Networking session Report

From stock assessments to offshore wind planning: Working toward enhanced utilization of fishery dependent information

Conveners: Anna J.M. Mercer (USA), Nathalie A. Steins (the Netherlands), Steve Mackinson (Scotland), and Andrew Jones (USA)

Introduction

Fishers develop a unique understanding of ocean dynamics as they observe and interact with the marine environment throughout their careers at sea. Observing the ocean through the lens of commercial harvest and being at sea through different seasons gives fishers insight into ecosystem trends and relationships that may not be apparent to scientists or managers. Thus, they are able to contribute both experiential knowledge, as well as more tangible fishery dependent data about their catches and the marine environment. While the experiential knowledge of fishers is acknowledged by the scientific community, it remains challenging to incorporate this information in fisheries assessments and other scientific products. Fishery dependent data has been brought into the scientific process to a greater degree more recently, but full utilization of this information remains a stubborn issue. Because of this, there is a need for sustained work across regions to share and discuss case studies and best practices for effectively bringing these valuable sources of information into the scientific process.

For this network session we shared case studies and discussed best practices for collecting, summarizing, and applying different types of fisher's knowledge across ICES ecoregions. For example, fishers' and processors' knowledge is being increasingly used to inform catch-per-unit effort indices in stock assessments, fishers' logbooks are being used to estimate the economic impact of offshore wind energy development, and recent research has leveraged fishers' ecological knowledge to identify oceanographic drivers and climate impacts on resource species. These case studies highlighted projects that engage the fishing community in answering research questions about oceanographic dynamics (Squid Squad, USA), ecosystem dynamics (ICES WKIrish, EU), and ocean use, including offshore wind energy development (ROSA, USA).

During this network session we gathered input on how fishers' experiential and quantitative data are collected, stored, and applied to different scientific products and processes in the ICES ecoregions. We discussed challenges that currently prevent each type of fishery dependent information (experiential knowledge, and quantitative fishery data) from being used to its full potential. We then highlighted the types of applications that have been successful for each type of data, if there are lessons that can be learned from these successes, and the transferability of strategies among information types.

Themed Breakout Sessions

1. Ecosystem Science

This topic focused on engaging fishers in advancing knowledge of ecosystem dynamics, including contributions to stock assessments. The case study highlighted was Ecosystem Based Approach to Fishery Management for the Irish Sea (WKIrish, EU). WKIrish was an initiative that focused on conducting an ICES assessment that incorporated a broad view of ecosystem information. This included

engaging with fishers to collect their long-term views on how the ecosystem had changed through time, developing a conceptual model of the focus system, and applying these perceptions to an assessment. This project led to an impactful scientific product, increased dialogue between scientists and fishers, and developed a more holistic understanding of the state of the Irish Sea ecosystem (ICES 2020).

The breakout discussions focused on three topics, which are summarized below.

1. Ways to work with fishers to collect experiential knowledge or quantitative fishery data to contribute to ecosystem science
    a. The breakout discussion covered a wide range of examples of where information from fishers has been used to advance understanding of ecosystem dynamics. These included examples of using fishing platforms/partnerships for the collection of ecosystem data including catch, diet, biological data, acoustics, and water temperatures, as well as examples of increasing the interaction between fishers and scientists to facilitate knowledge sharing and enhancement of trust, such as scientists sailing on fishing vessels or scientists having in-person semi-structured conversations about targeting decisions with fishers (to share perceptions as well as quantitative data). There was also discussion about how the collection of knowledge and data from fishers has been facilitated via management or compensation in some circumstances.

2. How data have been incorporated/used in ecosystem science
    a. First, it was noted that information from fishers has been the basis for many research proposals, e.g., that observations can help develop hypotheses to be tested with additional data or analyses. Second, participants highlighted that information from fishers has been applied in the development of conceptual models for socio-ecological systems. Other examples were given of applications for fisher collected data being used in more traditional stock assessments (e.g., through a CPUE), or into regional climate/weather models. The potential of the data to serve as a longer time series, and to detect unusual events was also highlighted as a strength of this type of information.

3. Other opportunities to collect and apply knowledge and data from fishers to ecosystem science:
    a. The breakout discussion highlighted that there are many opportunities to improve the exchange of knowledge between fishers and scientists and the application of that shared knowledge to ecosystem science. This includes getting information/analyses back to fishers, and engaging fishers more holistically in the science and management processes. Additionally, there are clear areas for improvement in assimilating data into ecological models and in building capacity to store industry-based data (both environmental and biological). Using industry data to predict fishery events (e.g., bycatch) or calibrate gears were areas that participants identified as ripe for progress. Participants also highlighted the need to improve the analytical capacity and expertise for working with information and data provided by industry, which are often collected using more complex sampling schemes (e.g., not a random sample). Finally, this breakout discussion made it clear that there is a clear and pressing need to standardize

and make available qualitative data from fishers so that it can be more easily incorporated into stock assessments and ecosystem research.

2. Fisheries Oceanography

This topic focused on engaging fishers in advancing knowledge of fisheries oceanography, including environmental drivers of fish stocks and the impacts of climate change. The case study highlighted was Squid Squad (USA). The "Squid Squad" is an interdisciplinary team of federal and academic researchers, industry members, and fisheries managers that are working together to investigate the complex interplay between oceanography and the Northern Shortfin Squid fishery. This highly collaborative team developed organically as they sought to gather both scientific expertise and incorporate fishers' ecological knowledge of both the fishery and regional oceanography. For almost 3 year the Squid Squad has been sharing knowledge and observations, while working together to improve data collection and visualization tools, analyze biological and oceanographic data, develop conceptual and statistical models, publish manuscripts, create platforms for tracking oceanographic conditions, and coordinate field sampling efforts between commercial fishing and research vessels (Salois et al. 2023, Mercer et al. 2023). The Squid Squad serves as an example of how interdisciplinary partnerships among scientists and industry stakeholders can improve the insights and understanding of a data limited stock, and what is achievable through open collaboration and cooperative research.

The breakout discussions focused on three topics, which are summarized below.

1. Ways to work with fishers to collect experiential knowledge or quantitative fishery data to contribute to fisheries oceanography
    a. Discussions around working with fishers to collect experiential knowledge and quantitative fishery data to contribute to fisheries oceanography highlighted a suite of successful initiatives and important considerations. Communication was a common theme as a majority of participants mentioned the importance of being both thoughtful and intentional about the ways we discuss data collection with industry. In particular, working to find ways to not only build trust but also social capital so that industry members can truly invest in these types of partnerships. One example of this is the co-creation of research by the inclusion of fishers in the proposal writing or experimental design processes, asking fishers what oceanographic features they are looking for and think are important, and understanding what drives their fishing activity. The groups talked about ways to ensure there is incentive for fishers to help scientists, such as financial compensation or access to fishing grounds. Participants shared multiple initiatives currently being employed to collect oceanographic data from industry including, acoustic data collection while vessels are steaming, interviews and GPS polling to understand the spatial dynamics of fishing behavior and related oceanographic dynamics. Additionally, participants noted the value and potential for the collection of data shoreside, for instance working with processors not just fishers themselves. A final common thread among these discussions was the consideration of ways in which the science community can facilitate the reciprocal flow of information. Suggestions included the providing of research tools to vessels (such as updated technology or phone applications) as well as visualization tools to convey physical ocean dynamics in relation to fishing efforts.

2. How data have been incorporated/used in fisheries oceanography
    a. Network session participants identified a myriad of ways in which data collected from the fishing industry has been incorporated into fisheries oceanography. These valuable qualitative and quantitative data sources have been used to build conceptual models for experimental design, inform MPA design and placement, develop the timing of fishing seasons and structure dialogue in a management context. Oceanographic data collected by fishers have been used directly in bycatch mitigation models as well as short-term weather forecasting, acoustic data has been used in ecosystem models, informed biomass estimation and species identification algorithms. These types of data have also been used to increase fishing efficiencies (e.g., fishing smarter not harder) aiding in the understanding of catchability, maximizing catch rates, and minimizing bycatch. Participants did note that challenges still remain in how to format and quantify the incredible amount of knowledge and observations that industry has to provide.
3. Other opportunities to collect and apply knowledge and data from fishers to fisheries oceanography
    a. This network session provided an opportunity for participants to brainstorm other opportunities to collect and apply knowledge and data from fishers to fisheries oceanography. Many noted that while there are some great examples of industry knowledge and data being used for science (detailed above), there are still many untapped opportunities for both data collection and application. Data collection efforts that were suggested included the flagging and monitoring of unusual events from fishers and the collection of observational data around phenology and changes in spatial distribution of species to get at the broader picture of ecosystem functioning over time. Furthermore, fisher's experiential knowledge could support the designing of new data streams to increase multi-use products. Participants noted the potential for the application of fishery-dependent data across scientific disciplines and more widely across ocean sciences. These data can be used for management plans considering habitat and species diversity patterns, to understand the role of economics and seasonality in fishing activity, as well as scientific evidence to inform policy. Additionally, these types of data could be used for data assimilation in biological models and models that support dynamic ocean management. Participants noted that there may be opportunity to work with manufacturers to develop equipment for industry data collection and sharing. This session also highlighted some of the challenges including a need to develop tools to handle the size and amount of ‘big data’ collected by oceanographic instruments on larger vessels on longer trips as well as finding ways to collect more of fisher’s ecological knowledge about ecosystem change in quantitative ways. Ultimately, the group highlighted that the collection and application of data from fishers improves the quality and impact of the science.

3. Ocean use planning

This topic focused on engaging fishers in ocean use planning, including offshore wind energy development. The case study highlighted was the Responsible Offshore Science Alliance (ROSA, USA). ROSA is a science-focused NGO founded by commercial fishermen and offshore wind developers to advance research, monitoring, and methods on the effects of offshore wind energy development on

fisheries across US federal and state waters. ROSA will soon be starting up a project that focuses on developing partnerships between fishermen and floating wind design engineers to optimize access to floating wind arrays.

The breakout discussions focused on three topics, which are summarized below.

1. Ways to work with fishers to collect experiential knowledge or quantitative fishery data to contribute to ocean use planning
    a. Participants reported using a variety of tools to engage with fishers in the context of ocean use planning, including surveys, interviews, biological sampling, and high-resolution fishing effort and catch data collection. Successful collaborations between fishers and scientists relied on trust, open communication, transparency, and shared goals. In many countries, building trust is difficult due to historical distrust between government/science and fishers. Furthermore, examples were shared where there were tensions between fishers who participated in data collection efforts to support the science behind ocean use planning and those who did not.
    b. Building trust was easier in countries where scientists fostered collaborative analysis of data that valued fisher input. For example, scientists might verify findings with fishers before sharing them with planners. Scientists might also provide data to fishers so that they can be empowered to use it in planning. For example, in one instance fishers used collected data to establish protected areas outside of their preferred fishing zones. While data sharing and transparency allow more scientist and fisher collaboration, researchers noted the balance between sharing information to foster collaboration and protecting trade-secret fishing areas. In some cases, establishing a Memorandum of Understanding before engagement was helpful in establishing clear guidelines for collaboration, data usage, and data sharing. Establishing shared goals was also an important tool for building trust among collaborating fishers. In many cases, the shared goal was to work collaboratively to address the uncertainties and potential impacts of offshore wind energy development. Participants noted that harnessing other shared goals earlier in the process could yield more sustainable results. Overall, finding ways to make data outcomes and uses clear to fishers was a useful tool in promoting collaboration and fostering productive relationships between groups.
2. How data have been incorporated/used in ocean use planning
    a. Data from fishers have been used to denote areas that were important fishing grounds and should not be included in either marine protected areas or wind development areas. Some surveys have been used to evaluate fishing practices before and after offshore wind construction and operations. Fishing industry catch information has been used to inform sampling efforts and industry resources have been used to expand scientific sampling. Fisheries data has been used to validate other studies of spatial ecosystem services and fishing locations.
3. Other opportunities to collect and apply knowledge and data from fishers to ocean use planning
    a. Engaging with fishers and industry on a more collaborative level could lead to more fruitful discussions of spatial use. Participants suggested scientists joining fishing trips, asking fishers to validate spatial analysis findings, asking fishers to rate their most

important fishing locations if effort were to be reduced, and providing compensation or other incentives for participation. The biggest opportunity noted by participants was in finding ways to build more trust between fishers, scientists, and industry through data sharing and collaborative analysis.

Conclusions

Participants in this network session contributed their perspectives and experiences working with fishers to collect and apply fishery dependent information to explore science questions related to ecosystem science, fisheries oceanography, and ocean use planning. Examples ranged from instrumentation of fishing vessels as ocean observing platforms to collaborative biological sampling to high resolution catch and effort data collection. During discussions, participants made recommendations for how to build and sustain momentum on the use of knowledge and data from fishers in the scientific process. Common recommendations across research themes included setting clear and reasonable expectations and goals from the start, building social capital within the fishing community, diversifying the group of fishers engaged in research, developing incentives for sustained industry collaboration, and demonstrating the utility of the data and knowledge shared by industry through tangible science products. Priorities for next steps and future work included standardizing the storage and availability of the data and knowledge provided by industry, developing expertise and capacity for working with the knowledge and data from fishers (including development of new analytical techniques), leveraging relationships with fishers to develop hypotheses for new research, applying industry knowledge and data to sense-check assessment outputs and management recommendations, and expanding the group of fishers engaged in collaborative research. The discussions initiated during this network session will be carried forward into the ICES WKAFPA meeting scheduled for October 10-12, 2023.