2022 and April 2023.
- **Speaker:** Brian Galvez, NOAA Fisheries

Between April 2022 and April 2023, the NEFSC Gear Research Team, held a series of stakeholder engagement workshops, to educate on the state of on-demand fishing; and engage state fishery managers, law enforcement, and industry members on the issues and obtain their input. The workshops outlined a set of data fields and database/web interface functions. Stakeholders were asked to provide feedback on which fields and functions should be required, and which would be helpful additions. A total of 37 participants were interviewed, including 24 government officials and 13 industry members.

Participants in the stakeholder engagement workshops unanimously thought that in the absence of surface buoys, deploy location and unique vessel identifiers should be required, and that all commercial fishing vessels should have access to gear location information. Additional helpful data may include trap count per trawl, electronic vessel trip reporting (eVTR) tracking, and trap tracking integration, which all had 33% endorsement ratings. While participants unanimously thought that GPS marking would provide sufficient accuracy, only 83% of respondents indicated that they would want to know the exact position of the gear. Filter options, both by permit number and management area (federal and state), and oceanographic data were mentioned as helpful information to have on a dashboard. Generally, the establishment of clear guidelines for access and permissions was found to be an essential step moving forward.

The presentation emphasized the importance of collaboration, standardization, and ongoing stakeholder engagement. It was noted that responses are not reflective of the agency’s views, and that stakeholder input was collected to inform a path going forward.

Requirements for a Gear Location Marking System

- **Objective:** To share results of stakeholder engagement workshops that aimed to identify preliminary requirements of a gear marking system for on-demand fisheries
- **Speaker:** Elizabeth Vézina, Canadian Wildlife Federation, on behalf of co-authors Mark Baumgartner, WHOI, Leah Baumwell, Pew Charitable Trusts, and Sean Brilliant, Canadian Wildlife Foundation.

The stakeholder engagement workshops looked at the replacement of buoys with a gear location-marking solution for on-demand fisheries. On demand fishing should be made viable for harvesters, and the best way to achieve this is to develop a system that is as close as possible to what they already know. Gear location-marking is a barrier to broad, non-experimental implementation of on demand fisheries, and stakeholder engagement is necessary to create a system that serves all needs adequately.

The co-authors held 17 meetings with 75 stakeholders in 2020 and 2021. Participants were from the US and Canada, and included government officials and NGOs, fish harvesters (primarily of lobster and snow crabs), and enforcement agencies. Participants were asked about detection distance, location accuracy, mode of data display at sea, data sharing, lost gear concerns, environmental impacts, battery endurance, and any additional information they might want.

Feedback revealed that without a gear location marking system that is suitable for Northeast Atlantic fisheries, progress in on-demand fishing will be stalled. The needs of end users like harvesters and enforcement are crucial to consider. While some fisheries may not need all of these requirements, this work intended to identify requirements that would serve all fisheries.

Following the presentation, workshop participants raised questions about the use of acoustics as a part of the solution and its ensuing impacts on marine mammals, permanent and temporary hearing threshold shifts, as well as whether impacts on mammals, other than North Atlantic right whales, should be considered. The presenter noted that there is awareness about these concerns and that there are military standards that may be adhered to for accommodating the typical distance at which lost gear is found, but these needs must be discussed further. Additional questions revolved around minimum acceptable standards for industry and enforcement, compliance with the same requirements across fisheries, and contested accuracy of on-demand technology in place over roped gear.

Discussion: The Needs and Perspectives of Fishermen

Objective: Understand fishermen perspectives on on-demand fishing, its challenges and opportunities

Panelists: Michael Lane, Lobster fisherman, Wes Townsend, Lobster and sea bass fisherman, Marc Palombo, Gear specialist, Sonny Gwin, Lobster and sea bass fisherman, Ted Platz, Fisherman, Robert Hache, Acadian Crabber's Association, Aubrey Church, Cape Cod Fishermen's Alliance.

The panelists shared their experiences and discussed fishermen's needs that must be considered while developing on-demand systems. Two major concerns emerged:

- The need to have real-time data for shared awareness on the location of deployed ropeless gear points to the need for vessels to have Internet connectivity and access to data managed in the Cloud, but this may add technical complexity and/or increase costs to fishermen.
- There is a risk of people "gaming the system" and fishing from their computers by going to areas based on where they are seeing gear on their devices, raising questions regarding traditional and proprietary fishermen's knowledge, data security and ownership.

Other concerns raised included the varying needs of fishermen, loss of gear, and overly complex technology.

The most important takeaway from the panel was the need to engage fishermen deeply and focus the technology around their needs. Other key takeaways included:

- Tailoring solutions to the various needs of distinct fisheries that have different gear types, species, and marginal profits
- Keeping standards minimal while allowing innovation in the marketplace to bring down costs

The panel noted the importance of redundancy in retrieving lost gear, and encouraged ongoing care in looking out for unintended consequences. The strong connection between members and fishing associations was highlighted, particularly the Council's Advisory Panels, as important forums to connect industry members with fishermen.

Workshop participants asked how much gear fishermen are currently losing. The panelists thought that although it may vary by fishermen, fishery, region, and year, gear loss is about 10% per year averaged over many years. The panel noted that lost gear is generally a known risk arising from fishing in risky areas, and a cost that is accounted for depending on the risk tolerance of the fisherman. Workshop participants also asked how to improve the effectiveness of outreach with fishermen. The panelists responded that word of mouth is the best way to improve uptake of on-demand systems. Building trust with fishermen takes time and transparency, and the willingness to maintain sustained engagement.

Discussion: The Needs and Perspectives of Enforcement

Objective: Understand enforcement perspectives on on-demand systems, their challenges and opportunities

Panelists: Jason Berthiaume - NOAA Office of Law Enforcement, Caleb Gilbert - NOAA Office of Law Enforcement, Tiffany Wolvek, California Department of Fish and Wildlife, Matthew Bass, Massachusetts Department of Marine Fisheries, Corey Webster, Fisheries and Oceans Canada.

The panelists represented law enforcement agencies in the US and Canada. The discussion highlighted the challenges they face with on-demand systems, and specific needs that should be fulfilled to make widespread use of on-demand gear more viable.

Major challenges highlighted include:

- Gear marking accuracy is critical, as enforcement needs to be able to easily locate and identify gear.
- As different models of on-demand systems evolve, panelists anticipate challenges around training officers to understand and use multiple systems.

Most panelists noted that gear conflict issues are often resolved directly by fishermen, and require little involvement from enforcement. However, on-demand systems could make it easier and faster to identify gear and gear locations, and this could provide an opportunity to reduce instances of gear conflict.

Enforcement agencies have specific data needs that should be fulfilled to allow them to operate.

These include:

- At a minimum, on-demand systems should fulfill all functions and data that buoys currently provide.
- It could be useful if all on-demand systems were required to collect data that assists with enforcing existing regulations.

Enforcement agencies in the U.S. and Canada have different requirements regarding access to gear positions from shore. The panel discussed the types of data that would help with enforcing existing regulations - this could include collecting the number of traps, soak time, gear location, gear deployment date and time, and vessel identification information.

To operate effectively, the panelists discussed the desire for cloud-based systems and a universal deck box that can trigger all available types of gear (see [Multiple Acoustic Standards](#), below). They noted the complexity of dealing with ghost gear and regulations around its retrieval. A desire for automatic gear marking or an equivalent system was highlighted.

Developing Draft On-Demand Data Specifications

- **Objective:** To share and seek feedback on suggested on-demand data specifications with workshop participants.
- **Speaker:** Kevin Staples, Maine Department of Marine Resources

Data Element	Transmission Type	Operator	Enforcement	Ocean User/ Mobile Vessel	Gear Manufacturer	Fisheries Manager
Unique Owner ID	Priority Cloud	Y	Y		Y	
Device ID	Acoustic/Priority Cloud	Y	Y		Y	
Device Trawl ID	Priority Cloud	Y	Y	Y	Y	
Device Health	Acoustic/Delayed Cloud	Y	Y		Y	
Device Status	Acoustic/Delayed Cloud	Y	Y		Y	
Device Location	Priority Cloud	Y	Y	Y	Y	
Device Datetime	Priority Cloud	Y		Y	Y	
Release Notification	Acoustic	Y	Y		Y	

The presentation shared a draft of suggested data specifications³ for on-demand fishing compiled by a Working Group with representation from federal resource managers and non-governmental conservation organizations from both the U.S. and Canada, a state resource scientist, and a NOAA law enforcement official. The Speaker summarized the approach and considerations taken by the Working Group, emphasizing identifying the most basic data fields necessary to translate the function of the traditional surface buoy. The suggested

data specifications would allow users with varying levels of access to identify gear location, whether subsurface gear were present on specific trawls, when gear was deployed and retrieved, parse ownership information, and interrogate device status and device health. This matrix of data would allow for the computation of additional data fields (e.g. gear soak time), as a component of optimizing data transfer to reduce device data transmission costs, in addition to differentiating when each mode of communication (acoustic, cellular, and satellite) might be best leveraged. The Working Group also outlined a proposed structure for ocean user permissions to consider against a backdrop of fishermen confidentiality concerns. The permission structure has a time component, where access to live and archived data among users may differ.

Independent of data collection and transmission, these specifications attempt to establish a hierarchy of data that is needed vs. data that is wanted across all systems, while prioritizing efficiency, transmission cost, and user privacy. It is also evident that there are still many unknowns, largely around data access, storage, structure, and formatting, and how these will align to existing regulations. Workshop participants broke into small groups to discuss the proposed specifications and provide feedback. The speaker stressed the need to keep required data fields simple and aligned to basic functionality.

³ The draft data specifications presentation and handout are available on the [workshop website](#).

Discussion Outcomes

Overall, participants discussed that the data specifications must be simplified as much as possible, with the option to build in flexibility with a bare minimum of “must haves” and a larger list of “nice to have” data fields. The main themes that emerged from the breakout discussions are summarized below:

- **Data standards must be limited to minimum requirements**, allowing users to fit data collection to purpose and to minimize cost and complexity.
- **Data elements must be clearly defined and explained**, leaving no room for doubt on what is collected. For example, participants were unsure if “Unique Owner ID” referred to the owner, the vessel, or some unique ID which combines the two.
- Data standards should include an explicit specification for “**Other vessel fixed gear**” instead of ‘Ocean User/Mobile Vessel’ to better describe the suggested groups used in the discussion.
- **Some data elements and access rights are nice to have, but not necessarily needed.** These include:
 - Trap counts
 - Data access by manufacturers
 - Access for fisheries managers (excluding enforcement which will need access) and take reduction teams
 - Date/time data only in select areas.
- **There should be room for customization:** The group encouraged that on-demand gear with a range of functional complexity/capabilities be allowed for use, which can be customized by individual fisheries to suit their needs. This allows manufacturers to work within their capacities, and allows each fishery to consider a range of options and select the technology which best fits their needs.
- **Data privacy and security:** Many participants asked, who needs to see the data? This gave rise to several considerations, including:
 - Fishermen collect and need to retain certain types of proprietary data, including exact locations of their gear. Some participants suggested that this data should be made available to enforcement, but should otherwise remain private to the gear owner.
 - Regulations often dictate and bound what can be shared. This must be considered and explored as we move to using on-demand gear.
 - Data security is essential. Where will data be stored and how will it be managed and how are security breaches handled?
 - Need to consider the use of geofences for different metadata based on a users’ location to ensure individuals cannot game the system by having access to all the data all at once from shore.

Conceptual Approaches to On-Demand Systems

Brett Alger, NOAA Fisheries, presented three conceptual approaches to ropeless systems that represent different paths forward for on-demand fishing. These are:

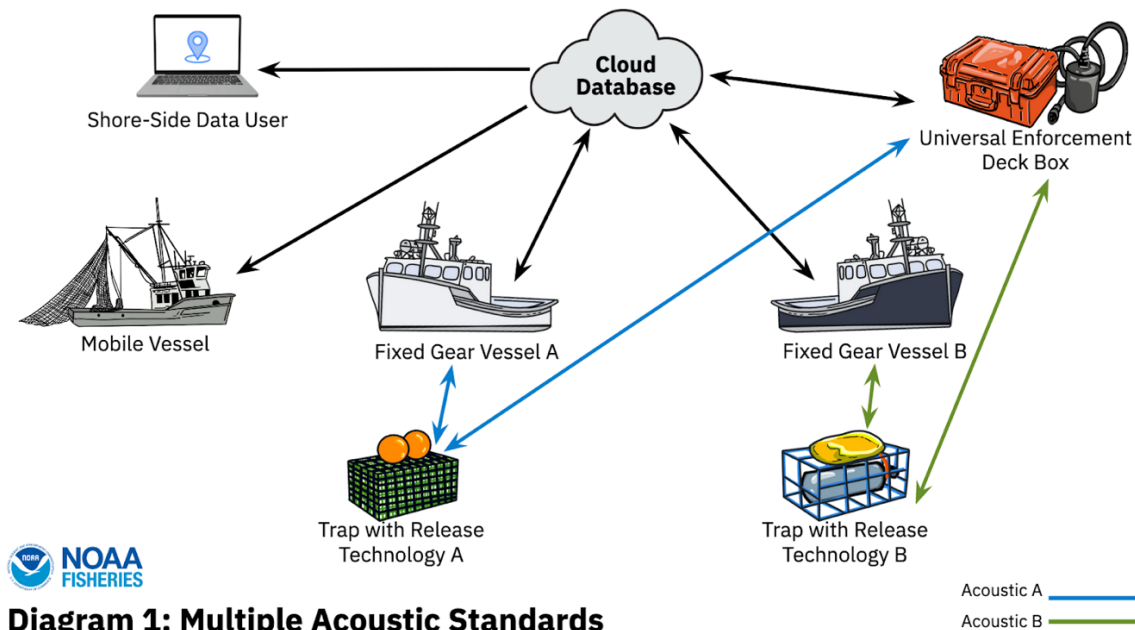
- A. [Multiple Acoustic Standards](#)
- B. [Open-Source Single Acoustic Standard](#)
- C. [Acoustic Gear Positioning Only](#)

The three systems are described below. Each description is followed by outcomes of each discussion, and overarching questions and considerations. Workshop participants discussed each approach in detail in small groups, and then brought their assessments of strengths and weaknesses, and overarching questions and considerations back to the larger group.

Please note that the strengths and weaknesses outlined for each approach reflect a summary of the group discussion. The strengths and weaknesses should not be read as (and are not an) agreement among small groups or across groups, a general consensus as to the direction that should be taken, nor an agency position or opinion.

Concept One: Multiple Acoustic Standards

Fixed gear vessels communicate both ways with a cloud database. The database provides this information to mobile vessels and shore-side data users. In the diagram, blue and green arrows depict multiple acoustic communications.



Discussion Summary

Strengths

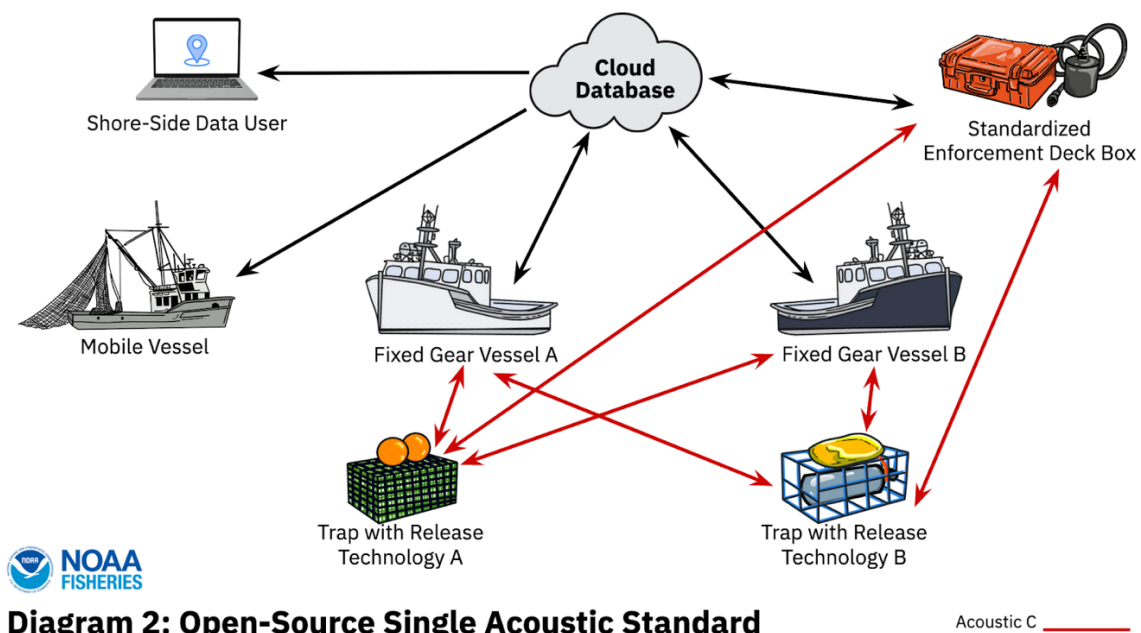
- **Availability of choice:** This approach allows people to choose whichever retrieval system best fits their needs. It enables flexibility for manufacturers and encourages competition. In turn, this might mean that costs will come down over time.
- **Known cost:** Costs are known or easy to estimate as there are many products already in development aligned with this approach.
- **Acoustic frequency:** Manufacturers can continue to use the acoustic transmission frequency of their choice, and need not adhere to a specific range. They can innovate and tailor their approach freely.
- **Enforcement:** A universal deck box that translates across systems is essential for enforcement, as it allows ease of use, and does not require learning to use multiple different systems.
- **Gear conflict avoidance:** Mobile fleets do not need transducers, saving effort in installation and considerable cost. This approach also allows users to view gear on plotters at a distance due to the use of cloud data.
- **Certainty:** As this approach is the most far along in practice, it offers a much higher degree of certainty in outcome and effectiveness.

Weaknesses and Questions

- **Acoustic frequency:** Use of many different protocols may lead them to interfere with each other, particularly at close proximity.
- **Cost and complexity:**
 - A universal deck box may prove to be more expensive and complicated for enforcement agencies. A possible solution could be if software and hardware are separated, then changes to software could be less expensive.
 - High input required for equipment, connectivity and software to talk across systems
 - This system requires every vessel to have real-time access to the cloud database, adding a range of costs like a Starlink or equivalent subscription.
 - If a user buys different gear over time, their vessel will need multiple tools to talk to different manufacturer's gear.
 - If a manufacturer goes out of business, it may be hard to maintain equipment, or push the user to invest in new equipment.
- **Data ownership and security:** It remains unclear how data access, storage and security will be managed.
- **Locatability:** There are two major concerns about gear locatability using this approach:
 - If gear is moved from its recorded location for any reason, it can only be found and identified by a vessel using the same acoustic system and gear from the same manufacturer. This reduces the likelihood of preventing ghost gear and associated entanglements.
 - Areas of **high-density** fishing are a concern. While some systems can provide specific locations, all current systems only use GPS, leading to variability in specificity. In some diffuse fisheries, this will be fine but in concentrated fisheries, it will increase gear conflict.
- **Enforcement:** Assuming enforcement would have full access to a universal deck box, which other users, if any, would have access to a skeleton key? Who will produce the universal box and who will set standards? How will this impact innovation?

Concept Two: Open-Source Single Acoustic Standard

A standardized acoustic system has a single standard for interoperable acoustic communication. In this system, there are two-way communications between fixed gear vessels with gear on the seafloor (acoustics) and the cloud database (via internet connection). This system differs from the Universal Box Concept in that traps and vessels can all communicate with each other and are not restricted by specific technologies.



Discussion Summary

Strengths

- **Locatability:** This approach allows for precision in locating and avoiding laid traps in dense fisheries as well as locating lost traps by mobile gear or other vessels.
- **Lost gear:** The biggest strength of this interoperable acoustic system is the ability to quickly and accurately relocate gear on the seafloor that has moved from the known location in the cloud database (either by storms or being trawled); by having all on-demand equipped vessels able to find lost gear, ghost gear will be greatly reduced.
- **Gear conflict avoidance:** Mobile fleets do not need transducers, saving effort in installation and considerable cost. This approach also allows users to view gear on plotters/tablets at a distance via the cloud database at no cost.
- **Advantages for Enforcement:** A standardized enforcement deck box is simpler because it is based on a single standard that does not need constant updates to accept new acoustic approaches. An existing standard also makes it easier to add new entrants.
- **Acoustic frequency:** A single data standard should allow means to solve acoustic interference among closely-placed gear, and therefore be able to support high-density fishing environments.

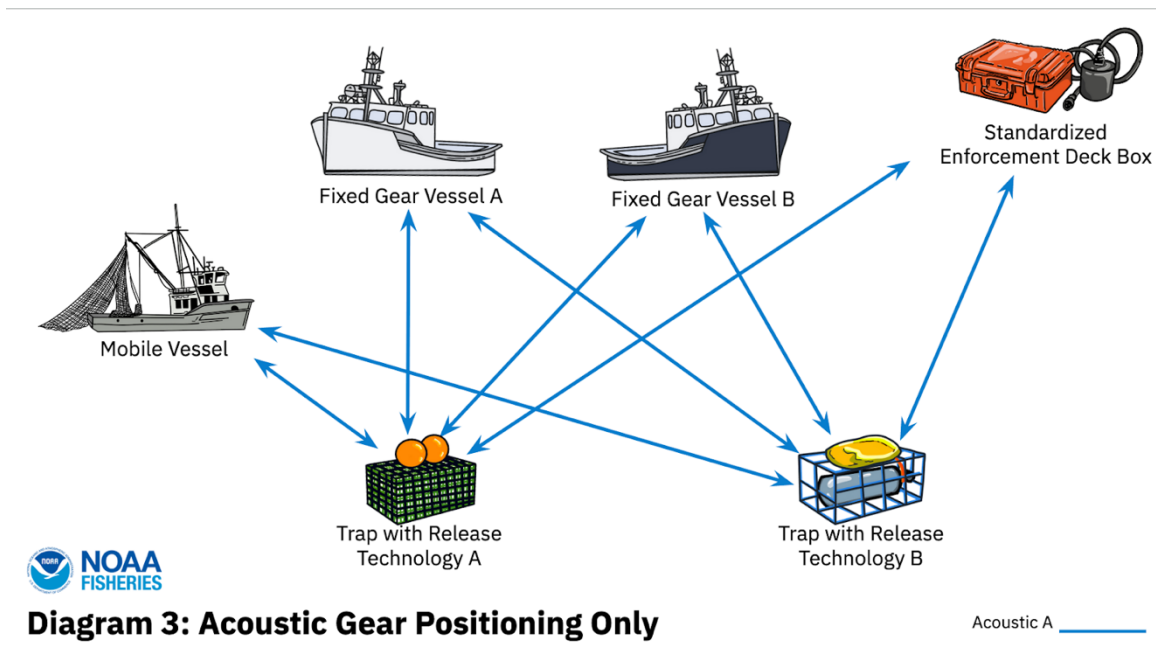
-
- **Adoption and Certainty:** This approach provides a single standard for all to adhere to providing certainty, uniformity and clarity. This clarity in requirements allows for wide utilization, while still providing adequate room for manufacturers to build for different needs and ensures that no one manufacturer dominates the market, thereby keeping costs down.

Weaknesses and Questions

- **Cost and complexity:** A standardized system will require every vessel to have real-time access to the cloud database, adding costs like Starlink subscriptions to every vessel.
- **Uncertainty:** A standard does not currently exist and must be developed. By contrast, the Universal Deck Box approach is further developed.
- **Data ownership and security:** It is unclear how data access will be managed and by whom.
- **Harm to Existing Developers and Deploying Fishermen:** There could be adverse impacts on early adopters of on-demand gear systems whose gear does not fit the new standard. Additionally, a standardized deck box could pose an issue for existing manufacturers whose gear may not fall under the standards and who may not want to change their acoustics.
- **Complexity and cost to manufacturer:** There is a greater risk and cost to developers who must make their systems conform to universal standards. Heightened interoperability increases the demand on the manufacturer.
- **Innovation:** Participants debated whether this approach increases or limits innovation, whether it forces concentration on a sole acoustics supplier, and whether the standard would be open or licensed.

Concept Three: Acoustic Gear Positioning Only

This system utilizes an enforcement deck box that interacts with traps. This can interact both ways with both mobile and fixed gear systems. While this system does not require use of the cloud, it would require that all vessels install a transducer.



Discussion Summary

Strengths

- **Locatability:** This approach allows for precision in locating and avoiding laid traps in dense fisheries.
- **Lost Gear:** All user vessels can detect each other's gear and understand whether and where it is lost. High mobile gear awareness makes it easier to find lost traps.
- **No cloud database:** The system does not require expensive satellite service and would avoid data management and privacy issues. However, it would require a standard acoustics protocol to function. Data would not be accessible in real time, but could be accessible once at port.
- **Familiarity:** The system is a close mimic of the existing buoy system, locating gear on the water in real and near time.
- **Data Security:** The limited and non-real time shared data helps prevent data breaches, access and privacy issues.

Weaknesses and Questions

- **Environmental Impact:** Due to the need for repeated pings, this system has the highest acoustic emissions and may cause highest environmental impact.

-
- **Mobile Gear Cost:** A transducer is required on every vessel, including mobile fleet and any vessel that needs to know where on-demand gear is located.
 - **Enforcement:** This approach is best for real-time at-sea detection. The lack of cloud access could mean, for example, that mobile gear could run through lobster gear leaving no evidence, while enforcement would not have known that gear was there in the first place.
 - **Gear conflict avoidance:** This system can see gear in a range of <1 to a few miles, and thus may not be able to signal extremely long trawls at sufficient distance to avoid conflict.

Overarching Questions and Considerations for All Approaches raised through Discussion:

- **Frequency interference:** Companies currently use different frequency ranges. In some high-density areas, similar gear types use the same frequency and can talk over each other, leading to communication issues. Participants recommended setting a broadband width for communication to avoid interference. The possibility and/or impact of frequency interference in standardized vs. non-standardized on-demand systems needs to be explored further.
- **Standards:** If you have a standardized enforcement deck box that requires basic standards such as kHz, reliability, strength of signal, one can still allow for innovation.
- **Environmental impact:** Are there defined limits on acoustic transmissions, and what is their impact on the marine environment? Narrow-band, high-powered systems may violate the limits. There is a need for clarity on permissible levels of acoustics, including range, frequency, “pings” per hour, etc. from the regulatory agencies in order to proceed.
- **Need for satellite connectivity:** Does the cloud database necessarily need satellite connectivity? Are there other ways to get access in “real enough” time?
- **Gear ownership:** Who owns the gear (whether leased, owned, government-purchased, etc.)?

Day Two: November 29, 2023

The second day of the workshop opened with participants reviewing and reflecting on the first day's closing discussion about conceptual approaches to on-demand systems. With these outcomes and considerations in mind, the group heard five presentations by manufacturers and proponents of existing approaches.

All presentations and handouts referenced below are available through the [NOAA Fisheries website](#), at the link titled [Workshop Resources](#).

Existing Approaches to On-demand Systems

Approach 1: Points on a Spectrum

Speaker: Marco Flagg, Desert Star Systems LLC

The presentation considered the pros and cons of developing an acoustic standard versus setting recommended operating guidelines for on-demand gear. The speaker explored the requirements an acoustic protocol must fulfill to align with the Open Systems Interconnection (OSI) Standards model and maximize interoperability. Three existing protocols were discussed:

- FONTUS, developed to function as an open standard (see [Approach 4](#))
- Open Ropeless Fishing System (RFS), developed by EdgeTech Corporation (see [Approach 5](#))
- Frequency Hopping Pulse Position (FHPP) Protocol, developed by Desert Star Systems

No single acoustic protocol fits all needs. While FONTUS meets OSI requirements, both Open RFS and FHPP offer additional capabilities that are important for certain fisheries and functions. For example, Open RFS allows trap detection at a longer range than other systems, while FHPP allows for greater precision pop up in high currents. The presentation highlighted operational differences and difficulties in setting an underwater acoustic standard as opposed to the OSI standard. For example, data transfer speeds are far slower underwater than they are in the air. An underwater acoustic standard must account for this difference, and account for the safety of marine life.

As an alternative to setting an acoustic standard, the speaker recommended creating operating guidelines that allow the use of multiple acoustic protocols. This approach would require the use of a universal deck box. The speaker offered suggestions for minimizing interference between boats and minimizing harm to marine mammals.

Participants discussed technical aspects of the three protocols, focusing on FONTUS and FHPP. Many noted uncertainty about what future regulations will or will not allow, including narrow-band

frequencies. Concerns were raised about gear conflict in high-density areas. Some noted that this will need closer attention, and minimum acoustic requirements for on-demand gear must be understood before trying to assess marine mammal impact.

Approach 2: Draft Interoperability and Enforcement Guidelines for On-Demand Fishing Systems

Speaker: Kim Sawicki, Ropeless Manufacturers Workgroup

The Ropeless Manufacturers Workgroup (RMW) is an industry standards group that coordinates collaboration across manufacturers of on-demand gear to ensure interoperability, enforceability and a diversity of choice of gear for fishermen. They initiated the RMW HUB, a cloud based data sharing platform that achieves interoperability, supports collaborative efforts toward chartplotter integrations and considers both feasibility and cost for fishermen needs. Using this system, acoustic interoperability is only needed for enforcement.

The speaker stressed that as on-demand fishing is still in its infancy, it is too early to set fixed technological standards. The RMW Hub operates under a set of flexible guidelines. This allows for greater gear availability, innovation, and use of a variety of acoustic ranges. The presentation concluded with examples of how the RMW Hub has been implemented so far.

Responding to a question about long-term cloud maintenance, the speaker clarified that the Hub is an integration tool that does not store any data long term, and is built to be flexible to user needs. A participant asked if gear trials have yielded any information about ongoing data costs to fishermen, as this is a central concern around implementing cloud based systems. Thus far, there are no significant patterns to call out, although a participant noted that costs could vary dramatically depending on the distance of the vessel from shore, and the mode of connectivity (e.g. Iridium vs. cell phone data)

Approach 3: Ropeless Riser: An Interoperable, Acoustic Only Solution for On-Demand Fishing

Speaker: Bud Vincent, Ropeless Systems

This presentation focused on Ropeless Riser, which uses acoustic positioning to manage gear in areas of high-density fishing and acoustic interference. In such contexts, basic requirements for acoustic interoperability include multiple points of access, position knowledge, trawl position, gear type, clear ownership, integrated displays and control of chartplotters for recovery. Acoustic modems are used to determine specific positions on the seafloor when there are multiple vessels at the surface.

The Ropeless Riser system uses transponders instead of acoustic modems, and allows for in-situ, real time acoustic positioning. It does not require use of the cloud, and could be a more cost efficient system for mobile fleets.

The audience raised questions on how this system could result in lower costs for the mobile fleet. The presenter responded that despite the initial cost incurred with installing the transponders, over the long term, it could be more cost-effective because it does not necessarily require cloud connectivity and the user would potentially have lower data transmission costs. Given how the proposed system would operate, participants expressed concerns about battery life especially if multiple vessels are communicating with the submerged fishing gear. However, the presenter clarified that once a surface vessel determines the location of the gear, the transponder does not need to communicate again and that battery life can be conserved long enough for it to be retrieved. Participants raised additional questions regarding potential acoustic interference and impacts to marine mammals, and it was noted that the proposed system is designed to manage a high volume of acoustic pings. Based on sea conditions, detection can be impacted, and Ropeless Riser is continuing to seek additional input from the mobile gear fleet to better account for this.

Approach 4: FONTUS Open Standard

Speaker: Mark Baumgartner, Woods Hole Oceanographic Institute

FONTUS is an open standard developed for on-demand gear location marking, gear retrieval, lost gear recovery and enforcement. It sets specifications for how and what is communicated, and what is done with information once received. FONTUS covers a wide range of functions, including deployment, recovery, gear location tracking, and retrieval of lost gear. It accounts for and addresses common challenges like background noise, transmission loss, range rate, and others.

The presence of an acoustic communication standard would allow any vessel to communicate with any on-demand acoustic device, regardless of manufacturing origin. The presentation outlined additional benefits of implementing a standard, including the ability to verify the presence or location of on-demand gear by any vessel, and ease of managing acoustic interference. Implementing a standard would accelerate, rather than stifle innovation. The presentation noted that standards can evolve over time, and will not necessarily limit innovation and flexibility. In response to questions, the speaker stated that initial development costs for manufacturers will be high, as some may need to alter their technologies to match standardized acoustic ranges.

During the discussion, a participant highlighted the risk to users who have already deployed gear that may not fit a future standard. It was agreed that fisheries should be informed of the risks before they are encouraged to purchase. In response to a question about FONTUS' approach to encryption, the speaker clarified that this is still in development, and will become clearer as the approach gains more buy-in.

Approach 5: EdgeTech Ropeless Fishing System

Speaker: Greg MacEachern, EdgeTech

The presentation explored interoperability as it relates to the Ropeless Fishing System manufactured by EdgeTech, and provided a detailed technical look at how it works.

The EdgeTech protocol can be used with any release technology and does not require licensing. Each vessel uses a deck unit that is controlled by an app on a phone or tablet, and a hull mount or dunking transducer. Data is only shared as needed for vessel locations within a 5 mile radius.

A participant asked if EdgeTech would be willing to adjust their working frequency and eventually shift to FONTUS. The speaker responded that the selected frequencies have been extensively tested and there are no current plans to adhere to a different standard. The preferred approach is to work under conditions where multiple systems can operate.

Discussion: Strengths and Weaknesses of Presented Approaches

Following the five presentations, participants broke into small groups to discuss the strengths and weaknesses of each approach. Each group was asked to consider the commonalities observed across approaches, note key questions that arose from all five presentations, and to consider what steps must be taken to advance the discussion on interoperable on-demand fishing.

Commonalities

Participants recognized that all fisheries are different, and that a one size fits all approach cannot exist. There was a shared recognition that an acoustic standard has a strong potential for supporting on-demand fishing, but the necessary time and resources to develop and implement this in the short-term could be challenging. Similarly, interoperability is valued, but it is not necessarily a baseline requirement for all users.

It was clear that all systems will need some degree of cloud access and compatibility, as well as data connectivity on vessels. Basic data specifications for on-demand fishing must be clarified and defined. There were a lot of tradeoffs discussed regarding the development of an acoustic standard. It was generally acknowledged that sound emissions and the protection of the marine environment should be a top priority to ensure that on-demand systems do not create adverse unintended impacts.

To develop and advance on-demand fishing, it is important to focus on the user requirements, primarily fishermen. They will need to operate the fishing gear efficiently and safely, and their feedback as technology is developed and implemented will be critical to the success on an operational on-demand fishing program. A collaborative approach that addresses area closures and incentives effectively is necessary to bring more fishermen into the process of developing on-demand systems. As the technology and usage advance, participants acknowledge that enforcement will face a steep learning curve and will need to invest effort and resources to manage the new system effectively.

Key Emerging Questions and Concerns

Requirements

- How can we identify needs and requirements for different types of fisheries?
- Where is the line between regulated requirements and market differentiators?

Differentiating Fisheries

- Is it possible to calculate future fishing density scenarios with different needs?
- How can we use social science to address fundamental adoption challenges?

Standards and Regulations:

-
- Which route will we take - rigid standards or more flexible guidelines? Or something in between?
 - What is the timeline and milestones for regulations?
 - Can NOAA provide guidance on acceptable acoustic standards to avoid or minimize harm to marine mammals?
 - Can we narrow the requirements for those already invested in existing systems? How will this be justified?
 - Is it possible to apply different levels of sophistication to different fishery situations, while identifying the fisheries that need a standard protocol?

Process:

- How can the objectivity of these processes be ensured?
- How to bring adequate agency resources to the work to develop and implement on-demand fishing? Most are resource-limited at this time.
- Will there be alignment and collaboration across the US and Canada? What will this look like?

Acoustics:

- How do we identify problems with interference?
- How robust does the acoustic system have to be in terms of acoustic releasing?
- Do the current acoustic frequencies used in these systems affect marine organisms?

Gear Systems, Testing and Demonstrations

- How, and how often is the gear going to be used?
- How does gear testing work? How is the mobile fleet engaged in gear testing?
- Are these systems being designed for closed areas only or fisheries-wide?
- How often are there false alarms in existing systems?
- What would it take for manufacturers to meet FONTUS requirements, or be able to coexist with that type of open standard? (i.e., from 17 kHz to 20)
- If and how do we want these systems to use geofencing for data availability as well as operations?

Cost concerns:

- What are the costs for each of the options?
- What are the key factors associated with the costs? E.g., battery life, cost of data, cloud backup, data streaming, security, etc.?
- Once the cost is known, who pays for it? This answer will have an effect on product design and development.
- Does technology reduce gear loss or help us find gear more rapidly which provides some offsetting cost savings?

Advancing the Discussion: What is Needed?

Looking ahead, participants thought that increased collaboration is essential, and considered what each group (users, manufacturers, law enforcement, and regulators) need from each other to move forward.

- **Needs from Regulators:** Participants recognized that regulation and standardization will take time, and encouraged an evolving, collaborative and iterative approach. Regulators were asked to set clear timelines and milestones for new standards and regulations. They were asked to define minimum baseline requirements for on-demand system operations and safety features, and to provide guidance on allowable acoustic ranges. There is a need for clarity on costs for the systems, as well as who is responsible for the costs. Participants asked for increased gear testing and trials, and for support for early adopters of on-demand systems in case changes in standards or requirements impact their existing gear.
- **Needs from Manufacturers:** Users requested manufacturers to provide demonstration, testing and more information upfront about their systems, how they work, and the requirements to operate them. They stated a need for clarity about acoustic frequencies and emissions, and speed and distance requirements. Enforcement agencies echoed the request for increased accuracy in positioning.
- **Needs from Users:** Manufacturers noted that increased gear trials requires more fishermen participating in testing. They seek deeper engagement with fishermen, who know the conditions and needs best - this may require some harvesters to take the lead in sharing their experiences with the gear across their industry. Some users called for the creation of an on-demand lobster market, with the goal of getting a higher price for lobsters caught using on-demand gear. Regulators noted a need to have more users participate in trials so they can gather more detailed information about each system in different types of fisheries.

Lessons Learned from NOAA Fisheries Implementing Technology

Brett Alger, NOAA Fisheries, provided an overview of different approaches NOAA Fisheries has taken to program design and regulations in technology-based data collection programs across the US, including examples from vessel monitoring systems (VMS), and electronic reporting (ER) and electronic monitoring (EM) in US Fisheries.

NOAA Fisheries has taken different approaches to regulating technology in fishery-dependent data collection programs, ranging from fishery-specific requirements to national regulations (e.g., VMS). Moreover, given the iterative nature to supporting technology innovation and relatively new data collection programs needing continued improvements, some ER and EM programs have paired Federal regulations with different forms of guidance and standards to support their programs. Because many requirements have been established at the fishery or regional-level, it has been difficult to scale the various tools across fisheries and regions. This has led to technology providers having to expend significant resources to meet specific requirements for a relatively small market share (e.g., 100 fishing vessels), whereas technology standardization at a coastwide or national-level could help lower costs and support greater adoption.

NOAA Fisheries and our partners have implemented 12 electronic monitoring programs in commercial fisheries across four regions. Given the significant challenges with developing fairly complex monitoring programs, EM rting programs has been piloted using exempted fishing permits (EFPs). The use of EFPs to develop program and technology requirements complement the regulatory components has proven vital. Additionally, NOAA Fisheries has developed several national EM policies to provide clarity and consistency on the underlying data management of these programs.

For on-demand fishing, the takeaways here are clear. On-demand systems must focus on program design, user requirements, and data standardization; supported by an overarching policy framework for managing and disseminating data. Especially in fisheries with potential gear conflicts between fixed and mobile fisheries, this will require a relatively complex system that needs continued refinement and improvement to meet evolving technology. All stakeholders in developing a new on-demand fishing program will need to balance performance standards and any Federal regulations to support innovation and that ultimately, a well-regulated technology marketplace will create competition and choice.

Closing: Creating a Shared System Across Different Sectors

The group closed the workshop with an open conversation about possible next steps, that built on the earlier small group discussion.

Themes that were reiterated in closing included:

- A clear timeline from regulators, and milestones for the next six months. There is a need to expedite establishing performance standards or guidelines and basic requirements.
- Clarify usable acoustic frequency ranges, and evaluate which ranges are safe for marine mammals and other marine life.
- Deepen engagement with (recruitment of?) fishermen, and focus on their needs and interests.
- Encourage increased testing and gear trials with fishermen, creating opportunities for trainings and practice.
- Create a dialogue around experiences and user requirements, and capture fishermen's experiences in a way that anyone can understand.

Day Three: November 30, 2023

State and Federal Agencies Only

Overview

Day three of the workshop was attended by representatives of State and Federal Agencies from the US and Canada. Many participants attended all three days of the workshop, while some attended Day Three only. The day opened with a recap of presentations, discussions and outcomes from the two day multi-sector workshop. Participants reflected on these conversations and the needs expressed of government agencies and discussed paths forward and possible next steps.

Recap of Two Day Multi-Sector Workshop

Fisheries and Enforcement Panel Discussions

Brett Alger, NOAA Fisheries, spoke about the two panel discussions that respectively explored the needs and perspectives of fishermen and enforcement agencies when implementing ropeless fishing systems. Referring to the fisheries panel, he highlighted the complexity of planning how and what data is made available. For example, lobster fishermen want mobile vessels to know where their gear is, but also want to limit data sharing of the locations of their fishing areas as much as possible.

A participant raised a question about the need for enforcement secrecy when conducting inspections. Representatives from both the US and Canada clarified that law enforcement is not always required to notify harvesters prior to an inspection, and there is occasionally a need to work covertly if investigating illegal fishing.

Presentation on Data Specifications and Discussions

Kevin Staples, Department of Marine Resources, reviewed the discussion about proposed data specifications. He highlighted the need to limit data standards to minimum requirements, and how some data types may be required in real time while others may not. Currently, fishermen can visually see who they are fishing in close proximity to, a feature that should be maintained in an on-demand gear visualization system. Whether shoreside users (e.g., the gear's owner, enforcement, fishery managers) should have access to the information as well is an open question.

The group considered adding an additional column for “Other vessel fixed gear,” and discussed access and confidentiality issues, including:

- **Access for fisheries managers:** Most participants thought that it was not necessary for fisheries managers to access this data. In Canada, it is likely that fisheries managers will need some level of access.
- **Access for other ocean users:** Other ocean users may need to know where gear is. This could include fisheries survey vessels, or vessels operated by offshore wind companies while laying cables, etc. The following questions were raised. How will data specifications address this need while balancing the needs of fishermen to limit sharing information on their preferred fishing grounds? Should data be available regionally through requests managed by an entity (government or otherwise), or just available spatially within narrow distances of actual vessels (such as within 5 nm of vessel position)?

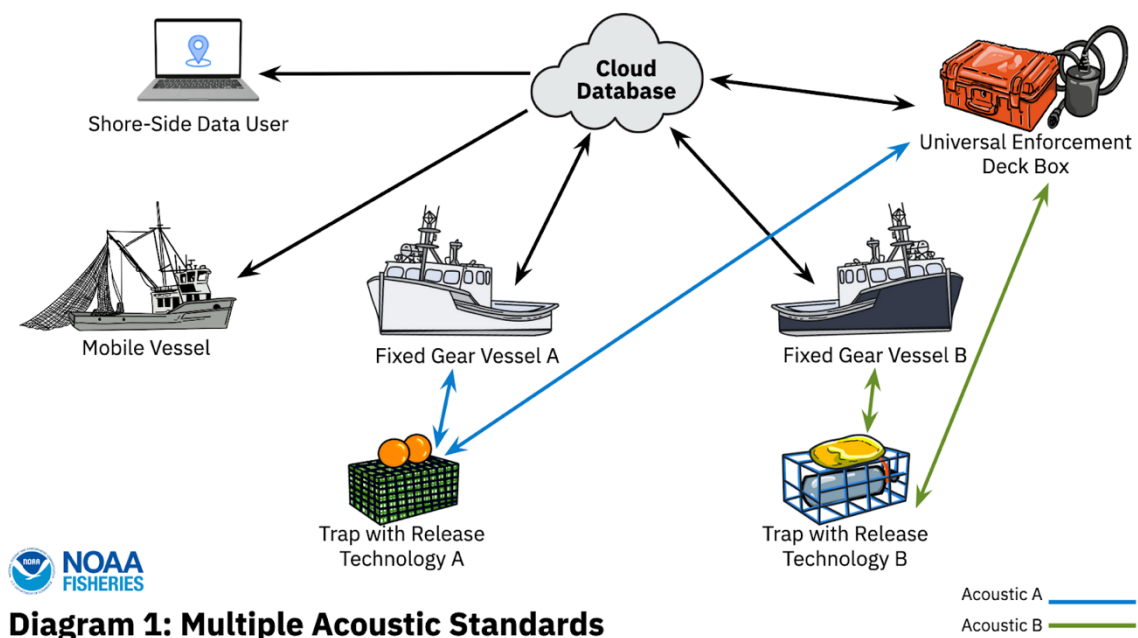
Discussion: What does each state require to move forward with developing data specifications?

- **Set up working groups:** Participants from New Hampshire and Maine requested the formation of a working group to address state and federal agency processes.
- **Determine roles and responsibilities:** The role of the Fishery Councils and the Commission will depend on how regulatory changes are recommended and implemented. Some participants thought that the Atlantic Coastal Cooperative Statistics Program should be involved in setting data standards.
- **Differences in fishery management in Canada:** In Canada, the Provinces do not have a direct role in fishery management, and regulation is handled by DFO. DFO will include the Provinces in discussions about gear trials, and ensure ongoing collaboration.

Presentation on Acoustic Technology and Standards Feedback

The group reviewed the diagrams showing three conceptual approaches to acoustic technology and standards, and reviewed the outcomes of earlier discussions covering pros, cons and questions raised from each diagram. Additional discussion covered the following themes:

Concept One: Multiple Acoustic Standards



- This approach is closest to the current approach to gear marking with GPS positions, although a universal deck box that can communicate with and trigger any and all devices does not currently exist.
- A benefit to this approach is it allows gear visibility at essentially unlimited distances due to cloud access depending on what permission settings are used to control data access.
- **Comments on data and cloud access:**
 - **Cost of cloud access:** A concern was raised about the cost of cloud access, as an internet connection is essential for real time updates. Providers like Starlink are reasonably affordable for large-scale commercial fishing operations, however, it will be important recognize any increase in costs especially for smaller sole-proprietor fishermen.
 - **Variable need for real-time connectivity:** Some trackers currently in use on lobster boats are cellular based. A universal deck box could use either cellular or satellite data. Some fisheries that do not need to update in real time may choose to uplink only when back in cellular range; but for high-density areas or areas with high currents, a real-time position update via internet connection on scene may be required to avoid gear conflict.

-
- **Utilizing a wider range of frequencies:**
 - Use of a wide range of frequencies could reduce gear conflict, but it also could adversely impact marine life.
 - Some of the participants were concerned about the potential need to have additional through-hull transducers to support a universal deck box that may be able to accommodate a wide range of frequencies.
 - **Ease of use:**
 - This is a good option that may work well for enforcement agencies, but may not be cost effective for fishermen.
 - If a new manufacturer enters the market, it is expected that all existing deck boxes could be updated remotely to account for the new system.

Concept Two: Open-Source Single Acoustic Standard

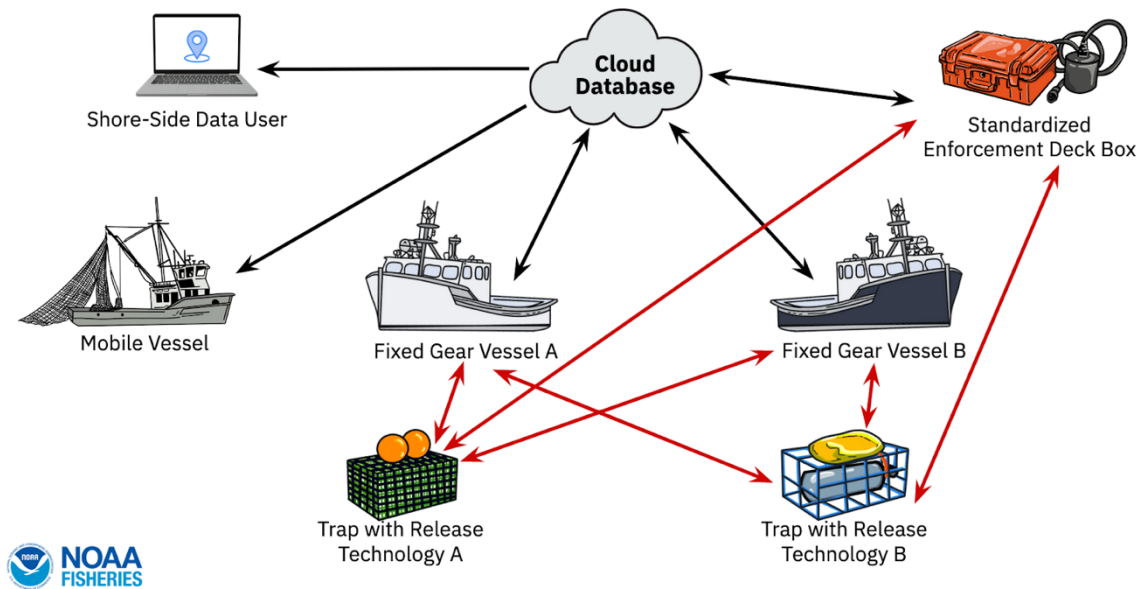
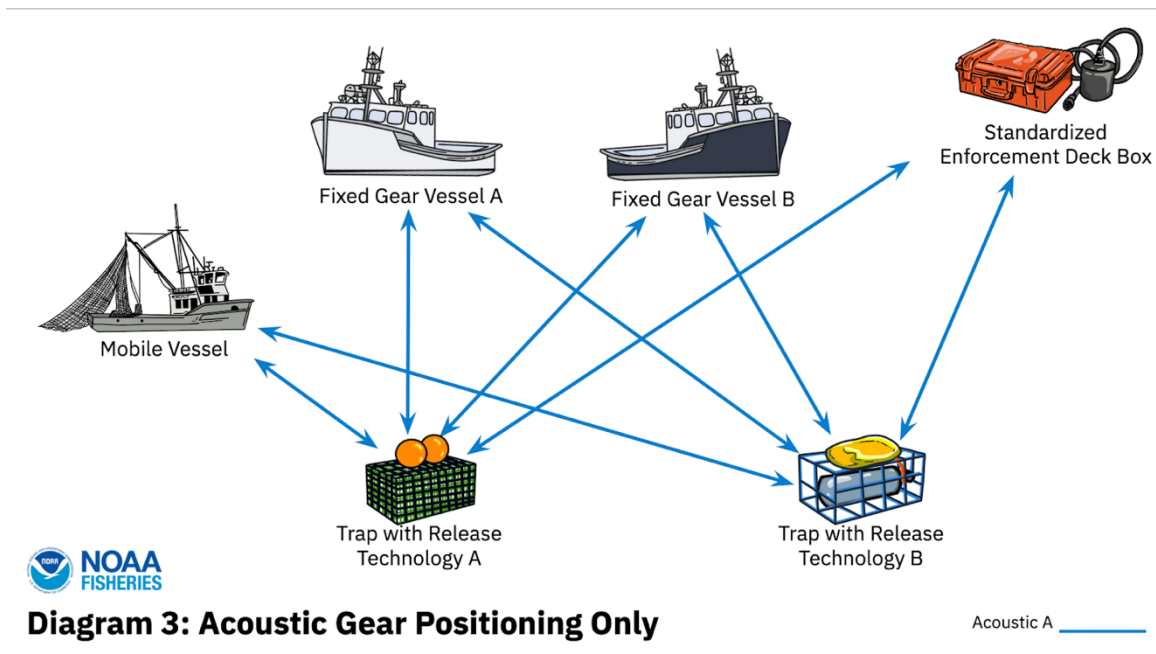


Diagram 2: Open-Source Single Acoustic Standard

Acoustic C _____

- **Harvesters want flexibility:** Fisheries have different needs, depending on fishing density in different areas. A universal standard would allow harvesters to choose and trial different systems at a lower price point if the acoustics were interoperable.
- **Tailored solutions:** An acoustic standard would allow manufacturers to create highly tailored and specialized technology that would support higher-density fishing with many adjacent ocean users (e.g., mobile vessels). In the absence of a standard, there is a risk of having numerous decentralized systems that cannot communicate with one another, but that may be OK in lower-density fisheries with limited or no adjacent ocean users.
- **Data usage:** It will be important to track the size and frequency of data being transmitted to sea, with a goal of trying to minimize data requirement but with the possibility of having Internet connectivity via Starlink and other systems that can provide greater bandwidth. The bandwidth limits may become a concern as data use increases. The data specifications discussion is useful here to model different possibilities. This is a concern for the universal deck box approach as well.
- **Possible hybrid approach:** If cloud connectivity is interrupted, a hybrid approach is possible. GPS locations (i.e., marks) could be shared with nearby fishermen. This is analogous to current practice where fishermen actively communicate their set locations with others to avoid conflict.

Concept 3: Acoustic Gear Positioning Only



- This model was the subject of intense debate and was negatively perceived by fishermen attending the workshop. It allows high specificity in locating gear and avoids data and security issues. However, each vessel would need a through hull transducer, and the high level of acoustic pinging may have environmental impact.
- There may be some unpredictability in detecting gear at certain distances, and there would be a reduced ability to recover lost gear due to the lack of cloud connectivity.
- The first two approaches rely upon cloud-connectivity to operate efficiently, while the no cloud option could function without real-time connection to the cloud.
- **Gear conflict avoidance** could be adversely impacted by latency of data.
- **Level of allowable acoustic frequencies:**
 - The maximum or minimum allowable range of acoustic frequencies is currently unknown. Establishing this range requires running several scenarios with different frequencies and evaluating impact on marine fauna.
 - The pings are short, but very frequent. In areas of high fishing density, the impact of a high volume of acoustic pings on marine life is unclear.
 - The closed areas have removed a significant amount of vertical lines and fishing vessels for an extended period of time, so any acoustic communication protocols should be evaluated given the reintroduction of fishing vessels and sound emissions from on-demand fishing systems in relatively discrete areas.

New England Gear Innovation Fund

Speaker: Gray Redding, National Fish and Wildlife Foundation

The presentation highlighted projects currently funded by the New England Gear Innovation Fund. The fund was established by the National Fish and Wildlife Foundation (NFWF) and NOAA, and seeks to support the development of gear that reduces risk to marine mammals.

In 2023, the fund made grants totaling \$18.3 million to 18 projects across 9 states. Many of the supported projects are located in Massachusetts and Maine. Details of these projects may be viewed [here](#). Work will begin in early 2024, and a grantee workshop is tentatively planned for late 2024.

Lessons Learned from NOAA Fisheries Implementing Technology

Brett Alger, NOAA Fisheries, gave an overview of NOAA Fisheries approaches to design and regulation in technology-based data collection across the US. This was the same presentation as shared on Day 2 of the workshop, repeated to ensure that all Day 3 participants were familiar with the material.

Questions and Comments

- A participant asked if certain fisheries face 100% requirement for electronic vessel trip reporting. Answer: Yes, almost all Federally-permitted vessels in the Greater Atlantic Region (with respect to the United States) have had paper logbook reporting requirement for a long time, and starting in 2021, that shifted to electronic reporting. As of 2024, lobster vessels will also have electronic logbook reporting requirements.
- Supporting industry during a technology transition is essential, and effective outreach is key. For electronic reporting, this involved an all hands approach that included many meetings, multilingual documentation and clarity of instructions.
- Any new technology must be easy for fishermen to understand and use, with incentives to make the systems attractive. This is true for ropeless systems as well.

Discussion: Data Management and Storage

Both acoustics and data management emerged during discussions as areas that need close attention to detail and clarity as this work moves forward. The group discussed next steps on data management. Some themes that emerged:

- **Data storage:**
 - A cloud database cannot accurately display what gear is in the vicinity unless it holds detailed positions over time in the face of currents, tides, etc.
 - A key question to answer is how long will data be held?
 - If we choose not to store data, it eliminates the opportunity to collect data for other uses, and erases both problems and opportunities.
 - Participants weighed the pros and cons of having a single database with a manager, or multiple databases.
 - Broadly, there was greater support for centralized databases either at the regional or national level.
 - Uncertainty around the mechanism of data sharing between the US and Canada.
- **Third-party data management**
 - Earth Ranger currently aggregates data for five ropeless systems manufacturers into a common cloud database. They have two-way integration with the Edgetech system.
 - RMW also brings multiple manufacturers into a single framework. When gear is deployed, it automatically uploads position, gear id and user id to the cloud. On retrieval, a signal goes to the server and that data is deleted. The database updates frequently and generally reflects gear that is currently in the ocean.
 - Attendees discussed that third-party sharing and access to data must comply with complex legal requirements related to data privacy and security.
- **Data confidentiality:**
 - Any information submitted to the Secretary, state fishery management agencies, or the Commission pursuant to requirements under the Magnuson-Stevens Act (MSA) is considered confidential under the MSA unless certain narrow exceptions apply. MSA confidentiality applies to data reported to federal agencies, including the Greater Atlantic Regional Fisheries Office (GARFO), and is a consideration for third-party data management going forward.
 - NOAA will be publishing a proposed rule on Magnuson confidentiality which will a national framework for data dissemination.
 - U.S. lobster and Jonah crab fisheries are regulated under the Atlantic Coastal Fisheries Cooperative Management Act (ACA). Data privacy for these fisheries are also an important consideration.

-
- **Anticipated challenges:** The group discussed the challenge of creating seamless reporting requirements and data sharing standards for fishermen crossing fisheries and management jurisdiction boundaries. U.S. lobster fisheries are managed under the ACA, while many other fisheries are managed under MSA. Unlike the MSA, the ACA does not have data confidentiality provisions.
 - **Needs of enforcement:** Enforcement must retain access to data for law enforcement purposes, no matter what route is chosen going forward.

Charting Next Steps: Small Group Breakouts

Participants identified four topics that would benefit from additional discussion and broke out into small groups to discuss them in more detail.

Creating a Roadmap and Establishing Milestones

The group discussed the path forward and identified certain milestones. They talked about existing progress, opportunities, barriers, and potential next steps. The main themes of this discussion are summarized below.

- As NOAA develops their roadmap, NOAA should message that ropeless fishing will not be required in all federal water. Rather ropeless gear will be primarily used to provide fishermen with access to closed areas. States may develop similar or different regimes.
- Canada is currently developing an initial 5-year draft of a ropeless roadmap. The issue is evolving quickly and will need constant revision as it is developed.

Rather than looking at sequential milestones on a roadmap, many things need to happen at once and they must be carefully prioritized. Required areas of work are listed below:

- **Establishment of timelines:** Need for a clear timeline on which milestones need to be reached.
- **Identify scenarios of use of on-demand gear to target milestone efforts:** Identify potential gear conflict hot spots and plan directed outreach to fishers in those areas. Also identify current and future closed areas and lines/vessels affected.
- **Data management:** Set requirements at both federal and state levels, and develop a regulatory framework. Establish clear connectivity requirements for mobile fleet and fixed gear vessels.
- **Fishery management Plan changes related to buoy marking requirements:** Conduct outreach with the public, and engage with the Councils and Commission processes.
- **Mobile gear outreach:** Talk to mobile gear users and discuss feasibility of approach 3 (no cloud option). Identify potential gear conflict hot spots for directed outreach.
- **Acoustic standards will have different milestones:** There is urgency to understand the marine mammal impacts of current gear – this is currently under literature review and field testing.
- **Use information provided by gear manufacturers** and perform a cost analysis of the interoperability standards/methods discussed at the workshop.
- **Areas to prioritize:**
 - Acoustic impact on marine mammals
 - Outreach to mobile gear fleet

Exempted Fishing Permits

Exempted Fishing Permits (EFPs) are issued by NOAA Fisheries. They authorize a fishing vessel to conduct fishing activities that would otherwise be prohibited under the regulations. Generally, EFPs are issued for activities in support of fisheries-related research, and in the case of ropeless fishing gear, they offer an opportunity to test different technology approaches and advance the conversations around on-demand fishing. The group discussed several issues concerning the EFP permitting process and data management and collection.

- **Streamlining the permit process:** Explore ways to make the process more efficient when individuals or groups apply for similar types of permits. For example, if NFWF is planning multiple similar projects, can those be filed under a single process? What could this approach look like?
 - A participant suggested that applicants could connect/partner with consulting parties who work on related aspects around fisheries.
- **Data collection by permit holders:** All applicants for permits should have a robust data collection plan. Researchers should plan to communicate the data they collect in closed areas.
- **Internal data management:** There is a need for federal agencies to plan for downstream data management after an EFP expires, and to consider the need to track on-demand EFP related data going forward. NOAA Fisheries is currently working on improving internal systems that will allow for identifying fishing trips under EFPs associated with on-demand fishing.

Establishing Regulations for Ropeless Fishing

The first two days of the workshop made a clear call for clarity on regulations, and many next steps must be actioned immediately and on a parallel track. Themes discussed included:

- **Buoy requirements:** The group explored potential benefits of examining state and federal regulations for buoy requirements across all types of fisheries.
 - Maine has unique buoy requirements, and participants thought that uniformity between Maine state law and federal law is desirable.
- **Council Priorities:**
 - Current New England Fishery Management Council priorities support the work of the On-Demand Gear Conflict Work Group which was tasked with suggesting what modifications would be required to replace a buoy.
 - It is unclear if this priority supports the initiation of a management action or if the Council will need to establish a new priority for 2025. Notably, the Mid-Atlantic Council does not have similar priorities for its fishery management plans.
 - The group also discussed the importance of collaboration between the Atlantic States Marine Fisheries Commission and the Councils to prioritize any necessary management actions to support on-demand fishing.
- **Involvement of State legislatures:** For regulatory changes in State waters, State legislatures must get involved and take action separate from, but in concert with the Fishery Councils.

-
- **Need for clear definitions:** For making regulatory changes, we must be able to describe what we are replacing buoys with, in terms of gear marking, visualization, and describing the entire on-demand system.
 - **Sharing of on-demand/buoyless gear locations:** what specific data must be shared? Who will it be shared with? What is the process for establishing requirements?
 - **Mobile gear requirements:**
 - The current requirements for mobile gear vessels to avoid fixed gear are likely inadequate. Are new gear conflict avoidance requirements needed? There was a suggestion to look at the MSA’s foreign fishing fleet regulations for gear avoidance. There was another suggestion to create a regulatory definition of negligence with respect to 16 U.S.C. § 1857(1)(K).
 - Under the existing EFPs, mobile fishing vessels do not require any exemptions from regulations and therefore are not required to be included on an EFP. However, as the use of on-demand fishing expands in terms of space and number of units in the water, it may be important to more formally integrate mobile vessels into the design and implementation of research projects requiring an EFP(s) in order to more fully test the technical solutions for data transmission and visualization to address gear conflict issues.
 - It was noted that regulations currently require radar reflectors for gear marking. But the mobile gear is not specifically required to have radar capable of “seeing” the reflectors.
 - There is a need for mobile gear vessels to get involved in the testing on-demand gear visualization. Testing in closed areas was suggested as an appropriate place to start.
 - Need to recruit mobile gear vessels to help design and test on-demand visualization. For this purpose, make sure mobile gear users are part of relevant existing research (and future) projects that require EFPs.
 - **Acoustic impact on marine life:** Do we need to set a requirement (e.g., a frequency range based on impacts to marine mammals or other protected species) as a starting point?
 - **Evaluate how gear testing is implemented:** Currently, gear testing is highly individualized to each vessel, and may not sufficiently explore all implications for a fully operational ropeless fishery.
 - **States could mirror federal regulations.** States may not need to develop an independent process to certify manufacturers. Regulatory uniformity is preferable.
 - **Other considerations and comments:**
 - Reminder that it is easy to disenfranchise people quickly from the process.
 - Begin in federal waters, and then implement on-demand fishing in state waters. Most of the inshore fleet does not want ropeless.

-
- What are the various regulatory pathways towards creating a commercial-scale on-demand fishing regime in U.S. waters? What are the roles of the Councils, Commission, states, and NOAA?

Acoustics and Marine Mammals

- **Urgency to establish allowable acoustic frequencies for marine wildlife:** There is a high level of complexity in measuring and changing reference points for acoustics in the air vs. under water. However, it is important to quantify and evaluate the potential sound budget increases due to implementing on-demand fishing. The group recognized this as an important initial step and to address concerns with impacts to marine mammals and other fauna.
- **Lower risk in approaches 2 and 3:** The group included some biological experts from NOAA Fisheries and the Marine Mammal Commission. There may be concerns about noise pollution with higher frequency marine mammal species, these sounds may be 'loud' in those frequencies, but would have short transmission durations and would attenuate quickly in the marine environment.
- The group thought that acoustic frequencies presented in Approaches 2 and 3 are generally not high risk to marine mammals, but could be more challenging to implement for other reasons.
- **Risk evaluation process:** NOAA Fisheries has modeling tools to evaluate sound impacts across the range of potential taxa at risk that can evaluate risks of sound (masking/behavior disruption, temporary and permanent threshold shifts). Steps to evaluate risk include:
 - Have NOAA Fisheries Office of Protected Resources (OPR) experts evaluate the existing sounds used or proposed by vendors to consider their impact on animals (including the current sounds they already have in production).
 - Ask OPR to give a presentation on how they evaluate such sounds and provide any tools (spreadsheet with risk calculation formula) they have to industry.
 - Develop several scenarios for different scales of on-demand fishing now and into the future.
- **Immediate next steps:** Develop preliminary guidance that can be provided to council and agency workgroups within the next few months.

Final Comments and Closing

Moving forward, it is important to act quickly and begin work on the action items that emerged from small group discussions.

The workshop collected information and viewpoints from individual attendees, but it did not seek agreement or consensus. Each individual attendee is deeply engaged and will continue to work on these issues and next steps in their own capacities. NOAA Fisheries will continue to work with fishermen and other partners to progress the implementation of on-demand fishing.