Seabird Bycatch Reduction Strategies Workshop (virtual)
February 11-12, 2026

Workshop Proceedings and Outcomes Report
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Workshop hosted by:
Bycatch Working Group of the Trilateral Committee for Wildlife & Ecosystem Conservation & Management
and the Atlantic Marine Bird Cooperative

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Table of Contents

EXECUTIVE SUMMARY

On February 11-12, 2026, the Bycatch Working Group of the Trilateral Committee for Wildlife & Ecosystem Conservation & Management and the Atlantic Marine Bird Cooperative, with professional facilitation services provided by Lynne Carbone & Associates, convened a virtual workshop entitled Seabird Bycatch Reduction Strategies. The workshop aimed to compile and share current information on seabird bycatch reduction techniques and interactions with specific commercial fisheries, identify interested parties, and explore potential partnerships to undertake/promote priority seabird bycatch reduction activities in the future.

Over 140 individuals (see Appendix A, p.32) from 14 countries attended the workshop, representing expertise from the fishing industry, agencies, universities, and non-governmental organizations. The workshop focused on seabird interactions with longline, trawl, and gillnet gear. In addition, the workshop highlighted the most effective ways to promote adoption of best bycatch reduction practices using effective outreach strategies and incentives. The workshop concluded with gear-specific breakout sessions where attendees discussed and recommended potential solutions and partners to advance successful implementation and adoption of bycatch reduction practices.

Longline-specific recommendations to reduce seabird bycatch included:

- Expand programs to distribute free bird-scaring lines (BSLs) to fishing vessels.
- Engage with willing individual vessels experiencing high bycatch rates in a respectful manner to efficiently identify voluntary reduction methods and realize large benefits of bycatch reduction.
- Engage in voluntary informal, “bottom-up” discussions (using interpreters when necessary) to provide captains and crews with assistance needed for bycatch-reduction success.
- Use online communication of best practices (e.g., via YouTube videos) to demonstrate practical solutions to fishers.
- Increase electronic monitoring to improve data, accountability, and bycatch reduction efforts.

Trawl-specific recommendations included:

- Make third wires (a large problem for trawls) more visible or relocate them away from seabirds with technologies (e.g., weights or floats) that may be more effective than snatch blocks.
- Increase connections between trawl seabird bycatch reduction efforts in the United States and those of Parties to the Agreement on the Conservation of Albatrosses and Petrels, including Argentina and Chile.
- Explore the feasibility of practices such as BSLs, lighting, and water-based deterrents.
- Devote limited seabird bycatch reduction resources to fisheries that have large incentives to reduce seabird bycatch.

Gillnet-specific recommendations included:

- Develop spatiotemporal bycatch hotspot programs that use environmental and fishery-dependent data to document and/or predict overlap between fishing effort and seabird populations to identify fishing areas with low risk of seabird bycatch.
- Investigate the feasibility of gillnet effort reduction programs where applicable and locally supported, including license buyouts or retirements.
- Continue to research the potential for visual or auditory deterrents (within established visible and auditory ranges of birds) to reduce bycatch.
- Refine best practices for offal and discard management.

Additional, **universally applicable recommendations** included:

- Involve fishers in project design from the start of research and testing.
- Conduct region-specific research that is adaptive and flexible, because reduction practice efficacy can vary widely by region and fishery.
- Where possible, identify solutions that apply not only to seabirds but also to other taxa such as sea turtles and marine mammals, and collaborate across taxonomic expertise.
- Better address the human component of seabird bycatch reduction.

BACKGROUND, WORKSHOP OBJECTIVES, AND OVERVIEW

On February 11-12, 2026, the Bycatch Working Group of the Trilateral Committee for Wildlife & Ecosystem Conservation & Management (TBWG) and the Atlantic Marine Bird Cooperative (AMBC), with professional facilitation services provided by Lynne Carbone & Associates, convened a virtual workshop entitled Seabird Bycatch Reduction Strategies. The TWBG is co-chaired by government resource managers and scientists from Canada, the United States, and Mexico; these managers and scientists collaborate with partners from non-governmental organizations (NGOs), academia, and other entities to advance actions related to reducing the incidental take (bycatch) of seabirds in commercial fisheries. The AMBC, an open and collaborative forum for people with expertise and interest in Northwest Atlantic marine birds, works to better understand marine bird bycatch, identify conservation and management needs, and develop collaborative actions to address these needs.

The TBWG and AMBC designed this two half-day workshop to bring together experts, practitioners, partners, and other interested participants from the commercial fishing, conservation, and research communities across Canada, Mexico, the United States, and beyond to advance shared knowledge and coordinated action on seabird bycatch reduction. (See Appendix A for a full list of workshop participants and their roles.)

Workshop objectives:

1. Identify the current state of knowledge for seabird bycatch reduction techniques and where they have been used for three commercial fishery gear types (gillnet, longline, trawl) with known interactions with seabirds.
2. Share information from existing published sources, stakeholders, and rightsholders to support the development of a Best Management Practices (BMP) Inventory.
3. Obtain input on what is needed to make bycatch reduction techniques beneficial and adoptable.
4. Identify interested parties and explore potential partnerships that benefit shared species to undertake/promote priority seabird bycatch reduction activities in the future.
5. Identify knowledge gaps for seabird bycatch reduction techniques that can inform future fundable projects.

Desired outcomes:

1. Expanded attendee knowledge and awareness of seabird bycatch techniques by gear type, including existing best practices.
2. Better understanding of what is needed to achieve adoption of bycatch reduction techniques.
3. Exploration of opportunities for partnerships and potential projects.

Over 140 individuals (see Appendix A) from at least nine countries attended the workshop, representing collective expertise from the fishing industry, agencies, universities, and non-governmental organizations (NGOs). The workshop agenda (Appendix B) focused on seabird interactions with three focal gear types: longline, trawl, and gillnet.

Day One: Following a series of gear-specific presentations to provide an overview of the state of knowledge of gear types and interactions, a moderated panel discussion allowed for a more in-

depth discussion of seabird interaction challenges related to each gear type. Day one concluded with attendees sharing their most valuable highlights or insights shared from the day.

Day Two: The day began with a presentation and panel discussion focusing on bycatch reduction promotion mechanisms, specifically, the most effective ways to promote adoption of best bycatch reduction practices using effective outreach strategies and incentives. Following that discussion, workshop attendees split up into separate, concurrent breakout sessions on longline, trawl, and gillnet gear. Workshop organizers encouraged breakout session participants to discuss and recommend potential solutions, partners, and fundable projects to advance successful implementation and increase adoption of seabird bycatch reduction activities. Following the breakout sessions, all participants gathered again as a full group to share the recommended strategies, actions, and potential partnerships and potential funding opportunities and projects discussed during their sessions. The following sections of this report discuss workshop sessions in greater detail.

DAY ONE PROCEEDINGS (February 11, 2026)

Workshop Introduction

After introductions of the workshop Planning Committee, workshop facilitators, moderators, and translators, the facilitators asked participants to identify the region where they primarily work. Respondents worked in most marine regions of Canada, Mexico, and the United States (see Figure 1). Some participants worked outside of these marine regions and were not represented in the poll.

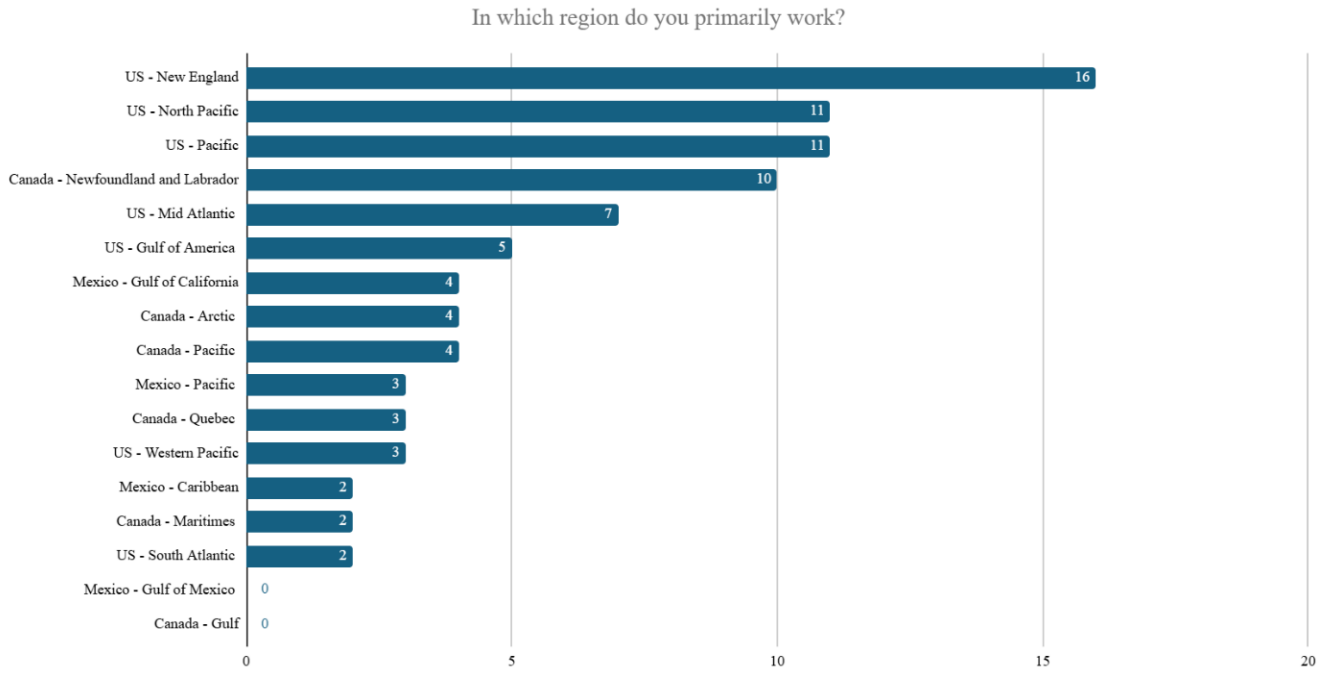

Figure 1. Primary work locations for workshop attendees identified during day one. Note: regions outside North America were not listed as options for respondents.

The facilitators then reviewed the results from their pre-workshop survey that included feedback from 83 respondents, the majority of whom hailed from governmental (45%), academic (22%), non-governmental (18%), and commercial fishing (10%) sectors. Pre-workshop survey respondents identified themselves as being from the United States (57%), Canada (25%), and Mexico (10%). Pre-workshop survey responses reflected nine themes of interest or suggested focus:

1. **Gaps in data and monitoring:**
    a. Limited observer coverage and inconsistent reporting.
    b. Lack of standardized monitoring and analytical tools.
    c. Insufficient data to assess the magnitude of seabird bycatch and effectiveness of proposed solutions.
2. **Desire for practical bycatch reduction:**

    a. Strong demand for proven, gear-specific solutions, especially with respect to gillnets.
    b. Need for regionally tailored, operationally feasible tools.
3. **Collaboration is essential:**
    a. Critical need for cooperation among fishers, scientists, managers, non-governmental organizations, and rightsholders.
    b. Desire for ongoing knowledge exchange and collaborative development of bycatch reduction efforts.
4. **Gaps related to communication and awareness:**
    a. Limited awareness of seabird bycatch challenges among fishers, public, and decision-makers.
    b. Need for better outreach, training, and education.
5. **Barriers related to economics and culture:**
    a. Concerns about cost, effort, and operational disruption of fisheries.
    b. Importance of fisher buy-in and incentives.
6. **Challenges for policymaking and enforcement:**
    a. Fragmented regulations and limited political urgency.
    b. Inconsistent requirements and enforcement.
7. **Limitations in funding:**
    a. Insufficient funding for monitoring, research, and innovation.
    b. Need for long-term support and capacity-building.
8. **Value of shared best-practice resources:**
    a. Interest in curated, accessible BMP repositories.
    b. Desire for shared understanding of global efforts (e.g., seabird bycatch measures promoted by the Agreement for the Conservation of Albatrosses and Petrels, or ACAP).
9. **Recognition of seabird bycatch as a dynamic systems problem:**
    a. Bycatch is driven by ecological dynamics, environmental change, gear characteristics, cultural and economic factors, policy, and seabird behavior.
    b. Effective solutions require integrated approaches that combine science, technology, policy, economics, trust-building, and on-the-water experience.

Longline Seabird Bycatch Overview

Overview Presentation

A workshop Planning Committee member presented an overview of seabird bycatch challenges related to longline fishing gear. (See Appendix C for the presentation slides.) Longlines, which consist of a main line with many kilometers of baited hooks hanging from branch lines, mostly attract birds through baited hooks and offal discharge during gear setting and hauling. Pelagic longlines float near the surface or in mid-water, and demersal longlines are set near the seabed.

Anderson et al. (2011) estimated that longline gear has killed at least 160,000 seabirds per year, mostly affecting albatrosses, petrels, and shearwaters. Brothers et al. (2010) have noted that seabird bycatch in pelagic longline fisheries has been grossly underreported.

The most widely recommended and implemented seabird bycatch reduction measures include bird-scaring lines (BSLs), weighted branch lines, and night-setting, used simultaneously when

possible. Other widely recommended and implemented longline measures include hook-shielding devices and management of offal and discards. In all cases, the intent is to reduce exposure of the baited hook to foraging seabirds. Recommended measures for monitoring and managing this fishery include mandatory observer coverage or electronic monitoring, observer training in seabird identification, and use of seabird safe-release practices for entangled seabirds.

Other measures used in a more limited setting for specific longline fisheries include side-setting, blue-dyed bait, underwater setting chutes, bird exclusion devices, line shooters, and spatiotemporal fishing restrictions. Some researchers and regional fishery management organizations (RFMOs) have concluded that other proposed bycatch reduction measures are unproven or not recommended, including smaller-sized hooks, olfactory deterrents, line setters, bait-casting machines, lasers, and weighted fishing hooks.

The workshop Planning Committee member also presented the results of Bell et al. (2025) as a case study. Bell et al. evaluated the effectiveness of seabird bycatch reduction measures for pelagic longlines in the South Atlantic. They concluded that if the International Commission for the Conservation of Atlantic Tunas (ICCAT) updated its bycatch reduction requirements to align with ACAP BMPs, seabird mortality in ICCAT fisheries would be reduced by up to 72-93% if all three ACAP recommended BMPs (BSLs, weighted branch lines, and night-setting) were used simultaneously.

The longline bycatch overview presentation suggested some **future directions**, including:

- Standardizing bycatch reduction measures across RFMOs.
- Enhancing bycatch monitoring, especially monitoring of cryptic (unobserved) mortality.
- Improving identification of bycaught seabirds.
- Expanding risk-based models such as the model used by Bell et al. (2025) to additional regions and species.
- Promoting industry engagement and capacity building.

The presentation concluded by sharing a matrix of widely recommended longline bycatch reduction measures arranged in a grid format that compared levels of cost and effort assumed for each measure. For example, the presentation suggested that hook-shielding devices would be costly but were predicted to produce a high level of bycatch reduction, while thawed bait would have a relatively low cost but also a correspondingly small impact on reducing bycatch levels.

Questions, answers, and discussion

Workshop participants shared additional resources related to seabird interactions with longline gear (including Melvin et al. 2019 and a Washington Sea Grant website[1]), as well as the following questions and thoughts during and after the longline presentation:

- Whether bycatch trends for longline vessels accounted for changes in catch per unit effort (CPUE), due to varying number of vessels in fleets over time and the fact that one vessel in a fleet might catch hundreds of birds while other vessels might have little bycatch.
- The importance of specifying units of effort when making comparisons of bycatch rates; such standardization may be more straightforward for longline gear (e.g., catch per set

[1] https://wsg.washington.edu/seabird-bycatch/longlines/

hook), whereas there is no easy or recognized standardization of effort for trawl or gillnet gear.

- Whether longline bycatch reduction practices are generally being adopted by fishermen (more likely when fishermen are involved in the testing of bycatch reduction practices, although Bell et al. [2025] found low uptake by fishermen overall for longline fisheries in the South Atlantic Ocean).
- On the topic of whether electronic monitoring (EM) is being used to document seabird bycatch events, participants shared that the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NOAA Fisheries) has conducted significant EM research for Alaska fisheries, and that the Hawaii longline fishery is implementing EM to focus on hauls in order to document seabirds entangled during gear retrieval, similar to how seabird bycatch data have been collected by human observers.
- A perceived lack of transparency regarding data used for scientific publications, which can contribute to distrust of bycatch reduction research by the fishing industry; this distrust could be reduced if researchers establish data agreements with their industry research partners when a research project begins.
- Potential confidentiality concerns that can arise from cooperative research with industry partners, as well as concerns regarding inconsistencies between the use of research results by managers and what industry partners expected, based on how the research was conducted.
- A workshop participant who fishes out of Newfoundland shared that the region is experiencing a resurgence in Atlantic cod (*Gadus morhua*) populations, which could lead to increased gillnet fishing effort and a related impact to seabird bycatch levels in the region.
- "Autoline" gear, highly automated longlines consisting of a single line with baited hooks attached at regular intervals, may contribute to relatively high levels of seabird bycatch for the fleets in the Northeast Atlantic (e.g., vessels from Norway, Iceland, and the Faroe Islands); Robertson (2000) and Robertson et al. (2006) have examined line weighting options with autoline gear, and ACAP has published a fact sheet describing best practices related to autoline gear.[2]
- An effort in New Zealand to assess bycatch risks by combining spatial overlap between fishing effort and seabirds, interaction parameters derived from observer data, and population dynamics information (see Abraham et al. 2019).

Trawl Seabird Bycatch Overview

Overview Presentation

A workshop Planning Committee member presented an overview of seabird bycatch challenges related to trawl fishing gear. (See Appendix D for the presentation slides.) The presentation described the difference between bottom trawls (which target fish on or near the ocean seafloor) and midwater/pelagic trawls (which target fish swimming in the water column). The presentation also described trawl gear components that interact with seabirds, including the trawl warp cable

[2] See Fact-Sheet 3, which can be found on the following webpage: https://www.acap.aq/resources/bycatch-mitigation/mitigation-fact-sheets

(used to guide the trawl net) and "third wire" (used for electronic monitoring of gear performance and protected species captures). Seabirds can strike these cables and wires in the air and/or in the water. Strikes can be either light (e.g., the seabird glances off the cable but flies away) or hard (e.g., the seabird flies into the cable, is injured and falls into the water or is partially dragged under the water).

The presentation described how fish offal and processing waste discharge can attract seabirds, and how fishing vessels can treat offal and waste (including mincing it) to make it less attractive. The presentation also described measures including batching releases of discharge outside of fishing activity and holding waste to reduce bird attraction. Trawl nets also pose entanglement risk when seabirds attempt to extract fish or swim into the mouth of a trawl net as it is being hauled onboard. Large-bodied, surface-foraging seabirds, including Laysan (*Phoebastria immutabilis*), Black-Footed (*Phoebastria nigripes*), and Short-Tailed Albatross (*Phoebastria albatrus*) in the Pacific, and Great Shearwater (*Puffinus gravis*) in the Atlantic, are birds of concern that could be impacted by bycatch in the trawl fishery, among others.

Best management practices related to seabird interactions with trawl gear include:

- Management of offal and discards, including retention, mealing, batching, or mincing of discards and offal.
- Warp cable strike reduction using bird scaring lines, or BSLs.
- Third-wire cable strike reduction using wireless monitoring systems, BSLs, or "snatch blocks" (a pulley used to change the direction of a line or cable).
- Practices to reduce net entanglement, including cleaning nets after every haul.
- Avoidance of peak areas and periods of seabird foraging activity, including near seabird breeding colonies.

Additional techniques include:

- Minimizing vessel lighting, consistent with safety requirements.
- Use of warp deflectors (i.e., a buoy clipped to each of the warp cables and designed to hang at the warp-water interface to deflect birds away from the danger area).
- Bird bafflers (i.e., two or more booms attached to the stern quarter of the vessel with "dropper lines" affixed to the booms with attached plastic cones).

The presentation highlighted results of a 2017 NOAA Fisheries workshop on seabird cable strike reduction (Jannot et al. 2018), which recommended a variety of bycatch reduction measures including water deterrents and colored or lighted third-wire cables. In addition, the following findings by Gladics et al. 2021[3], originally presented during the West Coast Whiting Trawl Seabird Cable Strike Meeting were revisited:

- Water deterrents dissuaded interactions from net warps, but not the third wire unless the third wire was heavily modified.
- Warp booms, a boom with streamers extending to the water forward of the stern to divert birds feeding on offal away from the warps, did little to reduce third-wire cable strikes.
- BSLs showed promise for bycatch reduction during trawl towing.

[3] The Gladics et al. presentation is available online here: https://media.fisheries.noaa.gov/2021-12/Gladics_CableStrikeWorkshopII_20211210.pdf

- The use of snatch blocks was challenging in deep water and may not be practical in that habitat.

Gladics et al. 2021 also suggested that vessels should focus on third-wire interactions during setting, as well as efforts to (1) manage offal via a pause in discharge during setting or offal retention and (2) decrease the third-wire aerial extent through additional snatch block designs.

The trawl overview presentation described several **current challenges to seabird bycatch reduction in trawl gear**, including:

- Offal batching (storage onboard prior to release when not actively fishing) may require major changes to infrastructure for some vessels.
- Bycatch risk varies by fleet, region, operational practice, species, and environmental conditions.
- Fishers may resist bycatch reduction efforts due to perceived reductions in fishing efficiency.
- Regulatory requirements can be inconsistent across regions and RFMOs.
- Where bycatch reduction is not mandatory, vessels have little incentive to implement measures.
- Enforcement and compliance can be a challenge in fleets with limited monitoring.
- A more effective towed object deployed in conjunction with BSLs could improve the bycatch reduction benefits of BSLs.

The presentation also mentioned some **promising directions**, including:

- Refining existing technologies rather than developing new tools.
- Tailoring bycatch reduction practices to individual fleets through fishery risk assessments.
- Collaborating with fishers to ensure ease of use and operational compatibility for bycatch reduction measures.

The presentation concluded by depicting a hierarchy of trawl bycatch reduction measures that fell under four general categories: offal management, third wire interactions, warp cable interactions, and net entanglement interactions.

Questions, answers, and discussion

Workshop participants shared the following questions and thoughts during and after the trawl presentation:

- In response to a question asking whether the workshop described in Jannot et al. 2018 was limited to interactions with fishing gear or whether it also encompassed secondary interactions including seabirds encountering fish oil associated with fish processing at sea, the presenter replied that the workshop focused only on trawl cable strikes.
- **When during trawl operations do seabird strikes mostly occur** (i.e., during the hauling of gear, or at other times):
    - Many trawl studies only examine interaction rates during towing of gear, but there can be higher rates of hard strikes by seabirds during trawl gear setting compared to towing and hauling.

    - In a Pacific hake fishery, Black-Footed Albatross interactions with the third wire were significantly higher during offal discharge than during trawl gear towing or haulback.
- Why a more effective **towed object** may be needed for BSLs:
    - BSLs require drag to increase the areal extent of the BSLs and that BSLs should track as closely as possible above the cable without entangling the cable.
    - Vessels commonly use buoys to achieve this effect, but buoys can migrate across the surface away from the cable that needs to be protected by BSLs.
- How does **trawl gear compare to other gear types** in terms of seabird mortality:
    - Such a ranking depends on many factors and is regionally dependent, but globally, trawl and longline fishing rank close to each other in terms of highest numbers of seabird bycatch.
    - Gillnet gear can affect a higher number of species, as opposed to individuals, than trawl and longline gear. (Zydelis et al. 2013 and Pon et al. 2023 discuss otter trawl seabird interaction rates, with Zydelis et al comparing those rates to rates for other gear types in eastern Canada.).
- Oceanwide match-mismatch analyses involving examination of bird distribution and fishing patterns, seasons, bird age, and other factors have helped reveal why certain boats or fleets encounter many birds and others do not and can also reveal "hotspots" and "cold spots" for these interactions.
- Another effort[4] has attempted to develop hotspot/cold spot analyses for seabird bycatch for vessels fishing in the Humboldt Current off South America, though integrating data from artisanal and small-scale fishery data into the overall dataset has been difficult.
- New Zealand and some partner organizations have collaborated to create a "seabird safe fishing toolkit"[5] to help pelagic longline vessels estimate risk for fishing in different areas.
- There has been resistance to certain trawl bycatch reduction measures including snatch blocks and BSLs due to crew safety concerns, especially on vessels that operate in rough seas such as the Drake Passage below South America, although researchers affiliated with organizations including BirdLife International and Ave Argentinas have studied these issues extensively for South American fisheries.
- Monitoring cryptic mortality, which can exceed observed mortality by orders of magnitude, on trawl vessels is a challenge, especially if human observers or EM systems are not positioned to monitor seabird collisions with wires and cables.

[4] For more information on this effort, see https://www.seabirdtracking.org/humboldt-current-seabird-tracking-data-call-for-fisheries-bycatch-risk-assessment/

[5] For more information on this effort, see https://doc.govt.nz/about-us/international-agreements/species/seabird-safe-fishing-toolkit/

Gillnet Seabird Bycatch Overview

Overview Presentation
A workshop Planning Committee member, as well as a researcher from Memorial University (Newfoundland, Canada) who is currently conducting a gillnet bycatch reduction trial, presented an overview of seabird bycatch challenges related to gillnet fishing gear. (See Appendix E for the presentation slides) The presentation described the varieties of gillnet gear (i.e., stationary/"set" and drift gillnets; bottom-, midwater-, and surface-set; passive; and baited in some fisheries). Gillnets are used in small artisanal fisheries as well as by large commercial fleets. Gillnets interact primarily with diving seabirds such as alcids, shearwaters, loons, cormorants, gannets, and sea ducks, with estimated mortality of over 400,000 individuals per year (Zydelis et al. 2013).

A 2016 review of seabird bycatch solutions found that there were no universally effective seabird bycatch reduction measures for gillnet fisheries (Wiedenfeld 2016). However, several reduction measures have been or are currently being used with mixed success, often depending on fishery.

Current gillnet bycatch reduction measures:

- Reducing gillnet soak times.
- Avoiding fishing during times of day and locations when/where there is a high risk for seabird interactions.
- Setting gillnets at depths that are inaccessible to diving seabirds.
- Implementing time and area closures, as well as gillnet gear "buyouts".
- Utilizing visual deterrents including "scarybird" kites and "looming eye" buoys to keep birds away from fishing operations.
- Modifying gillnets with colored or high-contrast panels, light-emitting diode lights, and/or acoustic "pingers" to increase visibility to seabirds, helping them be avoided.
- Managing discards and offal on fishing boats so they do not attract birds.
- Avoiding direct baiting of gillnets as they are deployed so birds are not attracted to fishing gear.
- Attending or checking gillnets regularly for interactions with birds.
- Using alternative gear types that have lower bird bycatch rates to catch the same target fish species.

Challenges to implementation of bycatch reduction measures in gillnet fisheries:

- No universally effective reduction measures exist due to variability across gillnet fishing practices, fishing locations, and associated species.
- Economic or operational concerns, especially regarding costs associated with gear modifications, impede adoption of measures.
- Cultural and trust barriers, including resistance to externally imposed measures.
- Monitoring and data constraints, specifically low observer coverage and underreporting of bycatch where self-reporting requirements exist.
- Lack of motivation for implementation of reduction measures due to a lack of perceived benefit for fishers, inconsistent regulations, and insufficient or inconsistent enforcement of regulations.

Future directions for addressing gillnet bycatch challenges:

- Use of risk assessment and adaptive management techniques.
- Collaboration among fishers, fishing organizations, indigenous rightsholders, researchers, and managers to identify, test, and refine new practices.
- Promotion of bycatch reduction technique adoption via education, outreach, and incentives.

Gillnet bycatch reduction case study

The gillnet presentation included a case study of a project working with inshore Newfoundland (Canada) fisheries. (This project, entitled Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries, has been funded by the U.S. Natural Resources Damage Assessment's *Deepwater Horizon* Open Ocean Trustees.) Activities presented as part of this case study included: (1) reducing deep-set gillnet soak duration in the Atlantic herring (*Clupea harengus*) bait fishery and Atlantic cod commercial fishery and (2) utilizing scarybird kites in Atlantic herring and Atlantic cod bottom gillnet and longline fisheries. The project is still in progress; however, the following preliminary (fishery-specific) recommendations were presented for minimizing seabird bycatch in gillnets while maintaining target catch:

- *Atlantic herring bait fishery:* Soak gillnets for no more than 24 hours (as opposed to the standard 24–48-hour soak) and haul gillnets in the morning (Collins et al. 2025).
- *Atlantic cod commercial fishery:* Set gear (gillnets and baited longlines) before sunrise; however, bycatch can still occur during the soak and when birds congregate near the vessel as fish are gutted onboard.
- *Atlantic herring and cod bottom gillnet and longline fisheries:* Preliminary data indicate that use of "scarybird kites" provide some seabird deterrence during fishing operations, with little or no effect on catch rate. Further testing of the reduction measure is underway, including use of a "falcon silhouette" kite that has been effective in European studies (Almeida et al. 2023, Frade et al. 2025).

The presentation concluded by sharing a matrix of promising gillnet bycatch reduction measures arranged in a grid format that compared levels of cost and effort assumed for each measure. For example, the presentation suggested that gear buyouts and time/area closures would be costly but were predicted to produce the highest reduction in bycatch, while maintaining tension in gillnets would have a low cost but also a relatively small impact on bycatch levels.

Questions, answers and discussion

Workshop participants shared the following questions and thoughts during and after the gillnet presentation (including questions related to the gillnet case study, results of which are published in Collins et al. 2025):

- Correlations between **soak times and seabird interactions** for different types of gillnets:
    - Sink gillnets used off Cape Cod do not seem to experience many interactions while the nets are soaking on the seabed due to the set depth of the gillnets.
    - There was a higher likelihood of catching seabirds as fishing duration increased in Alaska salmon surface gillnet fisheries, both drift (unanchored nets set from a boat offshore) and set gillnets (set from shore or anchored to the seafloor) (Dietrich et al. 2025).

    - The correlation found between longer soak times and seabird interactions in Collins et al. 2025 applied mostly to surface set gillnets deployed in the Atlantic herring bait fishery, where the nets are fixed six to eight feet below the sea surface and are accessible to diving birds–which are attracted to fish caught in the net–throughout the soak duration.
- **Maximum diving depths** for alcids such as murres, auklets, and puffins:
    - Diving depths are mostly 10-50 meters.
    - Some birds can dive more than 100 meters deep, e.g., murres (*Uria* spp.) are able to dive to 180 meters, puffins to 120 meters, and smaller alcids such as the Black guillemot (*Cepphus grille*) to about 50 meters.
- **Pinger** frequencies and efficacy:
    - Pingers used to repel seabirds from gillnets in bycatch research trials emit sound at a frequency of 1-2 kilohertz (kHz) (see Melvin et al. 1999), while marine mammal pingers emit sound at a frequency of 50-120 kHz.
    - Inconsistent study results can occur when different frequency pingers are used, e.g., Dietrich et al. 2025 found an increase in seabird bycatch in some Alaska salmon gillnet fisheries where higher frequency pingers were used to deter marine mammals, whereas Melvin et al. 1999 found a decrease in murre bycatch (but not for auklets) when lower-frequency pingers were used specifically to test for influences on seabird bycatch.
    - Efficacy of pinger use may depend on the ability of diving birds to hear and be deterred by the frequency at which they broadcast sound, with a workshop attendee mentioning a study that focused on underwater hearing in sea ducks in relation to potential gillnet bycatch reduction strategies using acoustic deterrence (McGrew et al. 2022).
- On longline vessels, acoustic deterrents appear to become less effective over time due to acclimatization; in addition, in the open ocean, the acoustic deterrent noise can often be obscured by other sounds (e.g., waves) in the marine soundscape.

Fishing Gear Overviews - Panel Discussion

The first day of the workshop concluded with a panel discussion involving presenters from the preceding three gear-specific overview sessions. Workshop participants shared thoughts and questions on a variety of topics, including:

- The feasibility of incentivizing the use of cod pots around seabird colonies and foraging hotspots, which could yield higher-value fish and reduce seabird interactions; a successful community-led initiative using this approach has been implemented on Newfoundland's Northeast coast.
- Whether behavior-change strategies, alternative livelihoods, eco-certification, or economic incentives have been incorporated into best management practices for small-scale tropical fisheries to reduce bycatch.
- Efforts by Chilean researchers and fishermen (associated with ACAP), as well as interest from researchers in Mexico, to refine new trawl and purse seine bycatch reduction approaches for Humboldt Current trawl and purse seine fisheries; these approaches include crew member best practices for safe rescue and handling of fish-oiled seabirds.

- The importance of developing bycatch reduction approaches that are effective across taxa, as well as approaches that do not impact fishery target catch, recognizing that there is a narrow space in which to develop effective tools across taxa.
- Concern that elimination of offal discards in certain fisheries have actually increased net interactions, and whether BSLs could be effective for trawl fisheries like the South African trawl fishery, which has not been able to effectively reduce seabird interactions.
- Especially helpful seabird bycatch overview resources include Melvin et al. 2023, which provides an overview of seabird bycatch reduction practices for four different gear types, and Vargas et al. 2026, which provides a global review of bycatch reduction technology assessments.

The panel discussion, and the first day of the workshop, concluded with participants sharing reflections on what they had learned so far during the workshop, including:

- The importance of including fishers in these types of workshops for a more collaborative and well-rounded experience, as well as to receive real-life feedback about how fishing activities are conducted and what practical obstacles on fishing vessels affect seabird risk.
- The need to explore the human dimension of bycatch reduction and the potential for effective financial incentives for seabird bycatch reduction.
- The critical need for scientists to meet with fishers and ask them about their challenges prior to deciding on research priorities, which can lead to better consensus; demystify the research process; improve communication between fishers and researchers; and help guide the management process.
- A general emphasis on a diversity of collaborative research partners, cross-sector collaboration, and tailored solutions that are responsive to fishery diversity.

DAY TWO PROCEEDINGS (February 12, 2026)

Recap of Day One Discussions

Day two of the workshop began with a summary of the discussion highlights from day one of the workshop, including the following **key messages from the gear-specific presentations**:

- Longline fisheries have many proven and established bycatch reduction practices, but major challenges remain in bycatch data collection and standardization, as well as in achievement of widespread adoption of reduction practices. Electronic monitoring is emerging as a scalable bycatch monitoring solution. However, increasing trust and collaboration with industry is essential to expanding adoption of reduction measures. Future changes in fisheries effort may shift risk profiles (e.g., recovery of target fishery stocks may lead to increased fishing effort and increased bycatch).
- Trawl fisheries bycatch of seabirds is complex and variable. New research shows mortality largely occurs during other parts of the fishing process besides towing and hauling, especially during setting and offal discharge. There is growing interest in spatial risk/hotspot modeling, but significant data gaps remain, especially for small-scale fleets.
- Gillnet fisheries remain a major risk to seabirds globally. Risk depends heavily on gear configuration (which varies by region and target species) and bird diving behavior (which varies among species). Studies have shown the effectiveness of visual deterrents such as

colored gillnet twine (Melvin et al. 1999) and bird-shaped kites attached to gillnets (Almeida et al. 2023) in reducing seabird interactions. Awareness and adoption of visual deterrents and other bycatch reduction mechanisms remain limited for gillnets.

Key messages from day one discussions included:

- Though promising, effective use of acoustic deterrents has been challenging and can lose effectiveness over time. More research on efficacy using specific frequencies within ideal bird hearing range is needed.
- Effective bycatch reduction should include a focus on human dimensions, including behavior-change strategies, eco-certification, and economic incentives.
- Research coordination is needed across taxa that interact with commercial fisheries (e.g., seabirds, marine mammals, and sea turtles), because reduction practices for one taxon can affect another. An ultimate goal should be multi-taxa bycatch solutions without a reduction of target catch.

Bycatch Reduction Promotion Mechanisms Panel, Presentation and Discussion

Overview Presentation and Panel

A panel of commercial fishermen; researchers (Coonamesset Farm Foundation, or CFF); and fishing industry representatives (Cape Cod Commercial Fisherman's Alliance, or CCCFA) presented results of a bycatch reduction trial in a baited Cape Cod-based gillnet fishery targeting dogfish (see Appendix F). In addition to presenting project methods and results, the panel discussed related outreach efforts to expand promising reduction practices to more fishermen. In this fishery, bait is tossed directly on gillnets while they are being deployed to increase dogfish catch rates, because access to fishing areas is limited by tidal cycles. This practice has historically led to extensive, but episodic, bycatch of some seabird species. The project developed by the panelists compared three baiting techniques:

1. Forward-baiting, i.e., placing bait along the side of the vessel during setting instead of directly in nets.
2. After-baiting, i.e., setting nets and then deploying bait over the location of the set after the net has settled.
3. End-baiting, i.e., releasing bait downtide from the stationary vessel after the nets are set.

The panelists compared these techniques to determine whether changes in location and timing of baiting would maintain or increase target catch efficiency while minimizing seabird bycatch. The panelists identified after-baiting, which increased dogfish catch rates over other methods and did not catch any seabirds during two years of testing, as the most promising approach. The panelists then described methods they were employing to promote and expand use more widely in the fishery.

The panel described steps in their general bycatch reduction project workflow:

1. Project conceptualization and proposal.
2. Consultation with, and input from, fishermen.
3. Discussion with relevant management agencies (e.g., the U.S. Fish and Wildlife Service).
4. Gear and vessel preparations.
5. Year-one trials.

6. Preliminary analysis and results.
7. Initial outreach.
8. Year-two trials.

The panelists also described an outreach plan they developed for the project, which includes outreach to the:

- Local fishing community, using newsletters and texts, polls, and industry presentations, which inspired two additional fishermen to join the research effort for year-two sea trials.
- Fishing community beyond Cape Cod via partner networks.
- Broader public via public presentations and social media including an interview and web story on a local National Public Radio station.

Current outreach efforts focus on promoting and increasing adoption of promising bycatch reduction strategies. Panelists identified potential barriers to wider-spread adoption. In addition, they identified potential solutions, including:

- Decrease difficulties in adopting new fishing methods and gear by involving fishermen in project design from the start.
- Demonstrate that new methods are viable and profitable by conducting at-sea trials with participating fishermen and identifying fishermen willing to serve as "early adopters" and promoters of new methods, which can increase confidence in these methods among fishing community members.
- Minimize the cost of new gear by ensuring that no specialized gear is required.
- Lower the risk of decreased target catch by conducting at-sea trials showing an overall increase in catch.
- Minimize the burden of additional fishing time due to use of new methods by demonstrating that a simple baiting change will not add a significant amount of time or complication to fishing operations.

Two commercial fishermen who participated in the workshop panel shared that it has been an easy decision to adopt after-baiting because trials they directly undertook showed them that the approach was effective in reducing seabird interactions with their vessels while maintaining target fish catch rates. Fishermen have an incentive to avoid seabirds in their operations because removing birds from their nets takes time away from fishing and can be a logistical challenge. Additionally, most fishers just don't want to harm seabirds and are willing to take voluntary steps to avoid it, such as changing baiting practices and keeping their decks clean of offal. The fishermen also expressed an interest in "getting ahead" of regulations before regulations could be imposed on them. They mentioned that due to the rigid (one-size-fits all), sweeping nature of regulations, even fishermen wishing to comply can experience accidental violations, causing problems for their operation.

Questions, answers and discussion

A workshop participant asked whether researchers on the project quantified rates of seabird interactions with their vessels during the trial study, and if so, what was the protocol. A panelist from CFF replied that the research team is still analyzing seabird interaction data using video and still imagery from cameras placed on the boats. The researcher shared that consistent annotation

of seabird interactions is challenging because the camera fields of view in the study varied from vessel to vessel.

Another workshop participant asked the fishermen on the panel how extensively the change to after-baiting is spreading through the fleet. The fishers responded that their fleet is small, so news of the trial results showing that catch numbers increased with after-baiting has spread around much of the fleet, facilitated by outreach activities by CCCFA. Although the fishery is competitive, its fishermen communicate a lot, even sharing productive fishing locations. Collaboration rather than competition in the fleet is supported by the large market demand for their target catch and relatively high catch allocation.

A workshop participant asked how new bycatch reduction strategies could most effectively be promoted within the fishing community without a regulatory body to disseminate the information. One of the fishermen suggested that it would be helpful to work with local fishing organizations, like the sector managers who help administer Northeast U.S. groundfish fisheries. A panelist and industry organization project partner at CCCFA also suggested that approaching research institutions that are known to conduct high-quality cooperative research with fishermen could be an effective practice. Another CCCFA partner added that even if there is no established fishing industry organization in the area, bycatch reduction practices can still be promoted by building relationships with fishermen at the dock, and by informally discussing bycatch reduction strategies when the fishermen are offloading their catch in the evening. There is no substitute for directly establishing relationships and trust.

Another workshop participant asked whether bird density around fishing vessels relates to the number of vessels in the area and whether overall efficacy of reduction practices could be affected by those vessels that are not employing bycatch reduction methods. One of the fishers responded that seabirds are smart and are going to go where the bait is. For example, if five boats are fishing, seabirds may be divided evenly among the five boats, but the birds may migrate to particular boats based on how the boats are handling their bait.

The same workshop participant added that when fishers participate in bycatch reduction projects, they need to work with researchers who communicate well with them. Without good communication, a project can fail. Researchers should not be inflexible regarding project design or goals. Rather, they should actively solicit feedback and insights from fishing industry partners. One fisherman panelist agreed, stating that research projects can be more compelling if they focused on practical problems that the fishermen help solve, rather than more abstract proofs of concept that fishermen do not have input in.

Gear Breakout Group Summaries and Recommended Strategies by Gear Type

Workshop attendees separated into three facilitated virtual breakout groups by gear type (longline, trawl, and gillnet) to discuss ideas for advancing implementation and increased adoption of seabird bycatch reduction activities. Workshop facilitators asked participants in each group to focus on identifying specific actions, potential partnerships, and locations where actions could be implemented.

Longline Breakout Group

Longline breakout group participants recommended region-specific seabird bycatch reduction efforts that should be pursued by potential partners. In addition, the participants recommended bycatch reduction efforts that could apply to multiple regions. The participants also recommended general strategies for increasing feasibility and adoption of seabird bycatch reduction measures in longline fisheries.

Region-specific bycatch reduction measures included the following:

- Due to its low cost and effectiveness, encourage expanded use of branch line weighting in the Gulf of California via hosting of participatory workshops with industry members.
    - Potential partners: Governments, NGOs, and large companies that work with fishing communities.
- Obtain funding to promote and provide free bird-scaring lines (BSLs) to U.S. West Coast longline fishermen, including former gillnet fishermen.
    - Potential partners: Regional fishery management councils, non-governmental organizations (NGOs), federal and state agencies.
- Test a combination of BSLs, night-setting, and line-weighting in Eastern Canada groundfisheries via pilot trials designed with fishermen during brainstorming sessions.
    - Potential partners: Demersal longline fishery cooperatives and local harvester groups and NGOs, with government and academic partners to help design and implement the trials.
- Test efficacy and feasibility of night-setting in Northern hemisphere fisheries (as opposed to Southern hemisphere fisheries that have been the focus of ACAP best practice guidance) to better understand impacts of location and fishery operations to efficacy of this method and ultimately promote adoption of these practices.
    - (Potential partners: Fishermen, scientists, managers, and regional fishery management organizations.

Recommended seabird bycatch reduction efforts that apply to **multiple regions** included the following:

- Expand distribution of free BSLs, as is done by U.S. government agencies and NGOs for Hawaii-based longline fishing vessels, to additional fishing fleets.
    - Because BSL effectiveness varies due to weather conditions, fishing location, and vessel characteristics, ongoing testing and adaptation will be critical for broader adoption of BSLs.
- Implement vessel-specific approaches to reduce seabird bycatch, especially in fleets where only a few boats may be responsible for most seabird interactions.
    - Regulators or outreach partners who are trusted by the fishing industry should approach fishermen on vessels with high bycatch rates to solicit ideas about how to reduce interactions without lowering catch rates.
    - This collaborative approach would be more likely to yield volunteer adoption of bycatch reduction practices, as opposed to new regulations and associated enforcement efforts.
- Increase human observer coverage or electronic monitoring (EM) to better identify causes (e.g., location and timing of fishing, environmental conditions, fishing practices)

of high vessel bycatch rates, as well as interaction thresholds that could require vessel-specific interventions (e.g., catching 25 albatrosses in one week).
    - These analytical efforts could be followed by vessel-specific approaches to reduce seabird bycatch, as mentioned above.

General strategies for increasing feasibility and adoption of seabird bycatch reduction measures included the following:

- Ensure bycatch reduction ideas, devices, and techniques are practical, affordable, adaptable, and co-developed with fishermen, utilizing an informal, "bottom-up" approach that involves asking captains and crew members what they need for success in reducing bycatch, and using interpreters where appropriate.
- Offer fishermen support regarding how to use bycatch reduction gear like BSLs or long-handled line-cutting devices to ensure likelihood of adopting measures voluntarily or complying with regulations.
- Use online communication of best practices (e.g., via YouTube videos) to effectively demonstrate bycatch reduction devices and reduction techniques.
- Recognize that bycatch reduction measures (e.g., night-setting) may vary in terms of fishery-specific feasibility (such as increased costs) and/or efficacy (i.e., levels of bycatch reduction).
- Explore performance-based and incentive-driven approaches that encourage fisher innovation and focus on particular outcomes and innovative solutions.

Trawl Breakout Group

Trawl breakout group participants recommended region-specific seabird bycatch reduction efforts that should be pursued by potential partners. In addition, the participants recommended bycatch reduction efforts that could apply to multiple regions. The participants also recommended general strategies for increasing feasibility and adoption of seabird bycatch reduction measures in trawl fisheries.

Region-specific bycatch reduction measures included the following:

- Engage in cooperative research with fishing associations based primarily in Seattle, Washington, to develop and promote better management practices for offal and fishery discards.
    - Potential partners: The Pacific whiting at-sea fleet, including West Coast catcher processors and motherships; the Pacific pollock fleet; and the Pacific and North Pacific Fishery Management Councils.
- Promote and utilize bird scaring lines (BSLs) in New Zealand trawl fisheries to test BSL efficiency and reduce net entanglement where discard management has resulted in net entanglements.
    - Potential partners: New Zealand fisheries organizations and NGOs.
- Develop a technical report to analyze the feasibility of eliminating third wires in North Pacific trawl fisheries.
    - Potential partners: Commercial fishing organizations and third wire technology developers and manufacturers, NGOs, universities, and/or agencies.

Recommended seabird bycatch reduction efforts that apply to **multiple regions** included the following:

- Engage in cooperative research to determine how weights or floats can change the extent of a third wire's entry into the water for trawl fisheries in Alaska, U.S. West Coast, and South America
    - Potential partners: U.S. trawl catcher processor vessels, along with similarly large vessel operators and managers in Argentina and Chile.
- Engage in cooperative research to develop wires that are coated with a durable substance that is also visible to seabirds for trawl fisheries in Alaska, U.S. West Coast, and South America.
    - Potential partners: U.S. trawl catcher processor vessels, along with similarly large vessel operators and managers in Argentina and Chile, as well as companies and engineers that manufacture third wires.
- Initiate collaborative research with fishing companies to test collapsible or foldable curtains to cover cables while towing trawl nets wherever fleets experience bycatch due to third wires.
    - Potential partners: Trawl companies, fishery associations, fishery authorities, RFMOs, and ACAP.
- Test new lighting systems (including alternate colors or frequencies, and alternate placement or direction of lighting) that minimize lighting that can attract or impede vision of seabirds and create a fund to support purchase of improved lighting systems for vessels fishing in higher latitudes with longer periods of darkness, or in areas near seabird breeding colonies.
    - Potential partners: Fishing and shipping vessels; researchers focusing on seabird vision, including at zoos; and researchers and managers focusing on light pollution in cities.
- Explore incorporating pumps and hoses on catcher processor trawl vessels with the greatest seabird bycatch reduction needs, in order to use water jets to scare seabirds away from third wires and warp cables.
    - Potential partners: Catcher processor trawl vessels that operate off of North and South America.
- Test the efficacy of weighted bottom lines to keep purse seine nets more vertical in Chilean, Peruvian, and U.S. West Coast fisheries.
    - Potential partners: Researchers and fishermen with expertise in purse seines used in Chile and Peru, U.S. West Coast sardine and anchovy fishermen.

General strategies for increasing feasibility and adoption of seabird bycatch reduction measures included the following:

- Make third wires (among the largest causes of trawl-related seabird mortality) more visible or relocate them away from seabirds using methods besides only snatch blocks.
- Devote limited seabird bycatch reduction resources to fisheries with large incentives to reduce seabird bycatch, recognizing, for example, that for Pacific U.S. trawl fisheries, there are not many incentives that can be used to encourage adoption of seabird bycatch reduction measures in comparison to that fleet's incentives to reduce bycatch of Endangered Species Act (ESA)-listed salmon.

- Resist the impulse to try to find solutions where there are no significant bycatch problems, or where there are already effective regulations in place.
- Focus on eco-certification opportunities (e.g., Marine Stewardship Council certification) to help inspire trawl fishers to collaborate with scientists on solutions, as opposed to implementing more regulations.
- Maintain and increase connections among trawl bycatch reduction efforts in the United States, Argentina, Chile, and via ACAP.
- Where possible, identify solutions that apply not only to seabirds but also to other taxa such as sea turtles and marine mammals, and coordinate associated reduction efforts.

Gillnet Breakout Group

Gillnet breakout group participants recommended region-specific seabird bycatch reduction efforts that should be pursued by potential partners. In addition, the participants recommended bycatch reduction efforts that could apply to multiple regions. The participants also recommended general strategies for increasing feasibility and adoption of seabird bycatch reduction measures in gillnet fisheries.

Region-specific bycatch reduction measures included the following:

- Initiate education and outreach, with fishermen and fishing organizations co-leading efforts, to increase awareness and integration of increased net attendance, tension, and cleaning for gillnet fishing operations in Seward, Homer, Cordova, Petersburg, and Sitka, Alaska.
    - Potential partners: Alaska Fisheries Development Foundation, local salmon fishery cooperatives.
- Pilot test the addition of electronic monitoring (and perhaps human observers) on currently unmonitored vessels to increase understanding of bycatch risk and causal factors for salmon gillnet fisheries in Kodiak, Alaska; various fishing districts; and other locations including very productive commercial drift, set net fisheries and small-scall subsistence fisheries.
    - Potential partners: U.S. Fish and Wildlife Service, Alaska Department of Fish and Game, local fishermen.
- Build upon work being funded by the Canadian Environmental Damages Fund and U.S. Natural Resources Damage Assessment's *Deepwater Horizon* Open Ocean Trustees to expand pilot use of visual deterrent "scarybird kites" attached to hi-fliers or buoys on herring and cod gillnets in Cape St. Mary's Bay Ecological Reserve, Baccalieu Island, and Witless Bay Islands Park Reserve in Canada.
    - Potential partners: Memorial University, U.S. Fish and Wildlife Service, Aquatic Conservation Initiative, a Newfoundland non-profit organization.
- Approach fishermen through local advisory boards to explore testing of acoustic deterrents (1-2k kHz range) in Canadian gillnet fisheries with lengthy fishery openings, keeping in mind various factors including funding, permitting, keeping experimental catch, fisherman compensation.
    - Potential partners: Commercial salmon gillnet fishermen in British Columbia and trusted Canadian governmental organizations.

Recommended seabird bycatch reduction efforts that apply to **multiple regions** included the following:

- **Offal and waste management:** In fisheries including the Gulf of Maine sink gillnet fishery and Newfoundland Greenland halibut gillnet fishery, conduct cooperative research (including obtaining feedback from fishermen on current practices) and consider incentives for
    - Testing deck management practices to control when and where fishing waste is discharged,
    - Keeping fishing waste onboard (e.g., using buckets for offal, not releasing waste through scuppers) while gear is being set or is near the surface, and/or
    - Creating collection zones in harbors where fishermen can dispose of retained offal.
    - Potential partners: Regionally dependent, including local fishermen, industry groups, governmental agencies, universities.
- For various locations (e.g., Bristol Bay, Alaska, or reserves in Eastern Canada), fund **spatiotemporal analysis** of overlap between fishing effort and seabird populations (with local fishermen collecting data on seabird occurrence during fishing) to:
    - Evaluate the potential of rolling seasonal closures or time limits for fishing, and/or
    - Provide education and outreach to fishermen to support avoidance of setting gillnets in or near reserves and colonies during breeding seasons.
    - Potential partners: Regionally dependent, including local fishermen and governmental agencies.
- Conduct research to determine whether night fishing (nets set after nautical dusk and retrieved before nautical dawn) can reduce seabird bycatch while maintaining or increasing target catch in demersal set net fisheries off the East Coasts of Canada and the United States.
    - Potential partners: Fishermen and local research organizations.
- Conduct large-scale outreach efforts and engage in cooperative research to determine whether bycatch reduction strategies for Cape Cod baited gillnet fisheries could be effective in any other North American fisheries that use baited gillnets.
    - Potential partners: Governmental managers, fishing organizations, fishing sector managers.
- Implement effort reduction programs including gear or license buyouts (offering cash equal to or exceeding fair market value for a license, e.g., Bertram 2023), license requirements, quota systems, or programs that allow for increased catch allocations if fishermen switch from gillnets to other gear types.
    - Potential partners: Fishermen, governmental agency managers, NGOs willing to fund such efforts.

General strategies for increasing feasibility and adoption of seabird bycatch reduction measures included the following:

- Recognize differences in regulatory authorities covering fish and seabirds, as well as other species such as sea turtles and marine mammals, and improve coordination and collaboration across these taxa-specific constituents.

- Consider perspectives of different constituents to build trust-based partnerships and work to identify mutually agreeable solutions.
- Ensure timeliness and accuracy of bycatch data and address monitoring data gaps.
- Engage fishers early on to determine where there is common ground for addressing seabird bycatch challenges.
- Identify fishing organizations, councils, and foundations that have an incentive to reduce seabird bycatch (e.g., due to negative public perceptions) via eco-certification programs such as Marine Stewardship Council seafood certification in order to develop partnerships.

OVERALL WORKSHOP MESSAGES AND FOLLOW-UP ACTIONS

Conclusions:
The workshop concluded with facilitators, Planning Committee members, and workshop participants sharing final overall workshop messages. Ideas shared throughout the workshop formed the basis for some potential next steps.

Summary of Overall Workshop Messages were shared by the workshop facilitators prior to wrapping up. These included:

- The importance of collaboration and trust building with commercial fishermen.
    - Engaging the commercial fishermen in shaping bycatch reduction strategies from their inception is essential to adoption.
    - Addressing human components of seabird bycatch reduction is a must. Integrating social science into bycatch problem-solving will yield more actionable strategies.
    - Building of trust and frequent collaboration are key to effective partnerships with fishermen.
    - Data-driven communication regarding the benefits of bycatch reduction measures to fishermen's "bottom line" (including preventing future regulations) should be part of outreach and promotion about these measures.
- Realistic approaches for bycatch reduction implementation.
    - Incentives to promote seabird bycatch reduction must demonstrate benefits to fishers, utilize "carrot and stick" approaches where appropriate, provide financial support, and keep solutions simple for adoption.
    - "One size does not fit all" in bycatch reduction solutions for gear types, particularly as they relate to size of vessels and/or fleets, and target species.
- Depth and breadth of collective resources.
    - The greater community of those with an interest in seabird bycatch reduction (academia, federal/state governments, commercial fishing industry groups, and non-profit organizations) provides a deep and diverse set of experiences, expertise, and knowledge of potential best practices. Implementing simple mechanisms to share and harness current knowledge and experiences of this community is foundational to advancing seabird bycatch reduction.
    - Learning from each other to support and advance seabird bycatch reduction will lead to global opportunities worth pursuing, including but not limited to the ones that emerged during this workshop.

Workshop Planning Committee Follow-Up Actions:
In response to workshop discussions and recommendations, members of the Planning Committee have identified the following actions to prioritize:

Action	***Lead***	***Timeframe***
Initiate a clearinghouse of links to existing resources: Investigate options to create a "living" directory of contacts and global resources on seabird bycatch reduction. This clearinghouse could be initiated by circulating a spreadsheet to workshop participants with a worksheet for contact information, and another for adding links to existing resources, including the Seabird Bycatch Reduction Best Practices 2026 workshop summary and published workshop proceedings. The spreadsheet would function as a simple, shared reference tool with links only (no database hosting). Hosting options to explore include websites of the TBWG, AMBC, or another partner, with communications staff that could support/maintain it. Conceptually, it would operate like a curated bulletin board of links and contacts, updated collaboratively over time.	Trilateral Bycatch Working Group	2026-2027
Organize additional discussion on purse seine issues and potential seabird bycatch reduction mechanisms	Trilateral Bycatch Working Group	2026-2027
Review recommended strategies (pp. 20-26) from gear type breakout groups, identify practical/feasible options, and follow up with the potential recommended partners to catalyze action and future projects	Workshop Planning Committee	Ongoing
Create a contact list of workshop attendees, identifying their identified interests, and share the list among workshop attendees to facilitate collaborative activities.	Atlantic Marine Bird Cooperative; Trilateral Bycatch Working Group	2026-2027
Explore collaborations with bycatch reduction efforts initiated to benefit other taxa (e.g., sea turtles, marine mammals).	Atlantic Marine Bird Cooperative; Trilateral Bycatch Working Group	2026-2027
Review strategies to inform future Deepwater Horizon Seabird Bycatch Reduction Project efforts, reporting on progress back to workshop attendees, and explore ways to incorporate social science into future on-the ground bycatch reduction efforts	*Deepwater Horizon* Bycatch Reduction Project	2027-2030

Workshop Takeaways "Word Cloud"

As the workshop ended, the facilitators asked participants to share their most significant "takeaway" from the workshop. The facilitators created a word cloud of ideas that were most mentioned in the participant responses (see Figure 2).

Figure 2. The most significant ideas expressed as takeaways by workshop participants.

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APPENDIX A. Participants in the Seabird Bycatch Reduction Strategies Workshop, 11-12 February 2026, including institutional affiliations, roles, and email address (if available) (ECCC = Environment and Climate Change Canada, NOAA = National Oceanic and Atmospheric Administration, USFWS = U.S. Fish and Wildlife Service)

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APPENDIX B. Workshop Agenda

Wednesday, February 11th * 1:00pm-4:30pm Eastern

1:00-1:15 **Welcome and Opening Remarks:** Introductions, workshop objectives and context; agenda and process overview.

Speakers:

- *David Bidwell, Lynne Carbone and Associates (Technical Introduction)*
- *Caleb Spiegel, U.S. Fish & Wildlife Service (Formal Welcome and Open)*
- *Lynne Carbone, Lynne Carbone and Associates*

1:15-1:30 **Pre-workshop Survey Baseline:** Overview of pre-workshop survey results as a snapshot of interested parties' seabird bycatch reduction experience, success, and impediments.

Speaker:

- *David Bidwell, Lynne Carbone & Associates, Inc.*

1:30-2:00 **Longline:** Share information about the current state of seabird bycatch reduction practices for longline gear including:

- Species and gear/fleets of concern
- Current techniques
- Promising solutions
- Impediments to implementation
- Case studies
- Best management practices
- Moderated Q&A

Speaker:

- *Jake Russell-Mercier, Canadian Wildlife Service*

2:00-2:30 **Trawl:** Share information about the current state of seabird bycatch reduction practices for trawl gear including:

- Species and gear/fleets of concern
- Current techniques
- Promising solutions
- Impediments to implementation
- Case studies
- Best management practices
- Moderated Q&A

Speaker:

- *Roberta Swift, U.S. Fish & Wildlife Service*

2:30-2:45 **Break**

2:45-3:15 **Gillnet:** Share information about the current state of seabird bycatch reduction practices for gillnet gear including:

- Species and gear/fleets of concern
- Current techniques
- Promising solutions
- Impediments to implementation
- Case studies
- Best management practices
- Moderated Q&A

Speakers:

- *Caleb Spiegel, U.S. Fish & Wildlife Service*
- *Robert Blackmore, Memorial University of Newfoundland and Labrador*

3:15-4:15 **Moderated Panel Discussion**

Speakers:

- *Caleb Spiegel, U.S. Fish & Wildlife Service*
- *Roberta Swift, U.S. Fish & Wildlife Service*
- *Jake Russell-Mercier, Canadian Wildlife Service*
- *Lee Benaka, American Institute of Fishery Research Biologists*
- *Robert Blackmore, Memorial University of Newfoundland and Labrador*
- *Kathy Kuletz, U.S. Fish and Wildlife Service (Retired)*

4:15-4:30 **Closeout:** Brief recap of workshop highlights, preview of day two agenda, participant reflections, and closing remarks.

Speakers:

- *Lynne Carbone, Lynne Carbone & Associates, Inc.*
- *Jake Russell-Mercier, Canadian Wildlife Service*

Seabird Bycatch Reduction Implementation: Collaboration and Problem Solving

Thursday, February 12th * 1:00pm-5:00pm Eastern

1:00-1:15 **Welcome and Recap of Day One:** Review of workshop objectives, agenda, and process overview.

Speakers:

- *David Bidwell, Lynne Carbone and Associates (Technical Introduction)*
- *Roberta Swift, U.S. Fish & Wildlife Service(Formal Welcome and Open)*
- *Lynne Carbone, Lynne Carbone & Associates, Inc.*

1:15-2:00 **Bycatch reduction promotion mechanisms:** Collaborate to brainstorm and agree on the most impactful ways to promote adoption of best bycatch reduction practices highlighting effective outreach strategies and incentives.

Speakers:

- *Liese Siemann, Coonamesset Farm Foundation*
- *Natalie, Jennings, Coonamesset Farm Foundation*
- *Emily O'Toole, Coonamesset Farm Foundation*
- *Melissa Sanderson, Cape Cod Commercial Fisherman's Alliance*
- *Aubrey Church, Cape Cod Commercial Fisherman's Alliance*
- *Greg Connors, FV Constance Sea*
- *John Our, FV Miss Fitz*

2:00-3:30 **Implementation Breakouts:** Interested parties breakout by gillnet, longline, and trawl gear types to discuss and recommend potential solutions, partners, and fundable projects to advance successful implementation and increased adoption of seabird bycatch reduction activities, inclu ding:

- Recap the most promising activities for reducing seabird bycatch in each gear type.
- What will it take to increase participation in testing and/or expanding these activities in the future?
- Who are potential partners to undertake and promote seabird bycatch reduction activities?
- What potential future fundable projects will best advance these efforts?

3:30-3:45 **Break**

3:45-4:45 **Report -outs and discussion:** Participants return as a full group to share the outcomes of breakouts, recommended strategies, actions, and potential partnerships and funding opportunities/projects.

4:45-5:00 **Closeout:** Brief recap of workshop highlights, sharing of next steps, reflections, and closing remarks.

Speakers:

- *Lynne Carbone, Lynne Carbone& Associates, Inc.*
- *Caleb Spiegel, U.S. Fish & Wildlife Service*

APPENDIX C. Longline Bycatch Overview Presentation

Current State of Longline

Jake Russell-Mercier, Canadian Wildlife Service
Roberta Swift, U.S. Fish & Wildlife Service
Lee Benaka, American Institute of Fishery Research Biologists

Overview – Longline Fisheries

What is longlining?

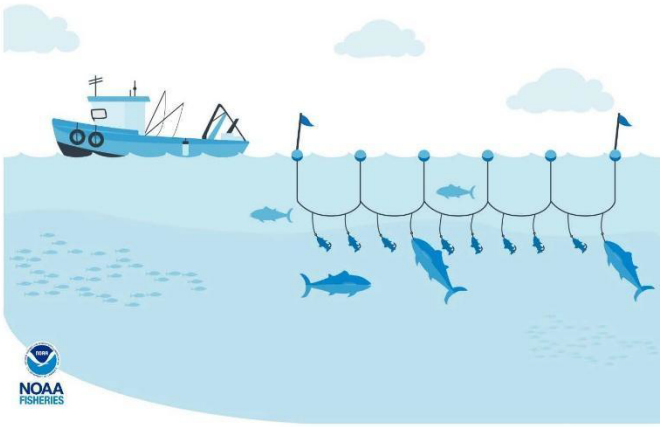
- A mainline (often tens–hundreds of km) with many baited hooks on branch lines
- Pelagic longlines: surface/open-ocean; Demersal longlines: near seabed

Common target species

- Pelagic: tunas, swordfish
- Demersal: halibut, sablefish, cod, toothfish (region-dependent)

Why seabirds interact

- Baited hooks and offal/discards attract birds during setting and hauling



Overview – Impacts and Concerns

- High global mortality: At least 160,000 seabirds/year killed in longline fisheries (Anderson et al., 2011)
- Most affected: albatrosses, petrels, shearwaters.
- Many species already threatened or endangered.
- Under-reporting of bycatch is an issue (Brothers et al., 2010).
- Long-lived seabirds face population-level declines from even small increases in adult mortality.

R. Swift

Current Seabird Bycatch Reduction Techniques

Widely Used / Recommended

- Tori (bird-scaring) lines
- Weighted branch lines
- Night setting
- Hook-shielding devices
- Offal/discard management

Moderately Used

- Side-setting
- Blue-dyed bait
- Underwater setting chutes
- Bird exclusion devices
- Line shooters
- Spatiotemporal fishing restrictions

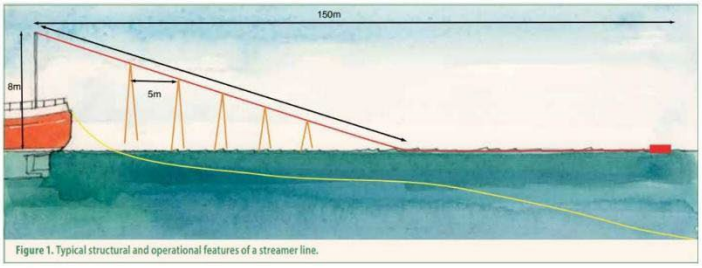


Figure 1. Typical structural and operational features of a streamer line.

Image from ACAP (2014)

Current Seabird Bycatch Reduction Techniques

Non-recommended or Unproven

- Hook size and shape (e.g., smaller-sized hooks)
- Olfactory deterrents
- Line setters
- Bait-casting machines
- Lasers
- Weighted fishing hooks

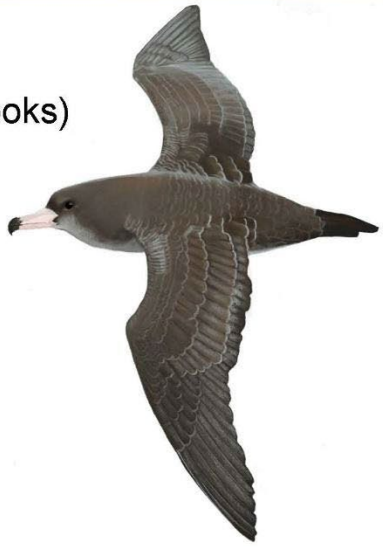
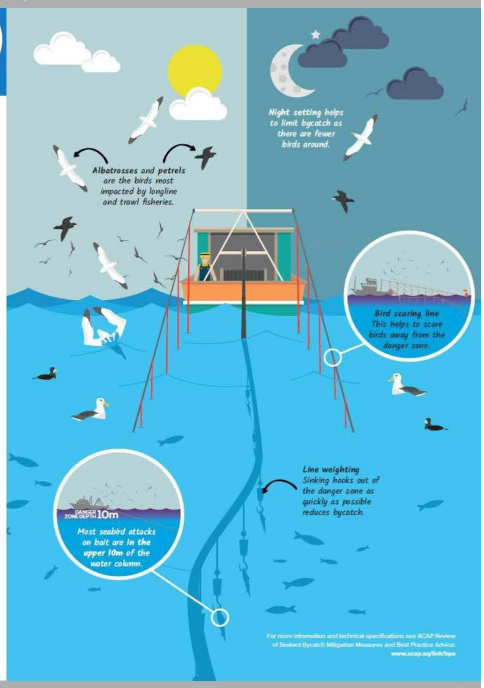


Illustration by Erin Wheeler

Best Management Practices (BMPs)

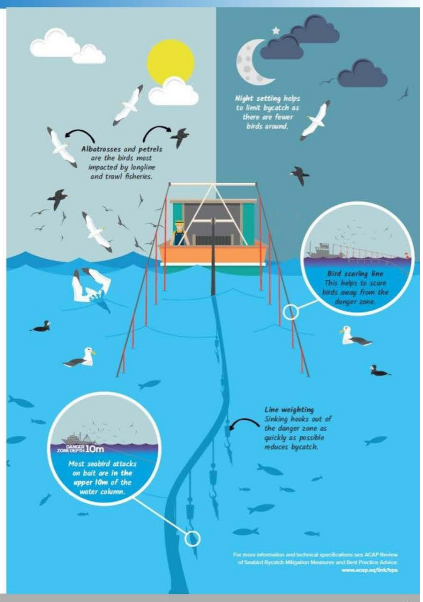
- Agreement on the Conservation of Albatrosses and Petrels (ACAP) Recommended Best Practices
  - Use simultaneous mitigation methods
    - Bird-scaring lines
    - Branch line weighting
    - Night setting
  - Or use an assessed hook-shielding device

- Other
  - Mandatory observer coverage or electronic monitoring
  - Observer training
  - Regular crew training in seabird-safe fishing practices



Case Study: Bell et al. (2025)

- Evaluating the effectiveness of seabird bycatch mitigation measures for pelagic longlines in the South Atlantic
- Key findings
  - Updating International Commission for the Conservation of Atlantic Tunas (ICCAT) mitigation rules to align with ACAP best practices would reduce seabird mortality by 41–86%.
  - Using all three ACAP measures together predicted to reduce mortality by 72–93%.
  - Strong recommendation for comprehensive adoption of best-practice gear and specifications.



Case Study: Bell et al. (2025) Continued

- Bell et al. (2025) recommend:
  - ICCAT and other RFMOs adopt updated ACAP-compliant gear standards.
  - Mandate the simultaneous use of tori lines, weights, and night setting.
  - Improve monitoring (observer and electronic).
  - Strengthen reporting due to known underestimation of capture rates.
  - Conduct population-level assessments of bycatch impacts.

Challenges to Implementation

- Pre-workshop Survey Highlights
  - Perceived economic tradeoffs, including concerns about reduced catch rates.
  - Operational challenges (e.g., gear handling complexity, safety concerns).
  - Inconsistent enforcement and uneven regulatory coverage.
  - Resistance when mitigation measures are perceived as imposed without consultation.
  - Respondents highlighted that social and economic barriers often outweigh technical ones.
- Baker et al. (2024)

Table 4. Suggested reasons why ACAP BPA not currently implemented, as indicated by responses to both listed options and an open text box in Questions 4 and 8.

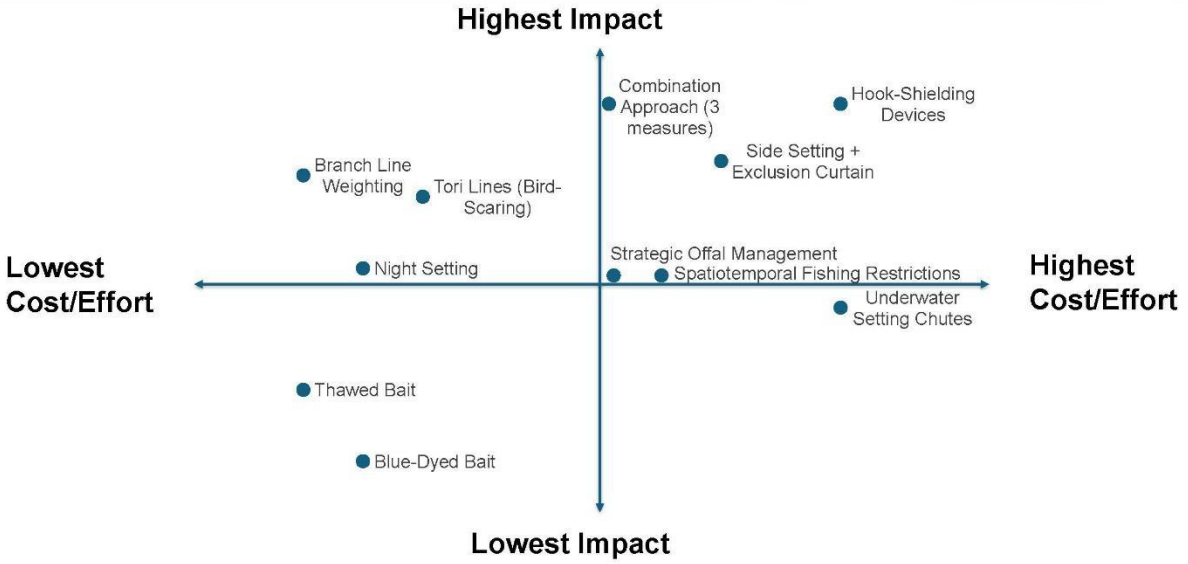
	No of respondents		
Suggested reasons	Longline	Trawl	Total
Not considered practical	12	18	30
Fishers do not want to use BPA measures	17	8	25
Not considered necessary, birds are rarely caught, conservation concern not demonstrated	11	12	23
Cost of installing mitigation	10	10	20
Fishing efficiency impacted	11	8	19
Safety concerns	13	4	17
Not regulated, weak management	8	4	12
Additional research required to demonstrate efficacy or need	4	6	10
Not considered effective	0	5	5
Flexibility needed to cater for individual vessels, 'Tool Box' approach preferred to prescriptive approach	2	1	3
Fishers need to be engaged in BPA process	1	2	3
Not tested in commercial situation across range of vessels and fisheries	0	2	2
Fishers don't care about seabirds	1	0	1

Future Directions

- Standardize mitigation across RFMOs (ICCAT, IOTC, WCPFC, etc.).
- Improve bycatch monitoring, especially addressing cryptic mortality.
- Improve bycatch identification (e.g., ASO training, share bycatch ID guides)
- Expand risk-based models, like Bell et al. (2025), to other regions and species.
- Promote industry engagement and capacity building

Illustration by Erin Wheeler

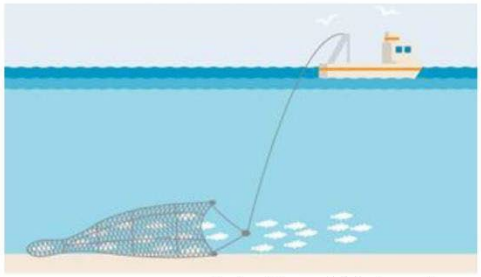
Cost vs Impact



APPENDIX D. Trawl Bycatch Overview Presentation

Overview: Trawl Fishery

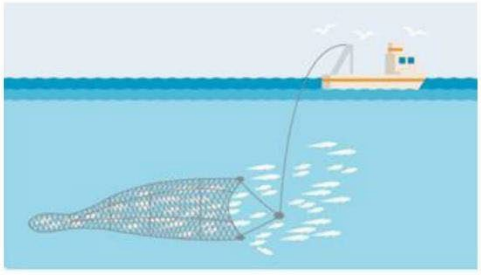
Bottom: Benthic & Demersal



Marine Stewardship Council

Target Bottomfish

Midwater/Pelagic

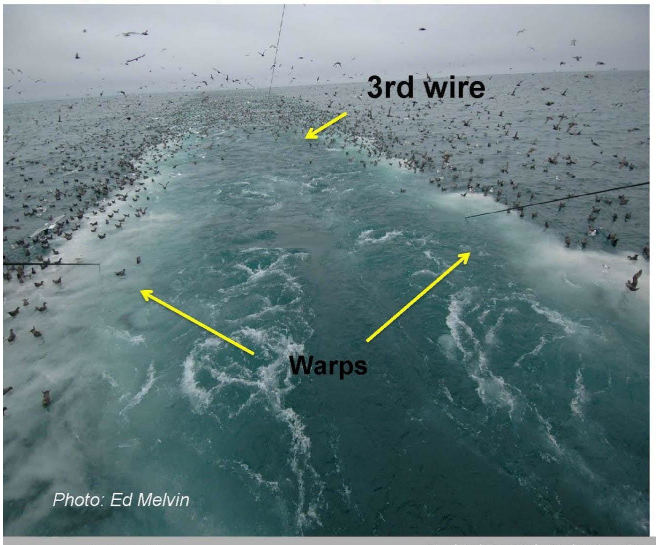


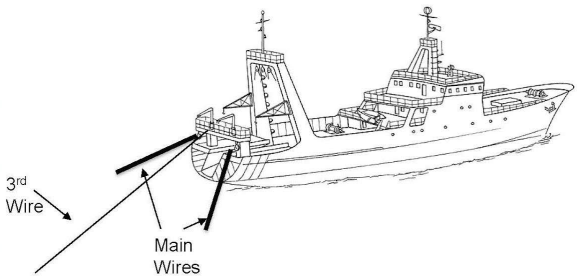
Marine Stewardship Council

Target Pelagic fish

Overview: Trawl Fishery

Warp cable (main wire) and third wire configurations





Gladics et al.

Overview: Trawl Fishery

Overview: Trawl Fishery

Offal and waste discharge

- Catcher vessels = no plume
- Catcher-processor vessels
  - whole discards
  - minced offal
  - waste water from meal production

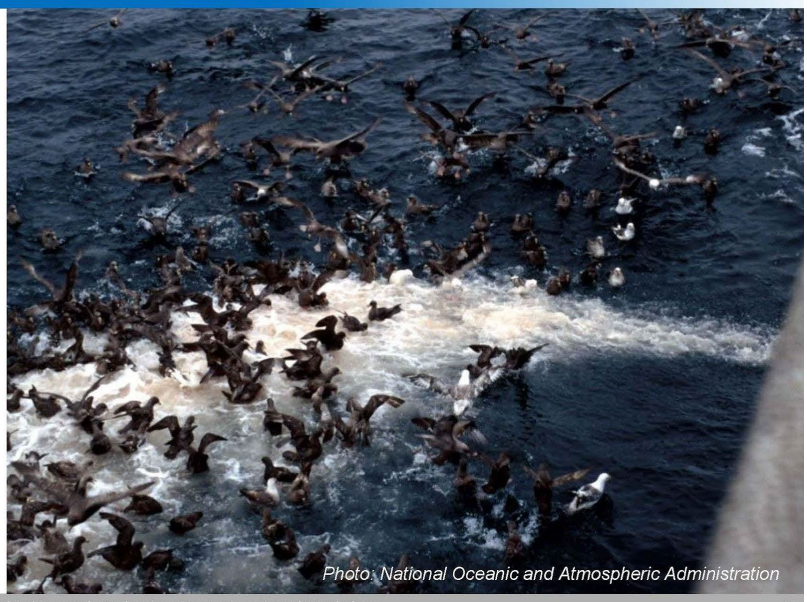


Photo: National Oceanic and Atmospheric Administration

Overview: Impacts and Concerns

Cable Strikes in air, on water, or both

Light Strikes – bird glances off or touched by cable but flies or swims away.

Hard Strikes -mortality possible – bird flies into or is struck by a cable and changes course, falls to water, or at least partially dragged under

(Gladics et al.)

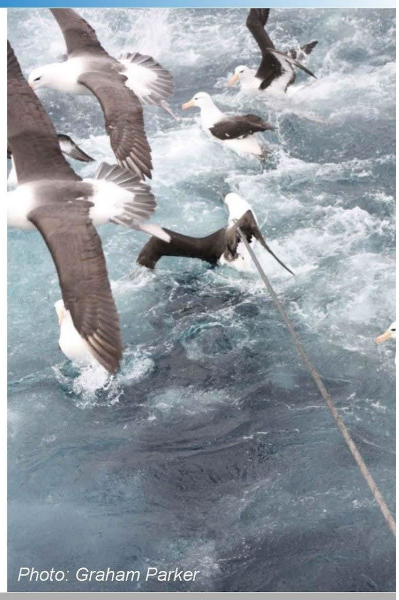


Photo: Graham Parker

Overview: Impacts and Concerns

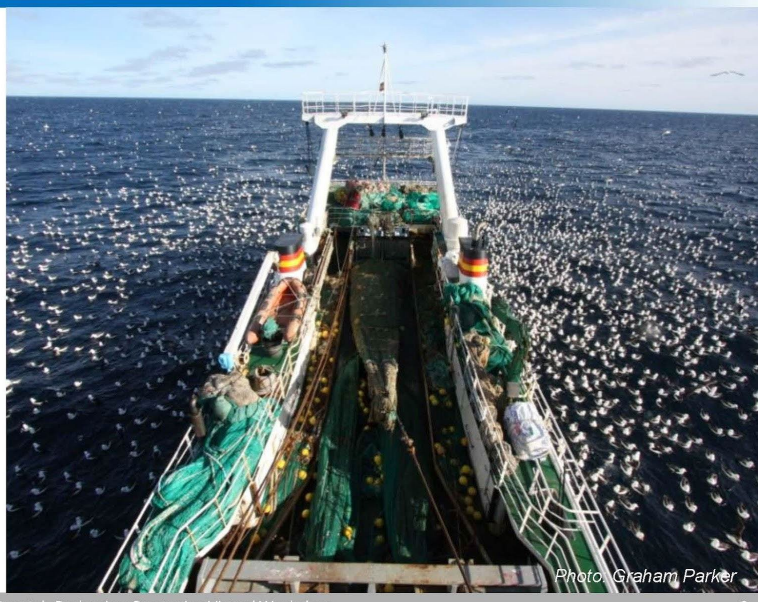
Net entanglement

- Setting or hauling
- Sitting on top of net to extract fish or fish parts
- Swimming into the mouth of the net

Species and Gear/Fleet Concerns

Seabird Interactions increase with:

- High seabird abundance.
- Continuous offal discharge during towing and hauling.



Species and Gear/Fleet Concerns

Species of concern

- Large-bodied, surface-foraging seabirds attracted to vessels and offal discharge
- Long-winged albatrosses & petrels, shearwaters, gulls

Pacific

Black-footed albatross (BCC)

Short-tailed albatross (ESA)

Photo: Roberta Swift, USFWS

Atlantic

Great shearwater

Northern gannet

Northern fulmar

DWHOS priority

Photo: Amanda Boyd, USFWS

Best Management Practices

Management of Offal and Discards

- Retention, Mealing, Batching, or Mincing

Warp Cable Strike Reduction

- Streamer Lines (aka Tori Lines or Bird Scaring Lines)

Third-cable strike reduction

- Wireless monitoring systems
- Bird Scaring Lines
- Snatch Block

Reduce net entanglement

- Clean nets prior to shooting and after every haul
- Minimize the time the net is on the water surface
- Net binding & weighting for pelagic trawl gear

Avoid peak areas and periods of seabird foraging activity.

Agreement on the Conservation of Albatrosses and Petrels

ACAP Review of Mitigation Measures and Best Practice Advice for Reducing the Impact of Pelagic and Demersal Trawl Fisheries on Seabirds

Reviewed at the Fourteenth Meeting of the Advisory Committee Lima, Peru, 12 - 16 August 2024

Best Management Practices

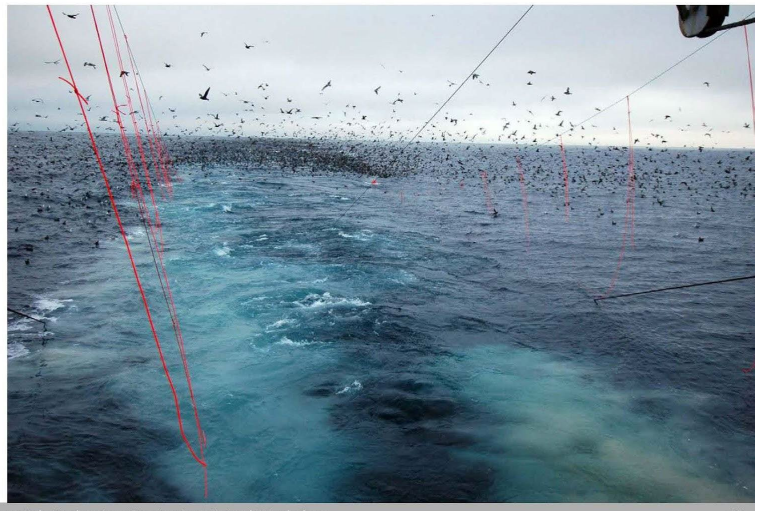
Offal and discard management:

- Full retention (favored)
- Fish meal conversion
- Periodic discharge (batching) while not fishing
- Mincing waste before discharge (least-favored)

Photo: Ed Melvin

Best Management Practices

Streamer Lines (a.k.a. tori lines and bird scaring lines)



Photos: Ed Melvin

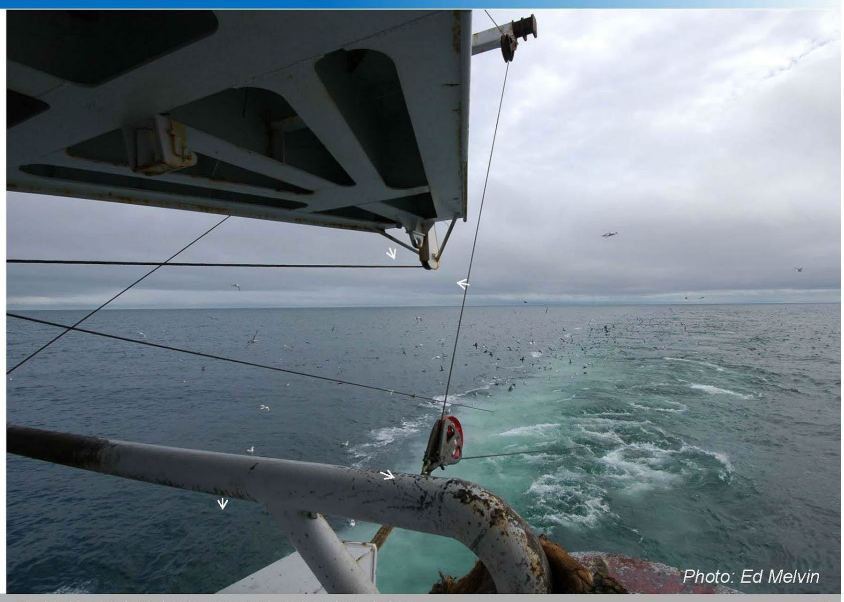
Best Management Practices

Warp Boom

Current Reduction Techniques

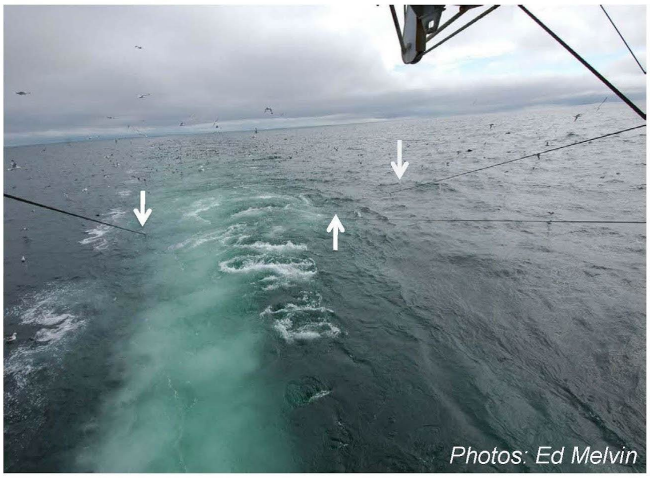
Third-cable mitigation measures

- Third wire elimination
- Snatch blocks



Best Management Practices

Snatch Block



Best Management Practices

Reduce Net Entanglement

- Clean nets
- Minimize surface time
- Net binding & weighting (pelagic trawl)

Additional Reduction Techniques

- **Bird-scaring lines** to reduce net entanglement
- **Minimize lighting** consistent with vessel safety
- **Warp Deflectors**
- **"Bird bafflers"**

Photo: Roberta Swift, USFWS

Additional Reduction Techniques

Warp Deflectors
Aka "pinkies"

Deflects seabirds that come into contact with the pinkie out of the way of the warp wire.

- Used in Australia
- Needs refining

Photo: Australia Fisheries Management Authority

Additional Reduction Techniques

Photo: South East Trawl Fishing Industry Association

Case Studies: Jannot et al., 2018

U.S. West Coast and Alaska Trawl Fisheries Seabird Cable Strike Mitigation Workshop, November 2017:
Summary Report

https://doi.org/10.7289/V5/TM-NWFSC-142

Edited by Jason E. Jannot[1a], Thomas Good[1b], Vanessa Tuttle[1a], Anne Marie Eich[2], and Shannon Fitzgerald[3]

Jannot, et al., 2018. Workshop Report
https://doi.org/10.7289/V5/TM-NWFSC-142

Proposed mitigation measures

Improved Snatch Block Design

Water deterrents

Third wire visibility
- colored or lighted cable

Combo warp boom

Third wire float & chain device

Case Studies: Gladics et al.

Understanding and preventing seabird interactions with the catcher-processor trawl fleet targeting Pacific hake (*Merluccius productus*) off the U.S. West Coast

Amanda J. Gladics,
Vanessa Tuttle, Tom Good, Jason Jannot

Photos by Amanda Gladics

Sea Grant Oregon | Oregon State University Extension Service | NOAA Northwest Fisheries Science Center | Pacific Whiting Conservation Cooperative

Case Studies: Gladics et al.

- Characterized **3rd wire strike risk** for the West Coast hake CP fishery
- Characterized **environmental factors associated** with 3rd wire strikes
- Identified **operational factors** associated with hard 3rd wire strikes.
- **Tested** Mitigation Measures
  - Snatch block
  - Water deterrent
  - Warp booms
  - Streamers

Photo: NOAA

Case Studies: Gladics et al.

Lessons:

- Estimate of albatross mortality is **much lower** than expected
- Interactions are primarily with 3rd wire cables, not net warps
- BFAL strikes highest during setting
- Higher risk conditions for hard strikes across all seabirds:
  - Offal discharge
  - Fishing in the fall
  - 3rd wire distance
  - Towing
  - Tail/cross winds
  - More birds around vessel

Photo: USFWS/ Roberta Swift

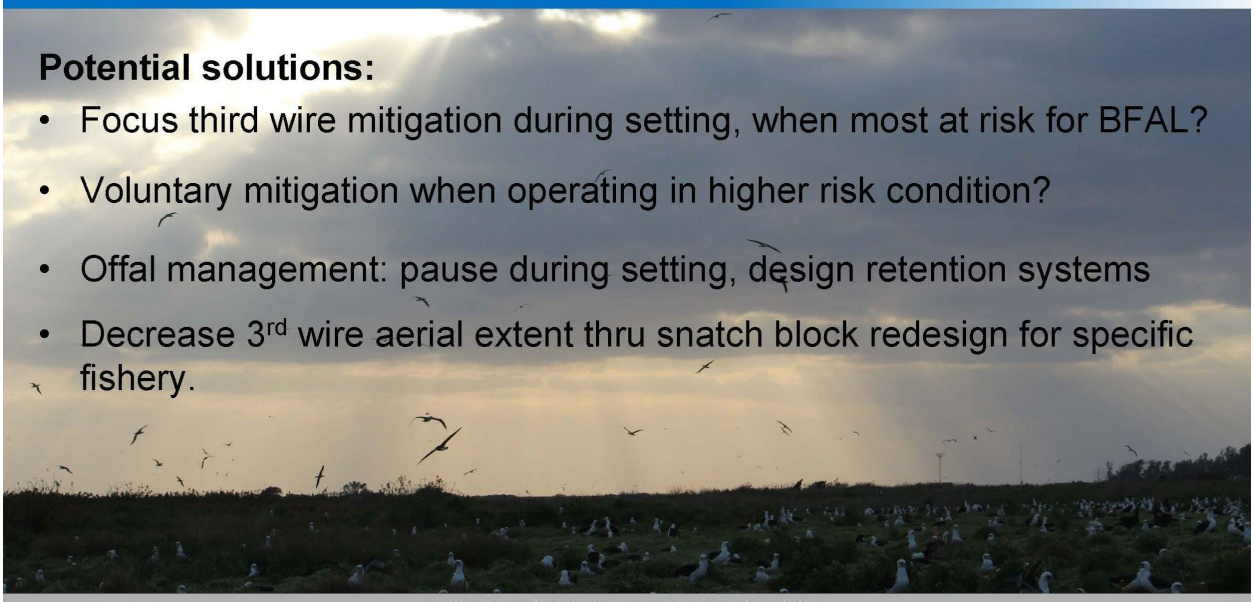
Case Studies: Gladics et al.

Mitigation Measures:

- Water deterrents could dissuade interactions with the net warps, but not the 3rd wire unless heavily modified.
- Warp booms had little effect for the 3rd wire cable
- Streamer lines with trolling shear boards showed promise for mitigation during towing
- Use of snatch block challenging in deeper water

Photo: NOAA

Case Studies: Gladics et al.



Potential solutions:

- Focus third wire mitigation during setting, when most at risk for BFAL?
- Voluntary mitigation when operating in higher risk condition?
- Offal management: pause during setting, design retention systems
- Decrease 3rd wire aerial extent thru snatch block redesign for specific fishery.

Challenges

- **Offal management** batching may require major changes to some vessels.
- **Bycatch risk varies** by fleet, region, operational practice, species, and environmental conditions.
- **Resistance** due to perceived interference with fishing efficiency.
- **Regulatory requirements** are inconsistent across regions and RFMOs.
- **Limited incentives** where mitigation is not mandatory.
- **Enforcement and compliance challenges**, particularly in fleets with limited monitoring.

Photo: Roberta Swift, USFWS

Research Needs

ACAP:

- Novel means of waste storage or discharging away from the stern of the vessel
- Development of an effective towed object for streamer lines.
- Quantification of streamer line strike effects on seabirds.

Photo: Roberta Swift, USFWS

Promising Solutions

- **Refine Existing Technologies** - rather than develop new tools.
- **Increase electronic monitoring** to validate compliance and effectiveness.
- **Improve specific measures:** warp deflectors, bird-scaring devices, streamer lines with shear boards.
- **Tailor mitigation to individual fleets** through fishery-specific risk assessments
- Continued **collaboration** to improve ease of use and operational compatibility

Photo: Roberta Swift, USFWS

Trawl Mitigation Measures

•Avoid Peak Seabirds
•Minimize lighting

Offal Management
Retention > Mealing > Batching > Mincing

•Water Deterrents

Third Wire
•Third Wire Elimination
•Third Cable Snatch Block *
• Streamer lines *
•Improved Snatch Block Designs
•Third wire visibility measures
•Shear boards with Streamer lines

Warp Cable
•Streamer Lines
•Warp deflectors
•Bird Bafflers
•Combo Warp Boom

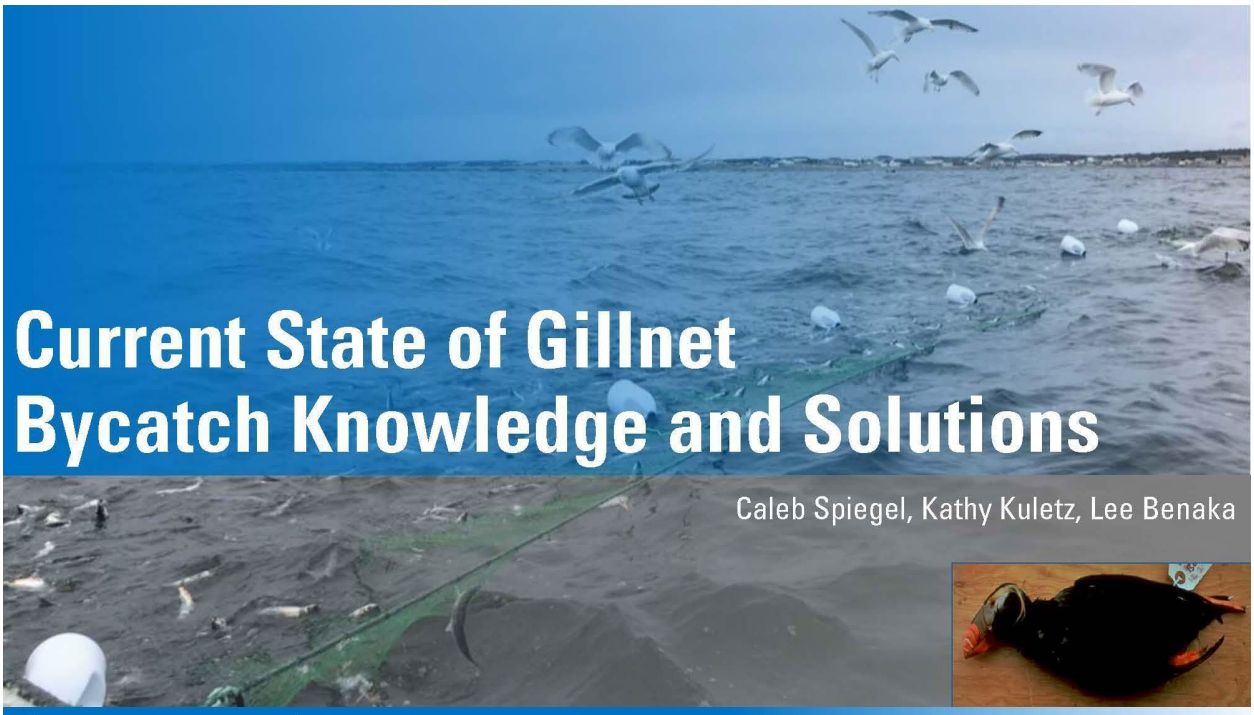
Net Entanglement
•Clean nets
•Minimize net surface time
•Net binding & weighting
•Bird scaring lines
•Net Streamer Lines

KEY:
Established BMP's
Additional solutions (not a BMP)
Promising solutions (~experimental)

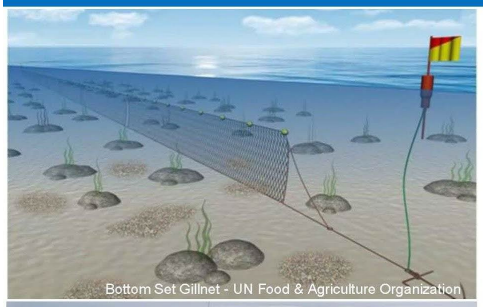
* Alone or together

Thank You!

APPENDIX E. Gillnet Bycatch Overview Presentation



Overview - Gillnet Fisheries



Sources: Žydelis et al. 2013; Marine Stewardship Council

- Used for many target fish species
  - E.g., herring, mackerel, squid, sardines, lumpfish, cod, hake, salmon, halibut
- Stationary (set) or drifting
  - Drift net use now less common due to UN moratorium
- Mostly passive but baited in some fisheries
  - E.g., dogfish Cape Cod
- Global w/ variability in size/characteristics
  - Small subsistence to large commercial fleets

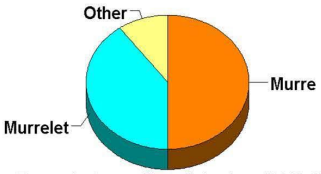
Overview - Impacts and Concerns

- Primarily impact diving marine birds
  - Alcids (murres, murrelets, puffins), shearwaters, loons, cormorants, gannets, sea ducks
  - Pursue prey underwater & vulnerable to entanglement
- Entangle >80 marine bird species
- Kills >400,000 individuals/yr.


Steller's Eider - Markus Vetemaa/BirdLife Intl


Northern Gannets - Montevecchi Lab

One or two species often make up most bycatch in a region

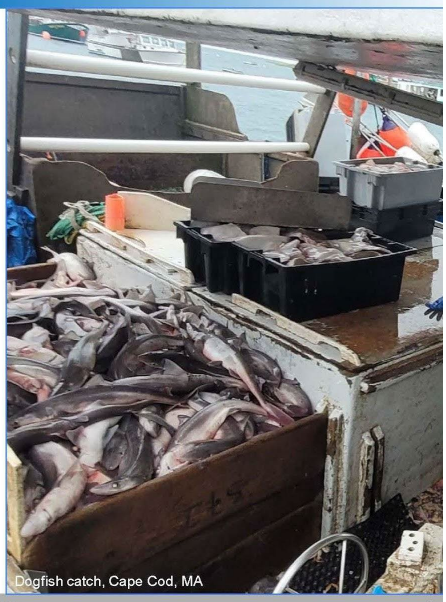


Example from gillnet fisheries, PWS Alaska

Sources: Žydelis et al. 2013; Dias et al. 2019

Overview - Impacts and Concerns (cont.)

- Risk varies by fishery, scale, & region
  - Highest density of affected spp. → temperate & sub-polar regions
  - Affect seabird colonies & migration corridors
    - Seasonal fisheries often overlap in timing
    - Coastal & nearshore fisheries overlap in habitats
- Concerns:
  - Lack of monitoring
  - Long soak times = more bycatch

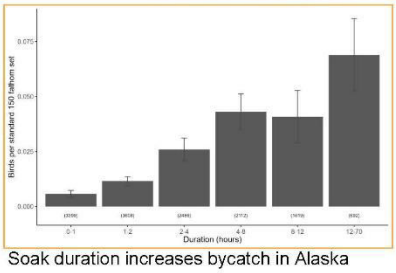

Dogfish catch, Cape Cod, MA

Sources: Žydelis et al. 2013; Marine Stewardship Council; Workshop pre-survey results

Current Reduction Techniques - potential or in use

Reduction of geographic, spatial &/or temporal overlap w/ seabirds

- Reduced soak time
- Avoidance of high-risk times of day
- Bird hotspot avoidance
- Minimum depth setting
- Time & area closures & gear buyouts



Soak duration increases bycatch in Alaska salmon gillnet fisheries *(Dietrich et al. 2025)*

Overlap b/t Great Shearwater hotspots and Northeast gillnet fisheries *(Hatch et al. 2016)*

Visual deterrents

- Keep birds away from vessels/gear
- e.g., "Scary bird" kites; "Looming eyes" buoys

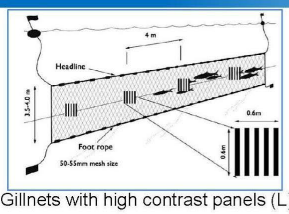
Looming eye buoy, Estonia *(J. Morkunas RSPB - active trial)*

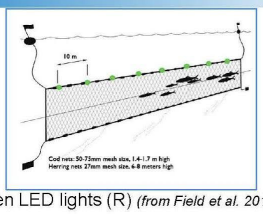
Configuration of scary bird kites in herring gillnet fishery, Newfoundland *(Montevecchi Lab – active trial)*

Current Reduction Techniques - potential or in use

Increasing net detectability & avoidance (visual/auditory)

- Net color & high contrast panels
- LED lighting
- Acoustic pingers





Gillnets with high contrast panels (L) & green LED lights (R) *(from Field et al. 2019)*

Operational practices

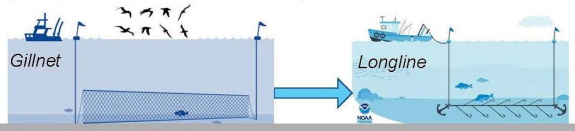
- Offal & discard management/deck cleanliness → reduces attraction
- Avoiding direct baiting (if applicable)
- Regular net attendance

Alternative to direct baiting in dogfish fishery, Cape Cod *(Coonamesset Farm Foundation 2025)*

Fishery discards *(Photo: Guardian UK)*

Changing gear

- Using other gear with lower bycatch (or those with more effective reduction practices)



Impediments to Implementation

- **No universally effective practice(s)**
  - Few proven, scalable options exist
  - Fisheries quite variable → encompass many target species, habitats & geographies
- **Economic and operational concerns**
  - Perceived or real impacts on catch/profitability → fisher buy-in essential
  - Costs of changes to gear and practices & limited funding to test new practices
- **Cultural and trust barriers**
  - Resistance to externally imposed measures
  - Hesitation to adopt new / potentially risky practices
- **Monitoring and data constraints**
  - Low observer coverage and under-reporting
  - Difficulty detecting mortality
- **Lack of motivation for implementation**
  - Perceived benefit/reward is low for fishermen
  - Impact on birds underestimated
  - Inconsistent regulation across regions/fisheries - enforcement weak/impractical

Sargasso Shearwater, photo: Mael Glon/USFWS

Promising Solutions

"At present, there are no highly effective, universal seabird bycatch reduction methods for gillnet fisheries." (ABC, Bycatch Solutions report)

- **General principle -** "Increase visibility…reduce encounter/entanglement rate."
- **Toolbox approach needed -** Integrated strategy by region/fishery including:
  - Risk assessment (understanding causes, spatial overlap models, hotspot mapping)
  - Alternative practices/modifications (e.g., change timing, use deterrents, ↑ visibility)
  - Adaptive management (test/collect data on new practices & incorporate if effective)

Red-throated Loon, photo: C.J. Sharp/Creative Commons

Promising Solutions

- **Collaborative approach needed** - fishers & fishing organizations, indigenous rightsholders, researchers, managers:
  - Identify, test, refine new practices
  - Adopt & expand effective practices that *do not affect catch yield*
  - Share new information – establish partner networks
- **Promote adoption among willing partners via:**
  - Education, outreach, & training efforts with fishers / fishing orgs.
  - Incentives (gear, MSC certification, etc.)
  - Support / promote champions within fishing communities

Case Study: Inshore Newfoundland Fisheries

William Montevecchi, Paul Winger, **Robert Blackmore**, Jessika Lamarre, Noah Careen, Jill Kieley-Conway

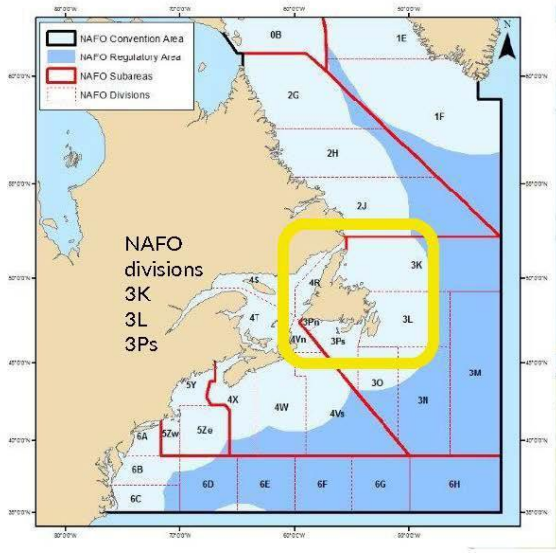
MARINE INSTITUTE

Montevecchi Lab Memorial University

MEMORIAL UNIVERSITY

U.S. FISH & WILDLIFE SERVICE DEPARTMENT OF THE INTERIOR

Newfoundland and Labrador

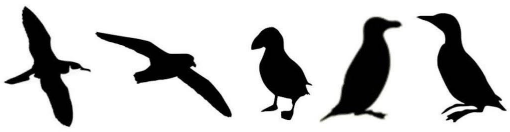


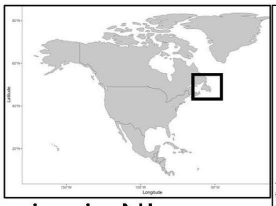
Atlantic Canada NAFO Management Divisions - Northwest Atlantic Fisheries Organization (NAFO)

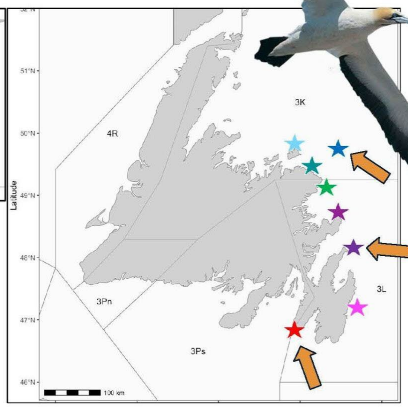
Atlantic Canada seabird colonies - Environment & Climate Change Canada (ECCC)

Newfoundland: Seabirds and Fisheries

Inshore waters of Newfoundland and Labrador are important foraging grounds for breeding and non-breeding seabirds







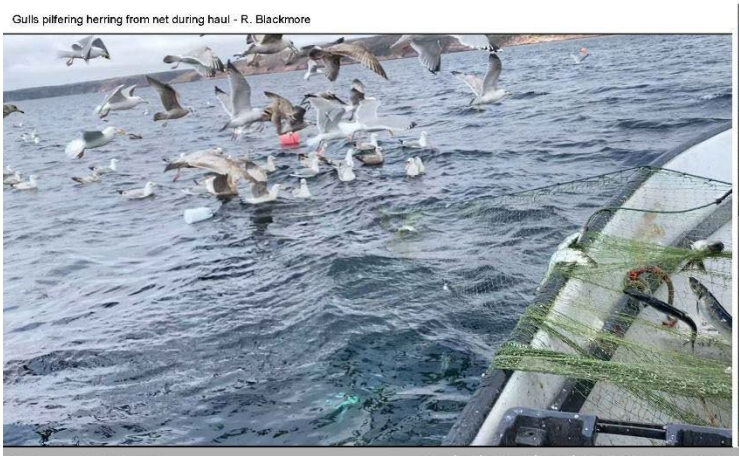
There are active commercial fisheries in NL, especially snow crab and Atlantic cod.
Inshore, two pose the biggest bycatch threats:

- **Herring bait fishery**: bait for shellfish traps, surface-set gillnets, near shore

- **Inshore commercial cod fishery**: deep-set longlines and gillnets

Atlantic Herring bait fishery

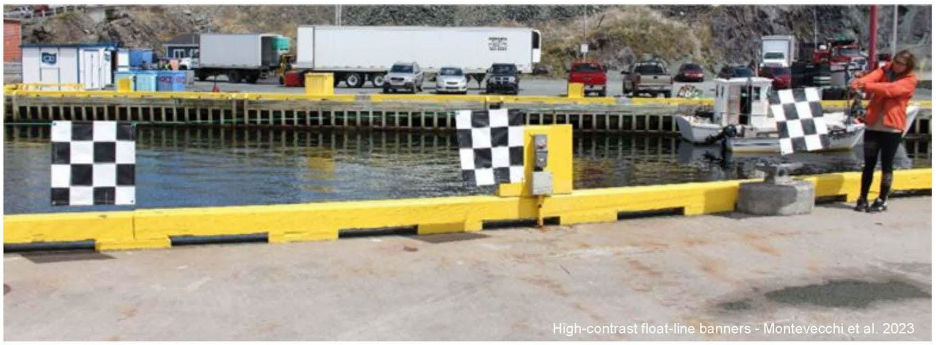
Largely unmonitored fishery, produces bycatch of other fishes, seabirds, and rarely, marine mammals



Gulls pilfering herring from net during haul - R. Blackmore

Atlantic Herring bait fishery

Bycatch reduction w/ visual deterrents have been investigated in the past: no success

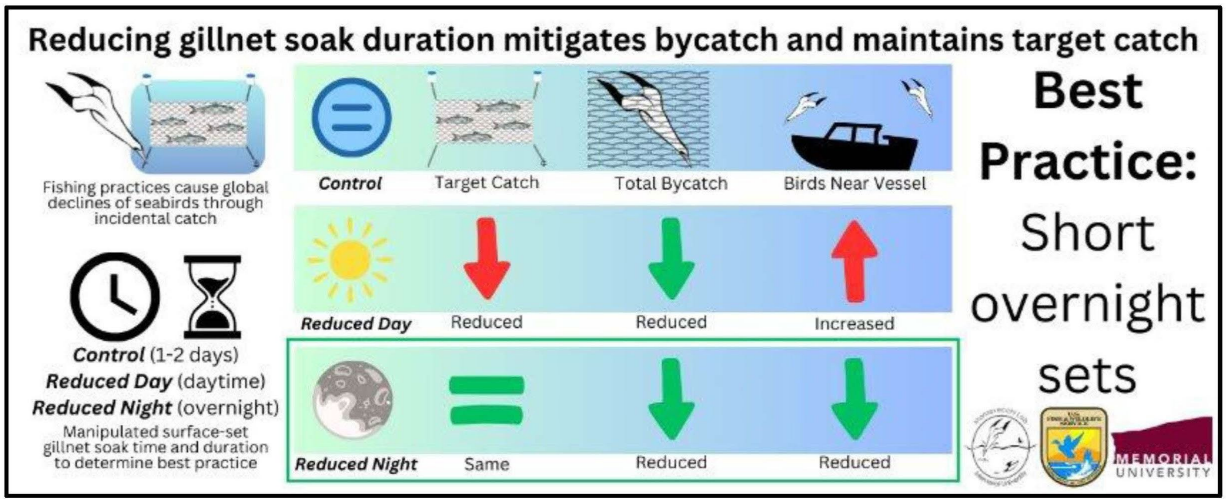


High-contrast float-line banners - Montevecchi et al. 2023

Most basic method to reduce bycatch is to reduce the time that gear soaks in the water

Atlantic Herring bait fishery

TRIAL: 2024 single-year study compared 24 hr sets to reduced ~12 hr sets



Atlantic Herring bait fishery

Results: **12 hr overnight** sets ideal to maintain catch and reduce bycatch

- Double the effort: set in the evening and haul in the morning
- Nets anchored (difficult to remove from water)
- Herring only provide bait, no incentive

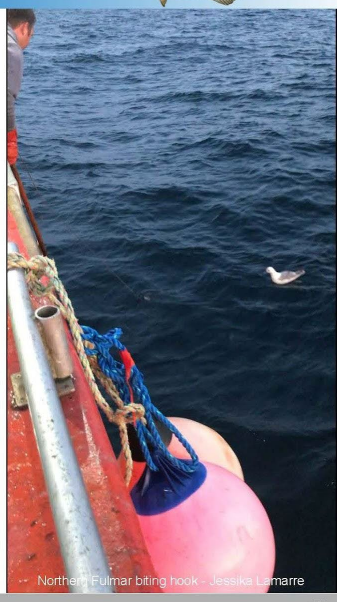
RECOMMENDATION: **24 hr soak, haul in morning** - standard practice, minimizes bycatch, freshest catch does not sit in net during day when seabirds forage


Gannet bycatch close call - R. Blackmore

Reference: Collins et al. (2025) PLoS

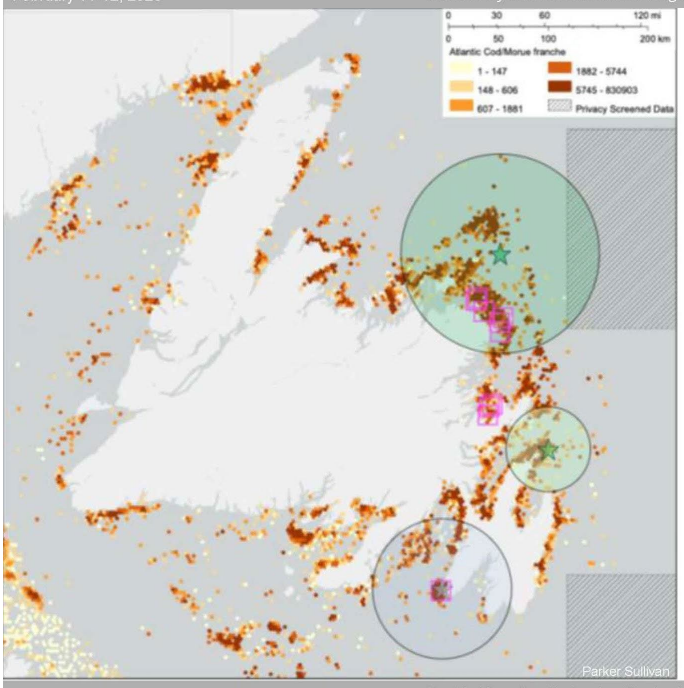
Atlantic Cod commercial fishery

- Many traditional gears including baited handlines and longlines, but <u>deep-set gillnets</u> most common
- Bycatch can occur during *setting and hauling*:
  Surface-feeders and shallow divers (Northern Fulmars, Northern Gannets, gulls, shearwaters)
- Bycatch can occur during *soak*:
  Deep-diving species (Common Murres, some shearwaters)


Northern Fulmar biting hook - Jessika Lamarre


Manx Shearwater gillnet bycatch - Jessika Lamarre

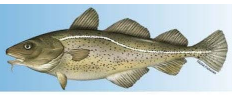

Common Murre gillnet bycatch - Andrew Chaulk



Overlap cod gear x breeding seabird foraging x capelin spawning

- DFO map of cod fishing gear distribution (gillnets and longlines, 2012-2021)
- Published foraging ranges for major colonies of gannets and alcids
- Published location of key capelin deepwater spawning sites (= seabird bycatch hotspots)

Atlantic Cod commercial fishery



RECOMMENDATION: set gear (gillnets & baited longlines) *before* sunrise to vastly reduce seabird interactions and bycatch potential

Great Shearwater attracted to bait - Jessika Lamarre

Remaining issue: bycatch can still occur during soak and when birds congregate (gutting fish on board vessel)

Current focus: bycatch reduction

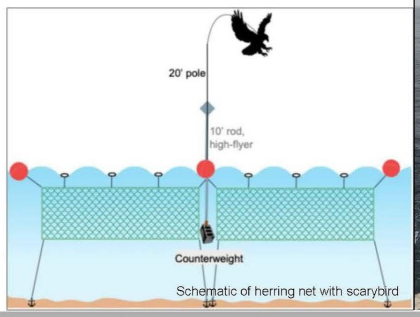
SOLUTION? Further reduce bycatch potential of gear, notably surface- and deep-set gillnets

Pilot trials of "Scarybird" kites in herring & cod fisheries

Preliminary findings:

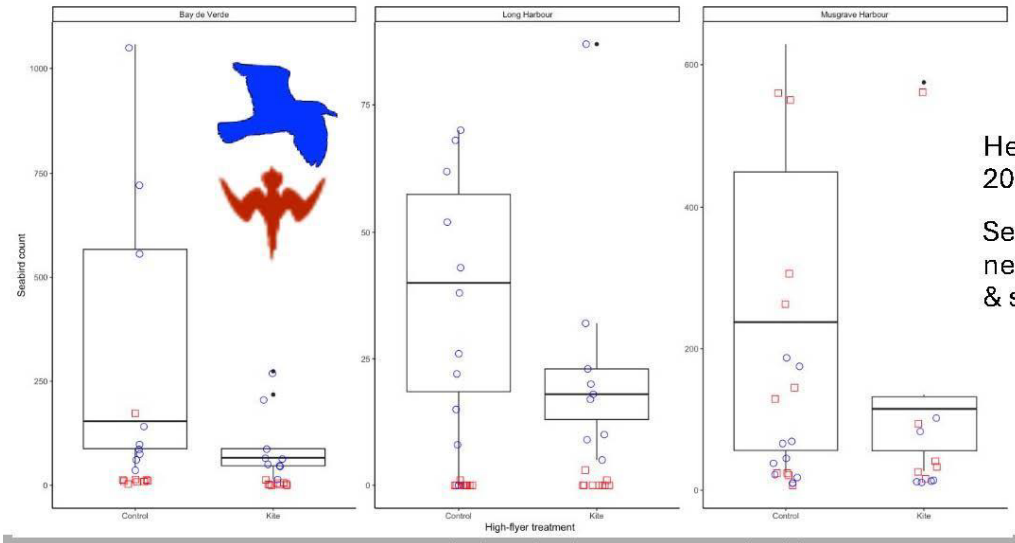
- Above-water visual deterrent; little to no effect on catch rate of the gear
- Year 1 (2025) promising seabird deterrent

Bald Eagle kite - Jackite



Schematic of herring net with scarybird

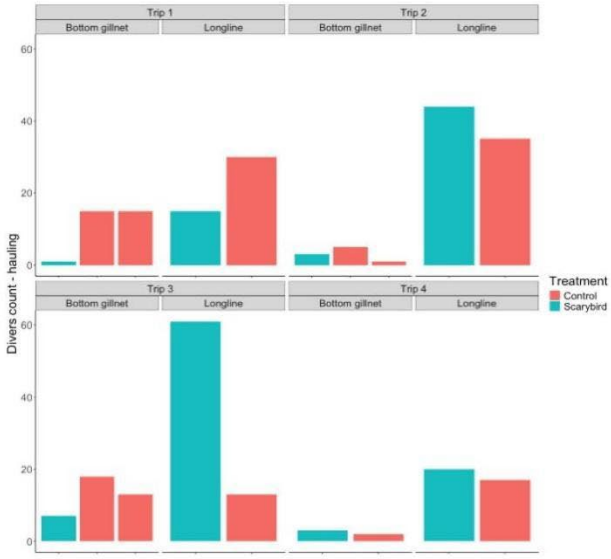
Current focus: bycatch reduction



Herring fishery 2025

Seabird counts near vessel: divers & surface-feeders

Current focus: bycatch reduction



Cod fishery 2025

Longline & gillnet

Diving seabird count near vessel (gannets, murres, puffins)

Future Directions

- Year 2 (2026): pilot deployment of durable "falcon-silhouette" kite
  - → Demonstrated effective in European studies (e.g. Almeida et al. 2023, Frade et al. 2025)

Falcon silhouette - Scarybird

- If continued success - introduce to harvesters for expanded use through outreach

Bill Montevecchi public outreach, World Oceans Day (R. Blackmore)


Eagle vs. falcon scarybird roof trials (R. Blackmore)

Potentially Best Practices

- **"Toolbox" Approach:** Set of well-tested practices that have proven effective in specific cases

- **Selection of Specific Practices Informed By:**
  - Fishery
  - Marine habitat & geography
  - Bird species affected
  - User expertise
  - Weight of evidence of efficacy under similar situations

- **Cost/Effort to Benefit Considerations:** Reduction of target bycatch vs. how much time/resources/effort needed to implement → Is it practical?

Weighing Costs & Benefits of Practices

Highest Impact

•Gear buyout*
•Time/area closures*

•Soak time management*
•Hotspot avoidance*

•Offal management
•Bird-beneficial baiting (*limited fisheries*)

• Net cleaning

•Frequent net attendance

•Maximizing set depth

Lowest Cost/Effort — Highest Cost/Effort

•Visual deterrents (kites/buoys)

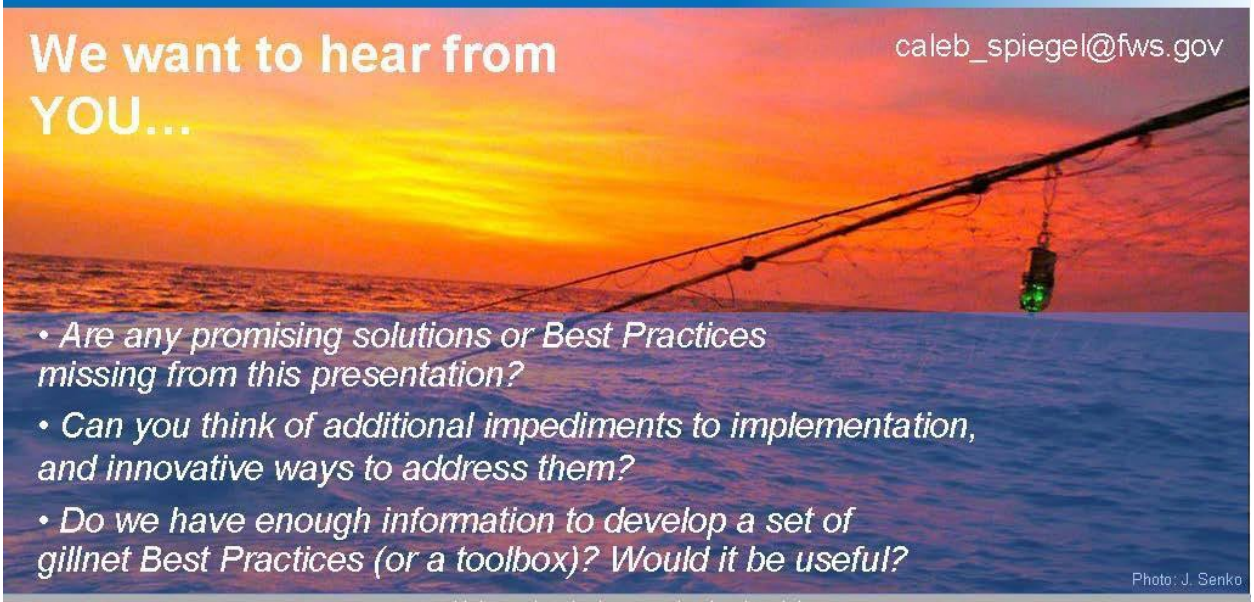
•Visual/acoustic alerts

•Maintain net tension

Lowest Impact

'**Impact**' defined as reduction in seabird bycatch; '**Cost/Effort**' for (1) fishers, & (2) management entities
*Mostly regulatory not voluntary

Future Directions



APPENDIX F. Baiting Practices and Bycatch Reduction Promotion Mechanisms Presentation (Coonamesset Farm Foundation & partners)

Investigation of baiting practices on catch and bycatch in gillnets and design of an effective outreach program to minimize seabird bycatch

Seabird Bycatch Reduction Strategies Workshop
February 11-12, 2026

Coonamessett Farm Foundation

Small Boats. Big Ideas.

NOAA

Project participants

Lead research organization

Coonamessett Farm Foundation

CFF's mission is to conduct collaborative scientific research and educational projects that support sustainable fisheries operation, local small-scale agriculture and aquaculture, and renewable energy development.

Since our founding in 2008, we have developed our research projects with fishermen to ensure that their expertise and knowledge of the marine environment meaningfully informs project design and implementation.

More effective and long-lasting solutions

Fishing partners


FV Constance Sea

FV Miss Fitz


FV Stranglehold

FV Carol Marie


FV Dawn Treader

Outreach

Cape Cod Commercial Fishermen's Alliance

Small Boats. Big Ideas.

CCCFA is fishermen, community members, public officials and scientists working together to build creative strategies, advocate for improved marine policies, protect the ocean ecosystem, and ensure the viability and future of Cape Cod's fisheries.

Since 1991, we've worked with commercial fishermen to tackle the issues faced by the fishing industry, focusing on engaging fishermen in the management process, supporting small fisheries businesses, collaborating on fisheries science and educating both the fishing community and the broader public.

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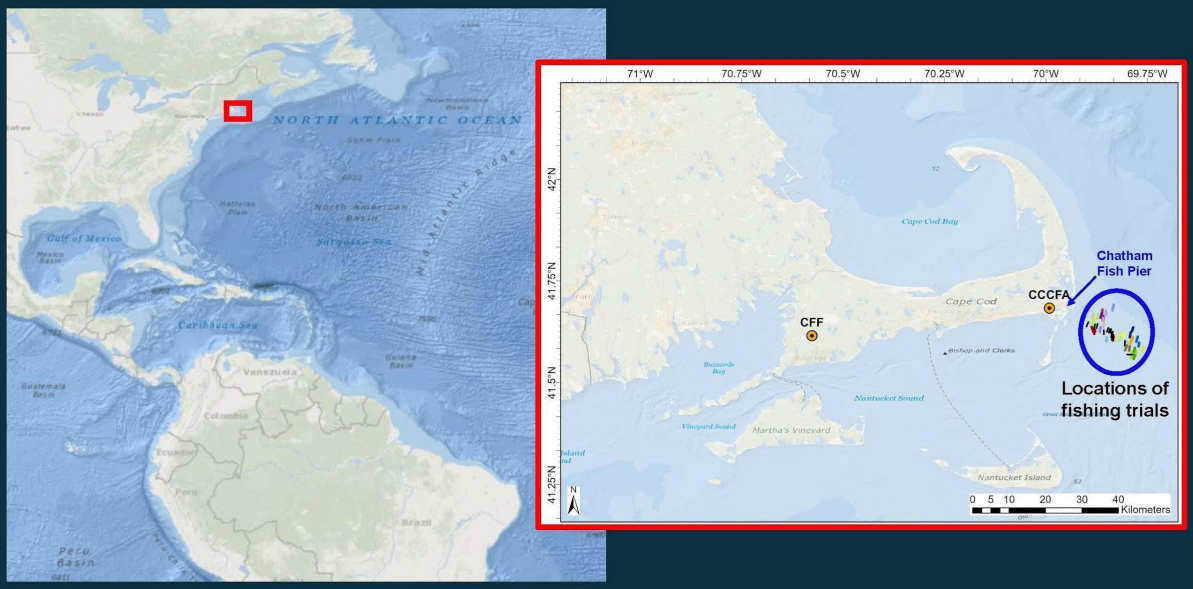
Location of project



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Project focus

The issue

Great Shearwaters often forage near fishing vessels, taking advantage of easily available food sources being discarded from the vessels. Bycatch of Great Shearwaters has been particularly high in gillnets targeting spiny dogfish in the waters off Cape Cod, MA. Fishermen toss bait directly on their gillnets while they are being deployed in an effort to increase dogfish catch efficiency because their fishing windows are limited by the tidal cycle; this baiting causes shearwater bycatch spikes.

Testing strategies for reducing bycatch

Would baiting in front of the nets (forward baiting), after setting (after baiting), or uptide of set nets (end baiting) increase target catch efficiency while minimizing shearwater bycatch?

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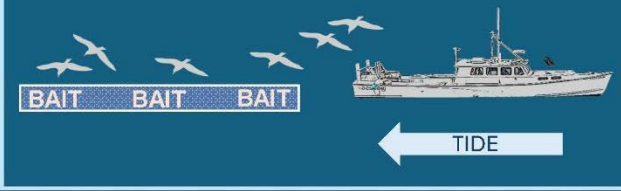
Direct baiting

Seabirds congregate by the stern where the nets and the bait are going overboard.

Bait is dropped onto the nets as they are deployed



Seabirds congregate at the stern and over the nets as they are sinking, diving into the nets as they are deployed.

Seabirds end up in the nets.

Use of this baiting method resulted in very high levels of seabird bycatch in the past

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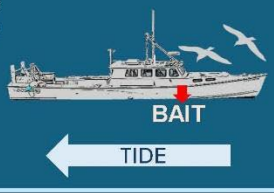
Alternative method 1: Forward baiting

Bait is dropped over the side of the vessel away from the stern.

Seabirds congregate by the side of the vessel where the bait is going overboard.

Nets are set off the stern of the vessel when the bait is already sinking off to the side.



BAIT BAIT

Seabirds are still congregating by the hauler where the bait is going overboard or following the bait until it sinks.

Seabirds do not end up in the nets.

Nets end up set on the bait.

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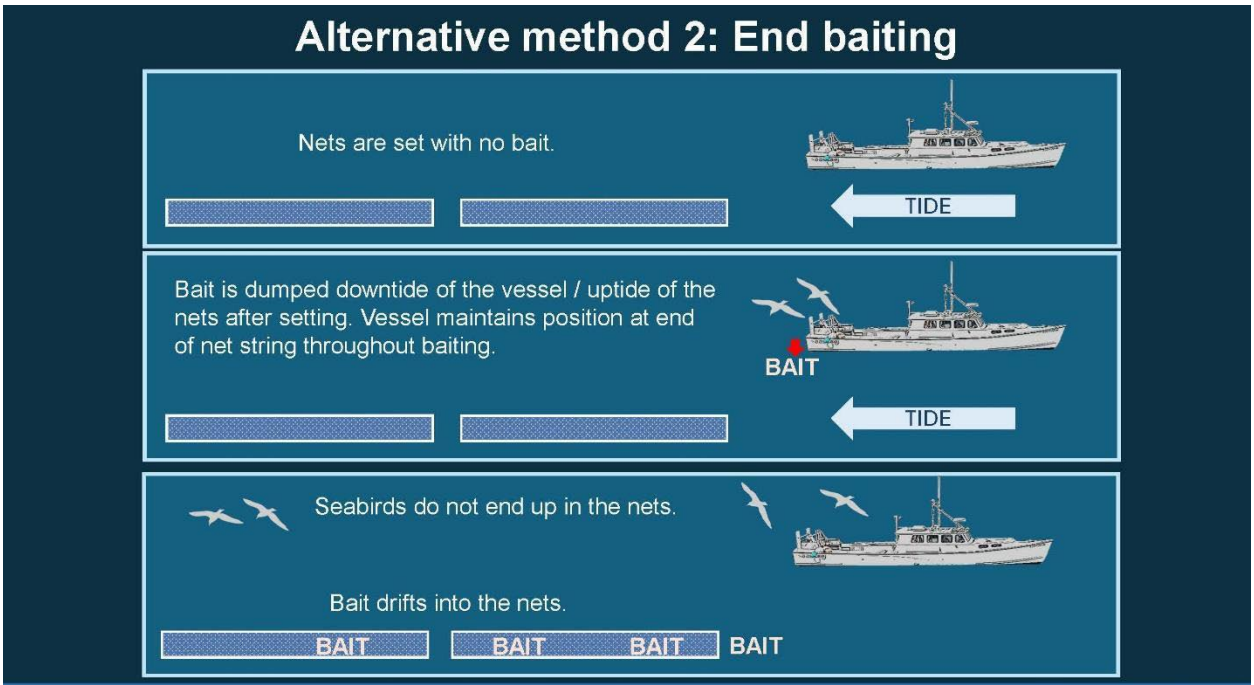
Alternative method 2: End baiting
Nets are set with no bait.
TIDE
Bait is dumped downtide of the vessel / uptide of the nets after setting. Vessel maintains position at end of net string throughout baiting.
BAIT
TIDE
Seabirds do not end up in the nets.
Bait drifts into the nets.
BAIT
BAIT
BAIT
BAIT
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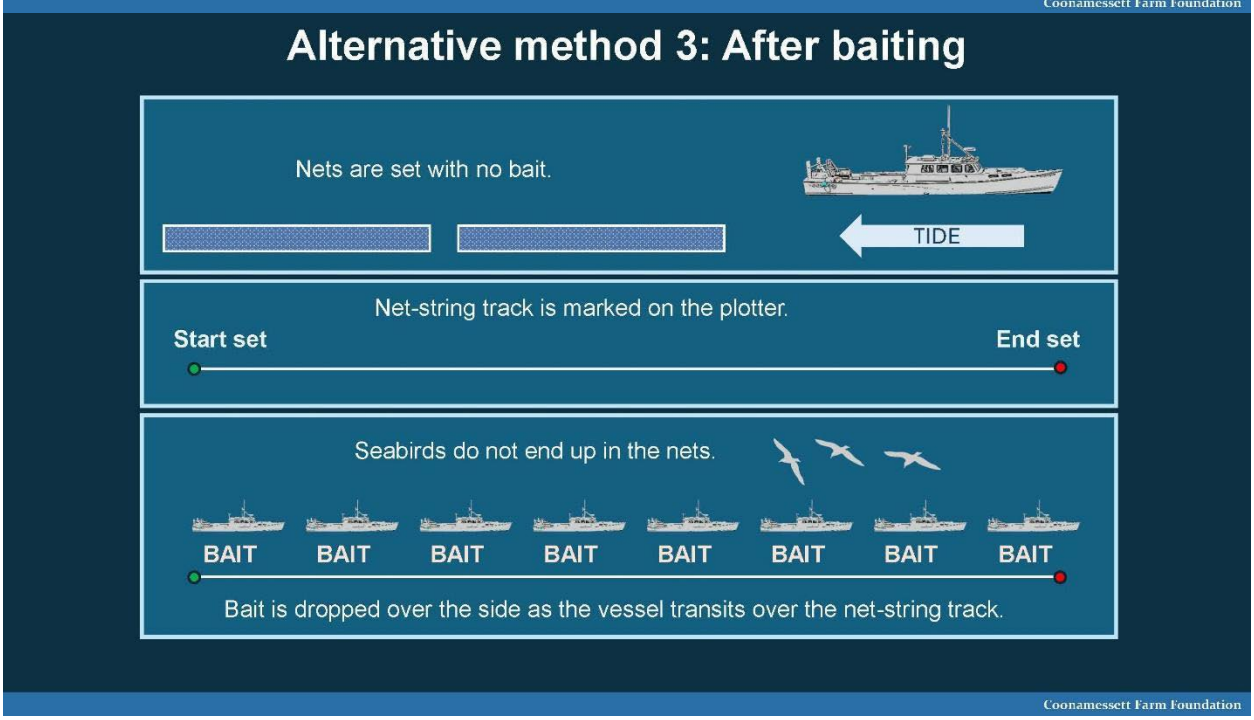
Alternative method 3: After baiting
Nets are set with no bait.
TIDE
Net-string track is marked on the plotter.
Start set
End set
Seabirds do not end up in the nets.
BAIT
BAIT
BAIT
BAIT
BAIT
BAIT
BAIT
BAIT
Bait is dropped over the side as the vessel transits over the net-string track.
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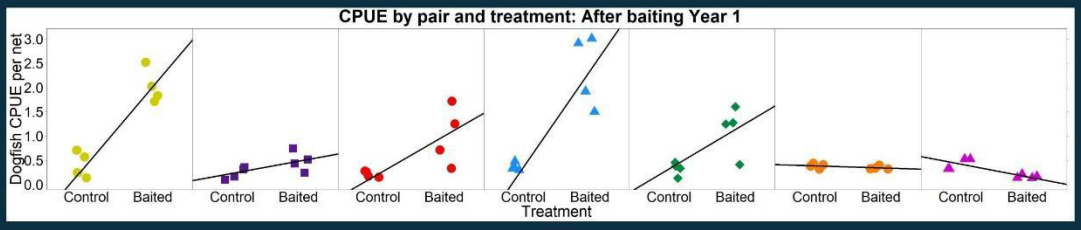
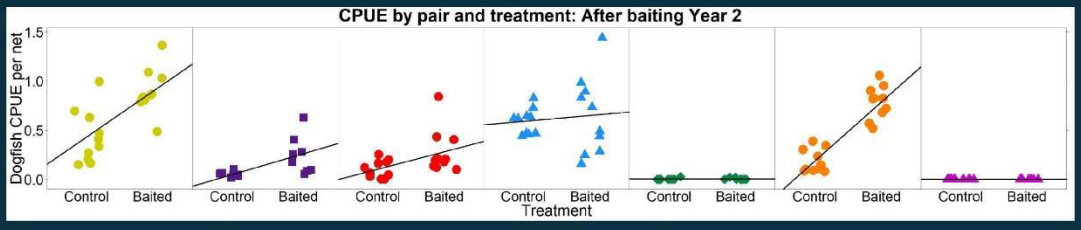
After baiting

NO seabird bycatch

Significant increases overall in Catch Per Unit Effort (CPUE) in both years.



Year 1: each string was half baited and half control



Year 2: two vessels fished as a pair, and each whole string was baited or control

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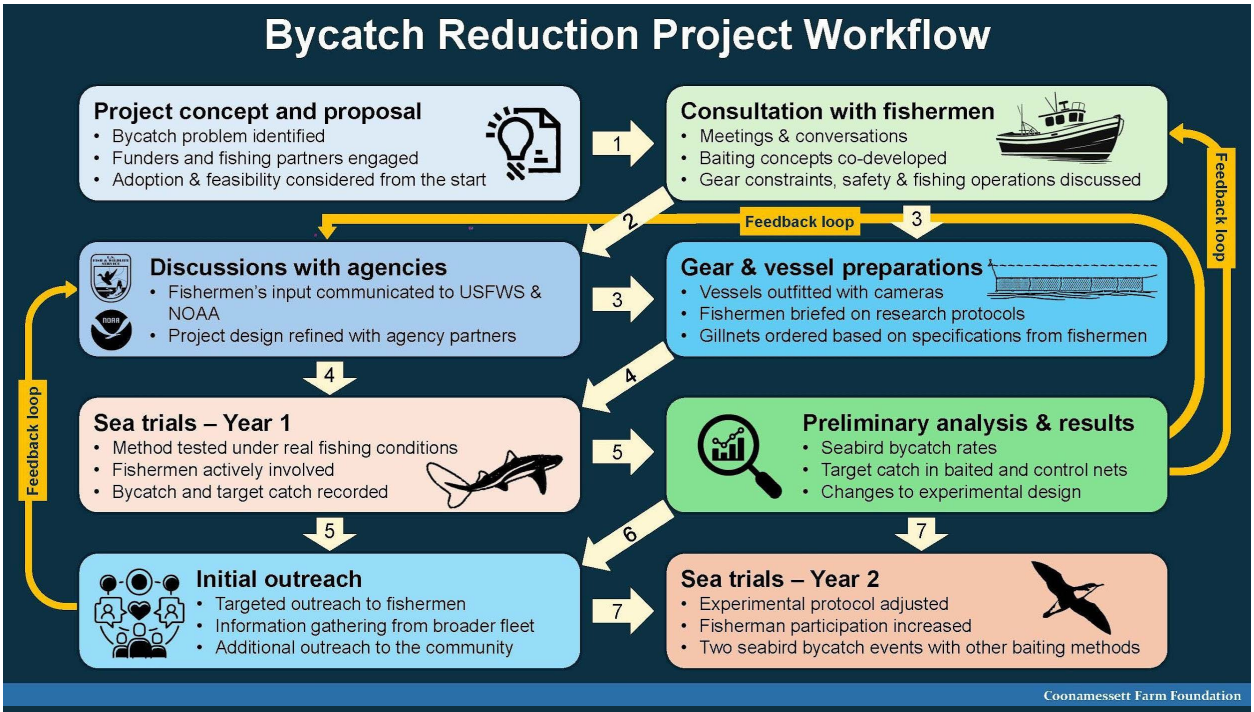
Bycatch Reduction Project Workflow
Project concept and proposal
• Bycatch problem identified
• Funders and fishing partners engaged
• Adoption & feasibility considered from the start
1
Consultation with fishermen
• Meetings & conversations
• Baiting concepts co-developed
• Gear constraints, safety & fishing operations discussed
Feedback loop
2
3
Feedback loop
Discussions with agencies
• Fishermen's input communicated to USFWS & NOAA
• Project design refined with agency partners
3
Gear & vessel preparations
• Vessels outfitted with cameras
• Fishermen briefed on research protocols
• Gillnets ordered based on specifications from fishermen
4
4
Feedback loop
Sea trials – Year 1
• Method tested under real fishing conditions
• Fishermen actively involved
• Bycatch and target catch recorded
5
Preliminary analysis & results
• Seabird bycatch rates
• Target catch in baited and control nets
• Changes to experimental design
5
6
7
Initial outreach
• Targeted outreach to fishermen
• Information gathering from broader fleet
• Additional outreach to the community
7
Sea trials – Year 2
• Experimental protocol adjusted
• Fisherman participation increased
• Two seabird bycatch events with other baiting methods
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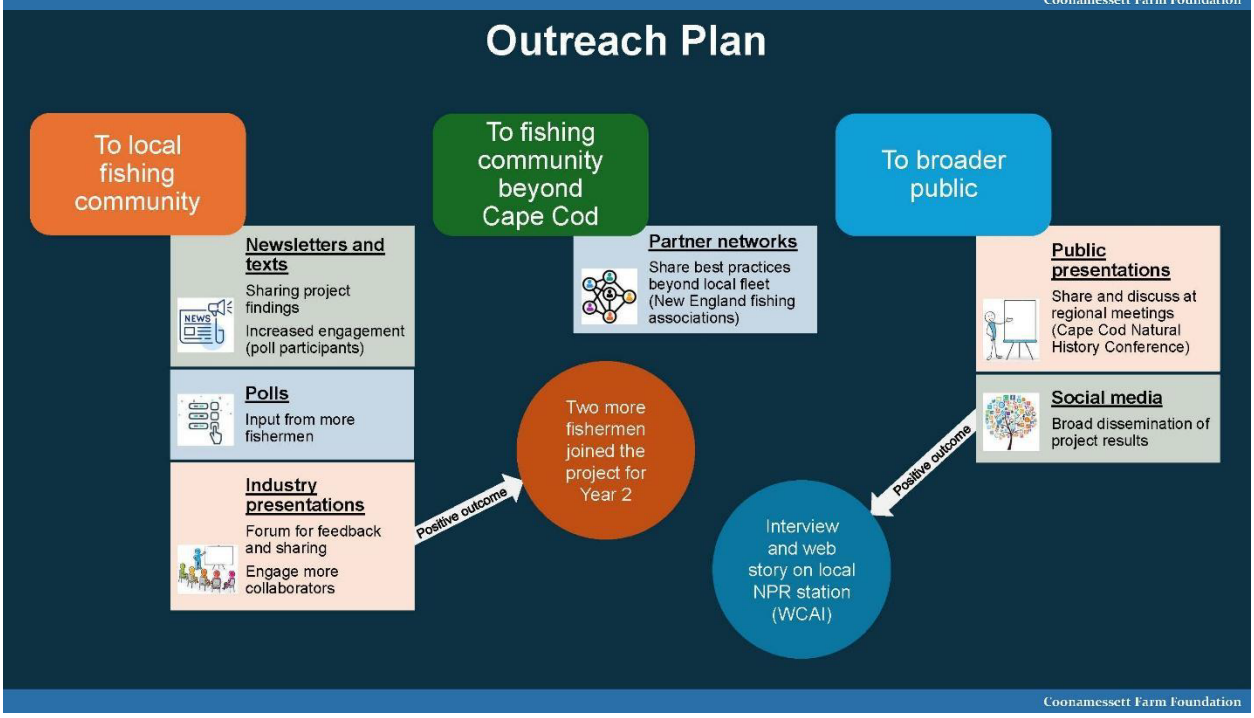
Outreach Plan
To local fishing community
To fishing community beyond Cape Cod
To broader public
Newsletters and texts
Sharing project findings
Increased engagement (poll participants)
Polls
Input from more fishermen
Industry presentations
Forum for feedback and sharing
Engage more collaborators
Partner networks
Share best practices beyond local fleet (New England fishing associations)
Public presentations
Share and discuss at regional meetings (Cape Cod Natural History Conference)
Social media
Broad dissemination of project results
Positive outcome
Two more fishermen joined the project for Year 2
Positive outcome
Interview and web story on local NPR station (WCAI)
Coonamessett Farm Foundation

Adoption of bycatch reduction strategies

Barriers to adoption	How this project addresses these barriers
Difficulty of adopting new methods/gear	• Fishermen involved in project design from the start
Trust that new method is a viable option	• At-sea trials with participating fishermen. • Early adopter trials to increase confidence in method
Cost of new gear	• No specialized gear is required
Risk of reduced catch	• At-sea trials showed that catch increased overall
Burden of additional fishing time	• Simple baiting change did not add much time to fishing operations

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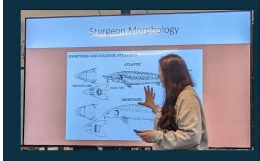
Panel


Greg Connors
Commercial fisherman and project collaborator from the beginning (FV Constance Sea)


John Our
Commercial fisherman and project collaborator from the beginning (FV Miss Fitz)



Emily O'Toole
CFF research technician who went out on many of the project sea trials

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