FishSCORE2030:
Fisheries Strategies for Changing Oceans and Resilient Ecosystems by 2030

Full Day Workshop: March 3, 2024
World Fisheries Congress
Seattle, WA

Fisheries Strategies for Changing Oceans and Resilient Ecosystems by 2030 (FishSCORE2030) is working to sustain fisheries as a global source of food and jobs, while protecting ocean ecosystem health and enhancing equitable benefits from fisheries. FishSCORE2030 is built on the core principles of inclusivity, equity, and diversity that will inform and strengthen collaborations and partnerships. FishSCORE2030 is an endorsed programme of the United Nations Decade of Ocean Science for Sustainable Development. The programme will result in direct outputs such as context-specific climate resilient strategies and synthetic outputs such as science and policy recommendations. A key outcome of the program and the FishSCORE2030 Network will be the development and implementation of practices that increase climate resilience in fisheries while simultaneously increasing the sustainability of marine ecosystems and food systems, as well as equity and agency of the people and communities that rely on them.

Workshop Goals:
Our goals for the workshop were to provide background about the FishSCORE2030 programme and to facilitate discussions about pathways to build climate resilience in fisheries, climate vulnerability and resilience assessment and planning, and co-development of knowledge and tools for resilience building.

Workshop Agenda:

08:30-08:45   Arrival and networking

08:45-09:00   Welcome and overview of today's workshop
Kathy Mills and Kristin Kleisner (FishSCORE2030 co-leads)

09:00-09:45   Introductions by all participants
Name, Organization, and where you are joining from

09:45-10:15   Overview of the FishSCORE2030 Program
Claire Enterline (FishSCORE2030 coordinator)
Full group discussion and Q&A

10:30-11:00   Morning break: Coffee and refreshments available in the hallway

11:00-11:15   Topic 1: Pathways to build climate resilience in fisheries
Presentation: Kristin Kleisner

11:15-11:40   Lightning talks on Topic 1 (5 mins each)
Ming-An Lee, National Taiwan Ocean University: Adapting to changing environmental conditions in the flathead grey mullet fishery in Taiwan Strait
Paola Diaz-Canales, Research Center of Marine Science and Limnology, University of Costa Rica: Adaptation strategies of a coastal community in an upwelling area of Costa Rica

Mary Grace C. Sedanza, University of the Philippines Visayas: UP Visayas Fisheries and Coastal Resilience Initiatives
Full group discussion and Q&A

11:40-12:20   Breakout discussion groups on Topic 1: Pathways to build climate resilience in fisheries

12:20-12:30   Morning Wrap-up

12:30-13:30   Lunch Break

13:30-13:40   Topic 2: Climate vulnerability and resilience assessment and planning
Presentation: Jacob Eurich (FishSCORE2030 Coordination Group)

13:40-14:10   Lightning talks on Topic 2 (5 mins each)
Daniel Corrie, Australian Fisheries Management Authority: Australia's Climate Risk Integration Framework: Using readily available information to assess the risk and integrate climate risk in decision making.
Marina Sanz-Martín, Spanish Institute of Oceanography: Fish, fisheries and climate change in the Spanish fishing sector
Tyler Loughran, Azura Consulting LLC for NOAA Fisheries Atlantic Highly Migratory Species Management Division: NOAA's Atlantic Highly Migratory Species Climate Vulnerability Assessment
Full group discussion and Q&A

14:10-14:20   Short Break

14:20-14:35   Topic 3: Co-development of knowledge and tools for resilience building
Presenter: Kathy Mills

14:35-14:55   Lightning talks on Topic 3 (5 mins each)
Hem Nalini Morzaria-Luna, Intercultural Center for the Study of Deserts and Oceans: Using Fishery Improvement Projects to increase climate resilience
Samuel Amoros Kohn, Environmental Defense Fund: Observation, Prediction and Early Warning System (SAPO) in the Humboldt Current Large Marine Ecosystem
Full group discussion and Q&A

14:55-15:35   Breakout discussion groups on Topic 2: Climate vulnerability and resilience assessment and planning, and Topic 3: Co-development of knowledge and tools for resilience building

15:35-16:00   Afternoon break

16:00-16:40   Panel Discussion: Operationalizing climate strategies

16:40-17:00   Planning next steps

17:00   Workshop End

Workshop Summary by Agenda Topic

<u>Introductions and definitions of resilience</u>
Before the workshop commenced, participants were invited to write or draw a picture of what resilience meant to them on a Post-It Note to place on the walls for others to consider. To begin the workshop, participants were asked to briefly introduce themselves and describe their definition or reflection on the term *resilience*.

Overall themes included:
- Physical metaphors of things that bend, sway, or stretch but retain their integrity (e.g. bamboo, Stretch Armstrong toy, kelp)
- The intersection of communities, ecological systems, climate impacts, economies, management, and other aspects of fisheries systems, and the need for engagement, respect, and flexibility across these components
- The concept of transformation, both that is occurring in ecosystems due to climate change and that needs to be considered as part of the resilience of communities (e.g. interacting with a changing ecosystem in new ways)
- Historical examples of systems and communities changing, adapting, and/or operating through drastic pressures such as wars, political upheavals, and previous changes in fish abundance
- Descriptions of what resilience feels like on a personal level

<u>Overview of the FishSCORE2030 programme</u>
Presentation: Claire Enterline (FishSCORE2030 coordinator)
Climate change has emerged as one of the greatest challenges facing marine fisheries around the world. Oceans are experiencing ongoing and compounding climate impacts such as acidification, deoxygenation, sea ice loss, marine heatwaves, extreme tropical and extratropical storm events, and sea level rise. These physical manifestations of climate change are impacting marine ecosystems and species, altering reliability for fisheries and influencing the nutrition, health, economic, and well-being benefits derived from them. In addition, increasing storminess threatens safety at sea for fishers; coupled with sea level rise, these threats pose risks to critical shoreside infrastructure that supports fisheries. Given the many ways climate change can impact fisheries, there is a need for interdisciplinary efforts that span fields of physical, ecological, and social sciences as well as community engagement. FishSCORE2030 is designed to facilitate efforts and partnerships at global, regional, and local scales. FishSCORE's global network, which all are welcome to join, brings together diverse participants to learn from one another about climate impacts, resilience approaches, and science and policy needs. Through global and regional workshops and topical working groups, participants will co-develop and apply information and syntheses to support climate-resilient fisheries. The FishSCORE2030 programme will also advance work in various fishery types and regions with the goal of understanding the unique and shared experiences of working to implement climate resilience strategies. Through these and other efforts, FishSCORE2030 aims to advance the science and practice of supporting climate resilience in marine fisheries.

Discussion
Questions following the presentation asked about the scale at which the programme will be working (geographical and fishery size), if the programme is funded, whether the programme will be able to provide funds to support projects, travel, etc., and how the programme plans to facilitate information sharing. FishSCORE2030 leads clarified that the programme is working at multiple geographic scales (local, regional, and global) and fishery sizes. We do not aim to limit the programme geographically or to a specific fishery size. Regarding funding, endorsement by the UN Ocean Decade does not include funding; FishSCORE2030 leads are actively working to garner funding to support program coordination and activities. While we do not currently have funding to provide to network participants, we are hoping to secure funding in the coming years to support projects, an early career ocean professional fellowship program, as well as participation in regional workshops and topical working groups.

Topic 1: Pathways to build climate resilience in fisheries
Presentation: Kristin Kleisner (FishSCORE 2030 co-lead)
Both the ecological and social dimensions of fisheries are being affected by climate change. As a result, policymakers, managers, scientists and fishing communities are seeking guidance on how to holistically build resilience to climate change. Numerous studies have highlighted key attributes of resilience in fisheries, yet concrete examples that explicitly link these attributes to social-ecological outcomes are lacking. To better understand pathways for building climate resilience, we discuss an approach by the SNAPP [Science for Nature and People Partnership] working group on Climate Resilient Fisheries to explore resilience pathways across 18 case studies spanning ecological, socio-economic, governance and geographic contexts and noted some of the current approaches to improving resilience in fisheries around the world. This work is detailed in a recent publication: *[Diverse pathways for climate resilience in marine fishery systems](Eurich, Friedman, Kleisner, and Zhao et al. 2023).*

Lightning talks on Topic 1
Ming-An Lee, National Taiwan Ocean University: Adapting to changing environmental conditions in the flathead grey mullet fishery in Taiwan Strait
Changing fishing methods and gear in coastal areas in Taiwan Strait in the northwestern Pacific have been associated with changes in movements and availability of the flathead grey mullet (*Mugil cephalus* L.) between 1954 and 2020. Flathead grey mullet migrate to the coastal waters for spawning in the winter (December to February) coincident with colder sea surface temperatures. This spawning habitat has shifted over time based on changes in location of optimal water temperature. As the gray mullet catches decreased due to shifting populations, the most common fishing methods and gear have shifted to better target the species. This trend indicates that the local fishing industry has been adapting to the impact of changing environmental conditions on mullet populations.

Paola Diaz-Canales, Research Center of Marine Science and Limnology, University of Costa Rica: Adaptation strategies of a coastal community in an upwelling area of Costa Rica
This research seeks to examine how fishing communities along the Pacific coast of Costa Rica adapt to environmental change. Specifically, this work investigates the social-ecological drivers behind the adoption of different methods for fishing and evaluates how fishing dynamics

changed, specifically with the use of an air-compressor with respect to changes in the seasonality of upwelling. During upwelling, non-compressor fishing methods are limited, creating economic problems for those reliant on non-compressor fishing. Because of drastic annual changes in ecosystem conditions, these changes in upwelling conditions are not always perceived as due to climate change. This work also examines the role of women's collectives, which traditionally are not recognized as having a central role in the fishery, however during upwelling seasons, they organize a group to respond to changes via supporting economic stability through diversifying livelihoods.

Mary Grace C. Sedanza, University of the Philippines Visayas: UP Visayas Fisheries and Coastal Resilience Initiatives
The University of the Philippines Visayas (UPV) Coastline Protection and Development Program is a multi- and trans-disciplinary program that seeks to advance and implement a more nuanced understanding of coastline protection and integrate existing related programs to harness the various development capabilities and collaborations. The program aims to: 1) establish and strengthen partnerships for integrated coastline protection, resilience, and sustainable development and stakeholder engagement; 2) conduct science- and evidence-based capacity development; 3) conduct policy review and development of a policy compendium that contributes to coastline protection and resilience, and to the sustainable development goals (SDGs) of the country; and 4) develop and promote proposed legislation creating the Philippine National Center for Coastline Protection, Resilience, and Sustainable Development. As an example, a current initiative is working to increase production of indigenous mussels through a pilot hatchery project, and investigate adaptation mechanisms for local fisheries impacted by invasive mussels.

Breakout discussion groups on Topic 1: Pathways to build climate resilience in fisheries
These questions were posed to guide small group discussions:
1. What conditions and approaches are emerging as most important for supporting climate resilience in the fisheries you work in?
2. What are some challenges associated with advancing climate resilience in the fisheries you work in?
3. Based on everything you heard today, what is one step you would take to advance climate resilience in marine fisheries (a specific fishery you work in or generally)?

Some of the themes of these discussions included:
- There is both an urgency to respond to changes occurring now, and perception of a lack of urgency in some places. There may be lessons to be learned from disaster preparedness systems.
- Rigidity of management systems is obstructing resilience outcomes. There is a need to get past assumptions of working within a static system (e.g. stock assessment methods, fishing area boundaries). Connecting work globally and making local and regional connections may help to move past these issues.
- It is important to understand and manage adaptively and proactively for impacts of climate change in the context of other changes in the fisheries: for example, aging of the fleet, competition for space with MPAs and renewable energy means we are at risk of

        losing entire fisheries and practices. It is also important to note the influence of foreign NGOs in SIDS and developing countries in these issues.
- There is uncertainty about how recreational fishing fits into this work: how is their effort impacting fisheries? How can they be included in learning about impacts of climate change and in efforts to advance resilience?
- Expanding monitoring and observation data needs to occur to capture impacts of climate change (geographically and designed in ways to determine change).
- Better communication is needed for fishers and managers about the science around these issues (more accessibility and public communication). This includes being thoughtful in how information is shared, and increased engagement with the fishing industry to make information salient to them.
- There is a general need to work with fishermen on data collection and trust of data as a prerequisite for climate resilience. In many places, fishers do not have the social capital to participate in management conversations about these issues. Involving fishers in the science and efforts to lift up their voices is needed.
- There is a need for information systems to bridge the science-to-management gap and provide decision support tools about climate impacts on fisheries. There is currently a disconnect between policy and management and the changes that are impacting fisheries. On the other hand, in some SIDS and developing countries, climate policy does not exist yet, or is nascent, so resilience actions are occurring from the ground-up by necessity.

Topic 2: Climate vulnerability and resilience assessment and planning
Presentation: Jacob Eurich (FishSCORE2030 Coordination Group)
Climate change poses significant risks to marine ecosystems and the communities that depend on them. Identifying and addressing these risks through Climate Vulnerability Assessments (CVAs) is critical for enhancing climate resilience. CVAs are instrumental in pinpointing regions, species, and stakeholders most susceptible to climate impacts, enabling the development of targeted and effective adaptive strategies. By evaluating species' exposure to environmental changes and their adaptive capacities based on life history characteristics, CVAs help determine vulnerability levels. This presentation focused on the role of CVAs in fisheries adaptation and resilience planning and introduced the Climate-Resilient Fisheries (CRF) Planning Tool. The CRF Planning Tool was designed to facilitate the integration of vulnerability assessments into practical, community-driven adaptation planning. Ultimately, we shared tools that practitioners can use to strengthen adaptive capacity, ensuring sustainable livelihoods and ecosystem health in the face of emerging climate risks.

Lightning talks on Topic 2
Daniel Corrie, Australian Fisheries Management Authority: Australia's Climate Risk Integration Framework: Using readily available information to assess the risk and integrate climate risk in decision making
In Australia, various jurisdictions are in different stages of adapting climate resilience and vulnerability assessment. Climate change is preventing stocks from bouncing back despite efforts to reform management. The Climate Risk Integration Framework is a transitional mechanism to describe the vulnerability of different species to climate change to inform future integration of climate data into stock assessments and harvest strategies. The framework is based on a three step process: 1) 'rapidly' identify risk using available data; 2) consider science and management

practices currently in place that may mitigate risk; and 3) identify where additional precautionary adjustments are required to increase climate resilience. The framework is not intended to require or trigger new science or testing before catch limits can be set, but rather to inform how stocks are being impacted using a climate risk ranking.

Marina Sanz-Martín, Spanish Institute of Oceanography: Fish, fisheries and climate change in the Spanish fishing sector
In the western Mediterranean, it has been determined that demersal species are moving south and southwest based on data collected over many years, including fisheries dependent and independent data, and surveys within Marine Protected Areas (MPAs). Researchers from the Spanish Institute of Oceanography are now working to incorporate socio-ecological perspectives into the regional understanding of how the impacts of climate change are affecting fishery systems. This is being accomplished using the Climate Resilient Fisheries Planning Tool through workshops and interviews with fishers, scientists, and managers, with the goal to co-create climate-adaptive strategies.

Tyler Loughran, Azura Consulting LLC for NOAA Fisheries Atlantic Highly Migratory Species Management Division: NOAA's Atlantic Highly Migratory Species Climate Vulnerability Assessment
Climate Vulnerability Assessments have been applied across regions of the U.S. and used in management strategies for incorporating climate impacts into species management. NOAA's Atlantic Highly Migratory Species Climate Vulnerability Assessment (HMS CVA) evaluates the vulnerability of 58 species/stocks to climate change using life history or behavioral characteristics ("sensitivity attributes") combined with the results of a climate projection model ("exposure analysis"). The HMS CVA is a two pronged approach that assesses the magnitude of environmental change and attributes of resilience/adaptation of a species. This pilot effort used updated ocean modeling (CMIP6) and quantitative analysis to create a visualization tool to illustrate impacts on a variety of species and regions. Relevant outcomes of the HMS CVA may contribute to identifying information gaps and research needs, and inform actions managers may pursue to encourage conservation and enhancement of managed resources through other federal initiatives.

Topic 3: Co-development of knowledge and tools for resilience building
Presenter: Kathy Mills (FishSCORE 2030 co-lead)
'Co-development' efforts support partnerships and collaborations that bring together multiple sources and types of knowledge to understand complex problems and identify potential solutions (adapted from Armitage et al. 2011, Norström et al. 2020, and Mills et al. 2023). It is a core tenet of many UN Ocean Decade programs, including FishSCORE, as it leverages local knowledge and scientific information towards achieving sustainable development goals. Both forms of knowledge are needed to understand change at relevant spatial and temporal scales, determine information needs for 'actionable' science, identify suites of options to advance resilience, and evaluate success of different resilience strategies. Moreover, co-development can help activate certain resilience attributes within fishery systems, particularly those related to learning. Within the science-to-action pipeline, co-development efforts seek to involve all concerned rightsholders, stakeholders, and new voices at design, production, dissemination, and implementation stages of the process. FishSCORE is building a global network that includes

scientists, fishery participants, fishery managers and practitioners, and policy experts to bring diverse perspectives, knowledge, and ideas to its efforts. In addition, FishSCORE upholds core principles of inclusivity and diversity, procedural equity, co-leadership, knowledge co-ownership, and reciprocal benefits to ensure all participants in a process have voices and derive benefits. Successful co-production requires work and resources, including committed partners and participants, time and energy investment, supportive institutional norms and incentives, adequate and sustained funding, and project management and stakeholder engagement skills.

Lightning talks on Topic 3
Hem Nalini Morzaria-Luna, Intercultural Center for the Study of Deserts and Oceans: Using Fishery Improvement Projects to increase climate resilience
In 2021, a partnership of organizations and governmental agencies released the document *Cambio climático en México: Recomendaciones de política pública para la adaptación y resiliencia del sector pesquero y acuícola.* This document provides recommendations to 1) revise environmental and fisheries laws at the federal and state levels, 2) strengthen federal and state institutions and environmental and fishery organizations working to increase adaptation and resilience to climate change, 3) support academic groups researching fisheries and climate change, and 4) address problems of inequality and poverty in coastal communities that limit climate resilience. Following the release of these recommendations, CEDO Intercultural has been working with 70 communities in Mexico on Fishery Improvement Projects (FIPs) to develop guidance for fisheries management using a risk assessment framework that is co-developed with the local community and fishers. These efforts provide a framework to assess risk from climate change to local fisheries, and to develop additional fishery management tools and strategies that include climate change criteria.

Samuel Amoros Kohn, Environmental Defense Fund: Observation, Prediction and Early Warning System (SAPO) in the Humboldt Current Large Marine Ecosystem
The observation, prediction and early warning system, *Sistema de Alerta, Prediccion, y Observacion* (SAPO) for the Humboldt Current Large Marine Ecosystem (LME) is an early warning system tied directly to local communities. The Humboldt Current LME supports 10% of global landings and the largest fishery in the world (anchoveta), in turn supporting regional and community food security and livelihoods. While the most productive fishing years are associated with the most variable LME cycles, there is more uncertainty in productivity and fishing safety due to climate change. SAPO was developed through a series of participatory workshops between participants from Ecuador, Chile, and Peru including multiple government agencies and marine institutes. SAPO is a tool that improves public access and understanding about information and data on climate impacts, including climatological, physical, and biological indicators, and includes a fisher directed early warning system and provides information to policy makers to better inform fishery decisions.

Full group discussion and Q&A
Some of the themes discussed included:
- There is a need to provide more opportunities for communication and collaboration at multiple levels, and include policy makers in both discussions and actions
- In working with communities, it is important to consider the actions communities have already taken, and what tools or actions may not be appropriate for a given community.

- There is a danger in this work being extractive of community time and knowledge. Efforts must be taken to facilitate work that is performed in concert with communities and fisheries, and that the result has a tangible outcome or tool for the community, with its support for implementation.

Breakout discussion groups on Topic 2: Climate vulnerability and resilience assessment and planning, and Topic 3: Co-development of knowledge and tools for resilience building
These questions were posed to guide small group discussions:
1. How are you approaching the incorporation of climate information into your planning and management processes?
2. What successes or challenges have you faced during these efforts?
3. What insights have you taken away from these efforts and this conversation that shape how you would approach co-development in the future?
4. What are some ways you have been involved in co-developing research as well as plans or solutions with stakeholders in marine fisheries?

Some of the themes discussed included:
- There is a need to include perspectives from local communities when doing an assessment and combining this perspective with input from scientists and managers. This could involve simplifying the way things are communicated, and should include involving communities and fishers in determining how their data will be used. This collaborative work is necessary to have transparency among different participants and build trust.
- When engaging communities and fishers, there is a need to be sensitive to "stakeholder fatigue". Stakeholder, or participant, mapping can be a tool to bring new voices in, but it needs to be repeatedly performed for a longer project. There is also value in building relationships with organizations for continuity when there may be a change in individual participation.
- Some of the conditions and approaches that confer resilience include: the ability to change gear type, fishing grounds, and target species; mechanisms to reduce bycatch (e.g. of a newly targeted species or new gear); and ability to adjust stock assessment methods to include impacts of climate change on population dynamics.
- Some of the challenges to incorporating climate information include both climate related issues (e.g. lack of long-term data to establish change from past conditions), as well as other ongoing challenges like increased ocean uses (e.g. ocean energy, aquaculture); aging demographics of fishing sector and the need to train new fishers; low flexibility/adaptability of the governance systems; illegal/unreported catches and activities; and fishers and communities not being included in management or strategy development processes.
- When developing new management strategies, specifically spatial management strategies like MPAs, local fishers and communities must be part of the process of identifying the strategies and helping to implement them.

Panel Discussion: Operationalizing Climate Strategies
Panelists:

Mark Dickey-Collas, DickeyCollas Marine
Nina Nichols, Tula Foundation, UN Ocean Decade Collaborative Center for the Northeast
Pacific
Harlisa, Environmental Defense Fund
Tarub Bahri, Food and Agriculture Organisation
Roger Griffiths, NOAA Fisheries Office of Science and Technology

Question to Panelists: How are you operationalizing climate resilience?
- Roger Griffiths shared information about the NOAA Climate, Ecosystems, and Fisheries (CEFI) program that facilitates development of ocean models and projections on various spatial scales, supports modeling distribution shifts of species and incorporating this information into stock assessments, encourages evaluating different management strategies under climate scenarios, and emphasizes a pivot to working with and developing strategies for communities.
- Tarub Bahri shared FAO's perspective on climate change, which includes increasing the knowledge base at the national level with the full involvement of local government and stakeholders, supporting implementation of those responses, and building momentum on aquatic foods under the COP climate negotiations.
- Mark Dickey-Collas reflected on past ICES efforts to include climate in management considerations, difficulties in changing established policies, and the need for managers to be ready to implement scientific information and climate considerations into governance systems.
- Harlisa described her work in Indonesia applying a climate vulnerability assessment for the snapper-grouper fishery in North Maluku, and the importance of community participation in the CVA process. In this effort, community engagement led to the revision of a desktop CVA because the community added information about predictability of the rainy season, which influences fishery production.
- Nina Nichols discussed her experience with the Climate Ready BC Seafood Program, an ocean hypoxia action plan that was developed collaboratively with science, industry, and indigenous partners. The effort advanced scientific understanding of regional seafood species while increasing communication and knowledge sharing among the different groups.

Question to all Panelists: How do different cultural systems incorporate climate change?
- Many countries are facing complex and immediate challenges; in some situations efforts to assess the impacts of climate change on fisheries and to develop resilience strategies may need to be reframed within local and regional contexts.
- In some systems where the impacts of climate change on fisheries has been gradual, it can be harder to perceive the impacts and therefore harder to implement management changes.
- Creating space for scientists and indigenous communities to work together can be difficult, but we are getting better in some places. There are large benefits in incorporating oral histories and stories to advance policies.
- Listening sessions are extremely important to obtain information from communities that already have cultural practices in place for maintaining the ecosystem and associated

fisheries. This knowledge exchange must be linked to scientific processes and management to achieve long-term impact.

<u>Planning Next Steps</u>
The workshop concluded with a question to all participants: How can FishSCORE support or extend your work?

Summarized responses:
- Amplify local and regional projects
- Build a network for knowledge transfer and exchange
- Support translation services for technical documents
- Conduct regional workshops for information exchange to a broader community that can facilitate this work on local and regional scales.
- Compile examples of moving from the assessment phase to evaluating solutions.
- Develop a database or online resource hub of examples of adaptation strategies
- Facilitate or give examples of scenario planning as a tool to involve different types of participants in the process
- Compile examples of how to operationalize alternative livelihoods and livelihood diversification