Food and Agriculture Organization of the United Nations

International Symposium on Fisheries Sustainability

Strengthening the science-policy nexus

Rome, 18–21 November 2019

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PREPARATION OF THIS DOCUMENT

This document has been prepared and edited by the Symposium Convenor, the FAO Session leads in collaboration with the members of the Advisory Board of the International Symposium on Fisheries Sustainability, and the symposium's local organizing committee. The compilation and edition of the document was carried out by Dr Diana Fernández de la Reguera.

For each thematic session of the Symposium, the document includes: i. the contents of the session, ii. a 'what you need to know' section, iii. the themes and composition of the different panels, and iv. the questions that will be addressed in the plenary discussions. In addition, it includes the abstracts of the keynote lectures and a list of FAO relevant publications related to the different sessions.

The graphic design of this publication is by Catherine Perry and Evan Jeffries (www.swim2birds.co.uk).

The Symposium will take place at FAO Headquarters, Rome, Italy, from 18–21 November 2019. It will bring together more than 800 participants from different sectors including academia, the private sector, government, international organizations, non-governmental organizations and civil society experts from around the world.

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FOREWORD

Through the 2030 Agenda for Sustainable Development governments agreed to a transformative vision to eradicate poverty in all its dimensions and to achieve sustainable development for all. This vision, of an unprecedented scale, recognizes the three dimensions of sustainability – economic, social and environmental.

The challenges to achieve Agenda 2030 are significant. After a prolonged decline, the number of undernourished people has increased to 822 million in 2018, while two billion people experience moderate or severe food insecurity. The fight against poverty and hunger demands that we use natural resources efficiently and sustainably.

Fisheries and aquaculture are crucial to meet the goal of a world without hunger and malnutrition. In 2017, the sector produced 153 million tonnes of fish for direct human consumption, a seven-fold increase from 1950. As a result, global per capita fish consumption has been growing at a rate twice as fast as population growth, reaching a record-high per capita consumption of 20.3 kg in 2016.

However, the state of fisheries resources is not good, and this compromises their future contribution to food security and nutrition. Although the percentage of global stocks monitored by Food and Agriculture Organization of the United Nations (FAO) whose biomass is consistent with the delivery of Maximum Sustainable Yield (MSY) has grown from 51 percent in 1974 to 60 percent in 2015, 33 percent of all marine fish stocks are fished beyond biological sustainable limits, a threefold increase since monitoring started in 1974. Fishers, in particular small-scale, are striving to maintain their lifestyle and contribute to the wellbeing of coastal communities as well as meet the demands of consumers.

In addition, other anthropogenic impacts are also affecting the productivity and distribution of aquatic living resources. Climate change in particular, is expected to decrease fish catch potential in some regions, and cause significant resource re-distribution, demanding adaptive management measures to minimize impacts and maximize opportunities. Inland fisheries, crucial in many of the poorest regions of the world, will be affected not just by climate change but also by the additional demands on the use of water by competing industries.

It is for these reasons that we see capture fisheries at a crossroad. As the only major food production industry that relies on the natural cycles of renewable biological resources, the sector must continue to grow sustainably while adapting to a rapidly changing world. Giving this context,, the need for an efficient and sustainable management of fisheries is becoming a more pressing issue in the agendas of both developed and developing countries.

This symposium is a direct reply to the needs and challenges faced by scientists and managers to achieve sustainable fisheries in a changing landscape. Our objective is to bring together the best expertise and knowledge and to use this opportunity to address key technical questions, identify potential solutions and help us deliver a new vision for fisheries in the twenty-first century. A vision that recognizes the role that global and regional fisheries play, while ensuring their sustainability for the decades to come.

The stakes are high and the responsibility of this generation of experts is to stand up to the challenge of not only providing evidence, but also provide solutions that can be applied by responsible managers. I am confident that this symposium will fulfill the expectative and provide the community with the solutions needed to advance towards the sustainability of the fisheries and aquaculture sectors.

As the only major food production industry that relies on the natural cycles of renewable biological resources, the sector must continue to grow while improving its sustainability status.

Manuel Barange
Director

FAO Fisheries and Aquaculture Department
Symposium Convenor

ACKNOWLEDGEMENTS

This Symposium is being organized under the supervision of Dr Manuel Barange, Director of the FAO Fisheries and Aquaculture Department and Symposium Convenor, and the coordination of Dr Vera Agostini, Deputy-Director of the FAO Fisheries and Aquaculture Department and Chair of the local organizing committee, and Dr Diana Fernández de la Reguera. The Fisheries and Aquaculture Department of the Food and Agriculture Organization of the United Nations (FAO) would like to thank all the members of the Symposium Advisory Board for their valuable contribution to the design and preparation of this event, as well as the local organizing committee for their exceptional contribution.

Special gratitude to all the Speakers and Panelists who have agreed to share their expertise and knowledge to shape the development of a new vision for fisheries for the twenty-first century, and support the planning process of the United Nations (UN) Decade of Ocean Science for Sustainable Development (2021–2030).

Particular appreciation is given to FAO and all the Symposium partners for their technical and financial support to the overall organization of the Symposium.

Very grateful for all the work of the local organizing committee in contributing to the success of this event.

Warm thanks to Mr Silvio Alejandro Catalano, coordinator of the Innovation Forum; Mr Benjamin Siegelman, coordinator of the Symposium organizational learning initiative; Ms Kimberly Sullivan, coordinator of the communication strategy; Mr Luca Limongelli, coordinator of IT; Dr Rumiana Uzunova, coordinator of meetings and liaison and Mr Weiwei Wang, coordinator of the side events.

Finally, we would like to extend our recognition to the Bureau of the FAO Committee of Fisheries (COFI), the Fisheries and Aquaculture Department, FAO Regional Offices and partnering Regional Fisheries Management Organizations, for their involvement in the Symposium and for their constant work and contribution to fisheries sustainability around the world.

ABBREVIATIONS AND ACRONYMS

ASFs ..... Animal Source Foods
ASIPES ..... Industrial Fishing Association, Chile
BOBP ..... Bay of Bengal Programme International Organization
CBD ..... Convention on Biological Diversity
CCAMLR ..... Commission for the Conservation of Antarctic Marine Living Resources
CCRF ..... 1995 FAO Code of Conduct for Responsible Fisheries
CEDAW ..... Convention on the Elimination of All Forms of Discrimination Against Women
CENPAT ..... CONICET – National Patagonian Center
CEPESCA ..... Spanish Fishing Confederation
CSIRO ..... Commonwealth Scientific and Industrial Research Organisation
DFOC ..... Directorate of Fisheries and Oceans, Canada
EDF ..... Environmental Defense Fund
GFCM ..... General Fisheries Commission for the Mediterranean
HLPE ..... High Level Panel of Experts
ICCAT ..... International Commission for the Conservation of Atlantic Tunas
ICES ..... International Council for the Exploration of the Sea
IEO ..... Spanish Institute of Oceanography
IOTC ..... Indian Ocean Tuna Commission
IRD ..... Institut de Recherche pour le Développement, France
LIFD ..... Low Income Food Deficit
MRC ..... Mekong River Commission
MSC ..... Marine Stewardship Council
MSY ..... Maximum Sustainable Yield
NEF ..... New Economics Foundation
NFI ..... National Fisheries Institute
NOAA ..... National Oceanic and Atmospheric Administration
PICES ..... North Pacific Marine Science Organization
RISE ..... Research Institute of Sweden
RSN ..... Regional Fishery Body Secretariats Network
SDG ..... Sustainable Development Goal
SIDS ..... Small Island Developing States
SOFIA ..... FAO State of World Fisheries and Aquaculture
USGS ..... United States Geological Survey
WCS ..... Wildlife Conservation Society
WWF ..... World Wide Fund for Nature

OVERVIEW

International Symposium on Fisheries Sustainability

ABOUT THE SYMPOSIUM

Marine and inland fisheries today are at an important crossroads. On one hand, they make a crucial and growing contribution to food, nutrition and livelihood security, especially in many Low Income Food Deficit (LIFD) countries in Oceania, Asia and Africa.

On the other hand, despite significant successes the proportion of marine fish stocks fished within biologically sustainable levels continues to decline, especially in least developed regions, while inland fisheries are profoundly affected by the growing demand for fresh water. In addition, the impacts of a rapidly changing world on the fisheries sector are becoming more and more relevant as we move towards the middle of the century. Among the many factors involved are the following:

- The world population will reach 9.5 billion by 2050, with the African continent growing by more than a billion people compared to today.
- Accompanying this, there is a significant shift of population to coastal areas, with consequent land-based environmental impacts on coastal fisheries, e.g. from increasing agricultural run-off, urbanization, etc.
- Economic development will continue to drive increased consumption of animal proteins, with annual fish consumption predicted to exceed 25kg per capita by 2025, over 20 percent higher than today.
- Climate change may force coastal communities and businesses to shift their geographical centres, following resource displacements, potentially leading to conflict between users.

THE WORLD POPULATION WILL REACH 9.5 BILLION BY 2050

ANNUAL FISH CONSUMPTION PREDICTED TO EXCEED 25KG PER CAPITA BY 2025,

20%

HIGHER THAN TODAY

- Biodiversity conservation paradigms are challenging conceptions of what we expect from natural systems, with consequences for capture fisheries, the only major food production industry that relies on sustainably exploiting wild populations.
- Finally, innovative technologies are making traceability of goods, from source to plate, more available across the value chain. This will have consequences for how business, regulators, stakeholders and the public make daily decisions.

The fisheries sector needs to develop a new vision for capture fisheries in the twenty-first century, in the context of the 2030 Agenda for Sustainable Development and the UN Decade of Ocean Science for Sustainable Development – a vision that better reflects the way society perceives and uses capture fisheries. What do we expect from the fisheries sector in this changing environment? How do we reconcile inclusive socio-economic development, consumer and value-chain demands with the need to sustain resources and conserve ecosystems and biodiversity? How do we support evidence-based decision-making in both developed and developing countries, when the volume of information may exceed our capacity to validate it?

The debates and conclusions of the Symposium will prepare the way for the development of a new vision for capture fisheries, outlining how the sector can respond to the complex and rapidly changing challenges facing society.

OBJECTIVES AND OUTCOMES

The objective of the Symposium is to identify pathways to strengthen the science and policy interplay in fisheries production, management and trade, based on solid sustainability principles, for improved outcomes in practice.

Ultimately, the debates and conclusions of the Symposium will prepare the way for the development of a new vision for capture fisheries, outlining how the sector can respond to the complex and rapidly changing challenges facing society and support the planning process of the UN Decade of Ocean Science for Sustainable Development (2021–2030).

The main output of the Symposium will be a technical document addressing the questions described above. This document, the result of synthesizing the information and debate in each of the Symposium sessions, will be prepared by the FAO Secretariat and tabled at the 34th Session of the Committee on Fisheries (COFI). It will include quantitative information on sustainability status, examples of best management and partnership practices, and recommendations on how to better connect evidence and policy to secure fisheries sustainability in the twenty-first century.

THESE DOCUMENTS WILL:

a) Help develop and articulate a new vision for fisheries sustainability in the twenty-first century

b) Promote strategies for synergistic and supportive actions and policies at multiple scales to support sustainable fisheries while meeting international commitments

c) Reinforce commitments to the FAO Code of Conduct for Responsible Fisheries and its associated instruments, and lead to new FAO partnerships

d) Assist countries as they debate and consider a new COFI Sub-Committee on Fisheries at COFI 34

e) Provide input to the planning process of the UN Decade of Ocean Science for Sustainable Development (2021-2030) to join efforts, in moving towards an Ocean We Need for the Future We Want.

International Advisory Committee and FAO Session Leaders

The following experts are members of the International Advisory Committee and supervise the technical and scientific contents of the different sessions of the Symposium.

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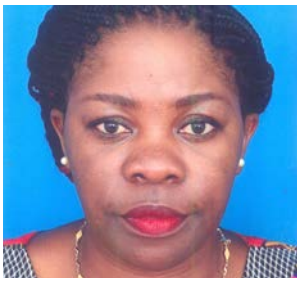

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The International Symposium on Fisheries Sustainability is being organized with the technical and economic support of FAO and the following partners:

STRUCTURE AND CONTENT OF THE SESSIONS

The International Symposium on Fisheries Sustainability is structured around a series of eight thematic sessions. The sessions' themes are the following:

SESSION 1	The status of global and regional fisheries sustainability and its implications for policy and management
SESSION 2	Sustainable fisheries: linking biodiversity conservation and food security
SESSION 3	Fish in food security and nutrition: from tide to table
SESSION 4	Securing sustainable fisheries livelihoods
SESSION 5	The economics of fisheries
SESSION 6	Fisheries management in the face of a changing climate
SESSION 7	Fisheries information systems and new technologies
SESSION 8	Policy opportunities for fisheries in the twenty-first century

The sessions are structured in plenary discussions of approximately two hours each. Sessions 1–8 consist of two keynote lectures, plus two panels of five panelists each. In each panel, the keynote lecturer will synthesize the state of knowledge and highlight prominent topics within the theme. The panellists will follow with their interventions, for which they are given leading questions to guide them, and the attendees of the Symposium will also be able to dynamically discuss them in real time. Session 9 consists of reporting from the different sessions' rapporteurs on main conclusions and messages.

FISHERIES INNOVATION FORUM

As part of FAO's International Symposium on Fisheries Sustainability there will be an Innovation Forum related to fisheries, sustainability and marine-derived products. It will begin in the morning of 18 November and will remain as an interactive display in the Atrium of FAO headquarters until the end of the Symposium.

The Fisheries Innovation Forum is intended to display dynamic and innovative projects and initiatives contributing to fisheries sustainability from a variety of points of view. These initiatives explore nuanced aspects of fisheries science and management and how they support fisheries sustainability and biodiversity conservation, poverty alleviation, food security, nutrition and other elements relevant to the UN Sustainable Development Goals.

In addition, the Innovation Forum offers an opportunity to all visitors to gather inspiration, energy and knowledge, and a chance to network with partners and fellow participants directly involved in and passionate about fisheries sustainability in the twenty-first century.

SIDE EVENTS

As part of the Innovation Forum, on top of the display of successful innovative initiatives, two dedicated side events will focus on specific aspects of innovation:

- **Blue innovation: Emerging technologies and trends in fisheries sustainability**
- **Innovative approaches at the regional level and their contributions to sustainable fisheries and the conservation of marine ecosystems (organized by General Fisheries Commission for the Mediterranean (GFCM))**

Session 1

The status of global and regional fisheries sustainability and its implications for policy and management

FAO session leads: Yimin Ye and Nicolás Gutiérrez

SESSION DESCRIPTION

Sustainable fisheries are critical for marine ecosystems and for communities dependent on fish and fisheries. Although no universal definition exists, there is a general concordance that sustainability is about meeting the needs of the present without compromising the ability of future generations to meet their own needs. In the context of fisheries, these needs can include a complex array of objectives, such as food provision, employment opportunities, income and nutrition requirements, as well as a wide range of social aspects. Given this complexity, fisheries sustainability needs to be translated into practical indicators to facilitate policy implementation and monitor its effectiveness.

Abundance-based and fishing mortality-based indicators are commonly used to measure biological sustainability. FAO has monitored the state of the world's fishery stocks since 1974 and currently carries out the assessment of about 450 stocks by FAO statistical area. These are used to determine geographically disaggregated biological sustainability indices, which are reported in the FAO State of World Fisheries and Aquaculture (SOFIA) report every two years. SOFIA is aimed at analysing major trends in fisheries and aquaculture, including the state of fishery resources. Those analyses are mostly based on the results of formal stock assessments carried out by research institutes, management agencies, and regional and international fisheries bodies or, where such quantitative information is not available, on qualitative assessments that use FAO's global capture statistics together with various sources of auxiliary information. For inland fisheries, the limitations of country-level statistics and their associated environmental drivers make it very challenging to determine stock status. The Sustainable Development Goal (SDG) 14 set a target of rebuilding all overfished stocks by 2020 and adopted Indicator 14.4.1 – "proportion of fish stocks within biological sustainable levels" – to monitor progress of individual countries against this target. Both SOFIA and the SDG Indicator are based on the concept of maximum sustainable yield (MSY), in line with other international instruments.

For inland fisheries, the limitations of country-level statistics and their associated environmental drivers make it very challenging to determine stock status.

This session will focus on three things. First, what is the current status of global and regional fisheries sustainability? Second, what are the challenges and potential solutions for assessing and monitoring stock status at regional and global level? And third, what are the challenges and solutions to move the world's fisheries towards biological sustainability, with a particular emphasis on developing regions? Ultimately, the goal of the session is to identify progress and failures on monitoring the status of biological sustainability at global and regional level as well as to understand what's needed to improve fisheries sustainability at the global level.

The topics of this session are closely connected to efforts to achieve SDG 14 Target 4, whose Indicator is based on the "proportion of fish stocks within biologically sustainable levels". In this context, this session will also seek to answer the following questions:

- How far are we from Target 14.4 on effectively regulating fisheries and ending overfishing?
- How can we best monitor progress towards Target 14.4?
- What are the challenges and lessons learnt in pursuit of Target 14.4?

The session will also aim to develop a research agenda and strategy for:

- Enhancing policy and management practices to improve fisheries performance around the world
- Identifying practical pathways to sustainable fisheries, particularly for regions that are in most need

THE OUTCOMES OF THIS SESSION WILL SUPPORT:

SDG 1 – Reduce poverty, SDG 2 – Food security, SDG 8 – Economic growth, SDG targets 14.4, 14.6 & 14.A, SIDS Samoa Pathways, FAO Code of Conduct for Responsible Fisheries

WHAT YOU NEED TO KNOW:

1 FAO´s initiative for monitoring the state of the world's fish stocks is the most authoritative and comprehensive analysis at the regional and global level, covering ca. 70 percent of global marine landings, and about 400 species/stocks (FAO, 2018). When possible, alternative reliable, comparable and validated monitoring initiatives should be integrated to improve the coverage, consistency and accuracy of these assessments.

2 Globally, the fraction of fish stocks that are within biologically sustainable levels has shown a decreasing trend, from 90 percent in 1974 to 66.9 percent in 2015 (FAO, 2018). Although some developed countries/regions have rebuilt overfished stocks and largely eliminated overfishing, developing countries face a worsening situation in terms of overcapacity, production per unit of effort and resource sustainability (Ye and Gutierrez, 2017; Rousseau et al., 2019).

3 There is currently no equivalent initiative to monitor the state of inland fisheries, limiting our ability to understand and to estimate the sustainability status of inland capture fisheries around the world.

4 The monitoring of stock status at regional and global levels can benefit greatly from better data collation, curation and management; improved protocols for capturing and integrating qualitative information into assessment approaches; and enhanced capacity to conduct assessments. Fisheries information and knowledge, when based on best available science and validated by relevant stakeholders, will support the development of effective policies and enhance the capacity of countries and regions to manage stocks sustainably.

30%

OF WILD CAPTURE LANDINGS HAVE QUANTITATIVE STOCK ASSESSMENTS,

LESS THAN

20%

OF THE TOTAL NUMBER OF SPECIES CAUGHT

5 There is strong evidence of a direct link between the comprehensiveness and effectiveness of fisheries management systems, including the capacity to conduct stock assessments, and the status of stocks. In this respect, it is significant that only ca. 30 percent of total wild capture landings have quantitative stock assessments (RAM Legacy Database; Ricard et al., 2012), corresponding to less than 20 percent of the total number of species caught (Costello et al., 2012).

6 Smaller stocks in developing countries and those under weak governance are often in a poorer state and have a higher risk of overfishing (Ye and Gutierrez, 2017). The overriding problem, particularly in inshore fisheries, is often the political difficulty of managing access rights and excessive fishing effort when poverty levels are high and alternative job opportunities to fishing are rare and unable to sustain livelihoods.

FISHERIES SUSTAINABILITY CAN ONLY BE ACHIEVED IF POLITICAL WILL IS BROUGHT TO BEAR TO ADDRESS OVERFISHING

7 Improving the monitoring, assessment and management of small-scale fisheries requires understanding of the ecological, social, economic and institutional context in which the fisheries operate. Local capacity, including the development of communities of practice, is required to design and implement strategies that are tailored to each specific situation.

8 Furthermore, there is an urgent need for the development of fish stock assessment and harvest control rules that are suitable for data-limited and capacity-poor situations, including inland fisheries, and that take account of existing fishing practices and informal rules, in order to improve sustainability in developing regions and small-scale fisheries. Trying to replicate approaches conceived by and used in developed regions will not be effective.

9 Strengthening institutional capacity for adaptive fisheries management (including decision-making processes and enforcement) involving all relevant stakeholders is essential, particularly in developing countries.

10 In summary, fisheries sustainability can only be achieved if political will is brought to bear to address overfishing. This requires a global and long-term effort in improving assessment and management capacities, and including lasting policies that influence entire sectors of the economy. A critical aspect of ensuring sustainable and productive fisheries at a global level will be finding alternative opportunities to reallocate excessive fishing capacity in marine and inland fisheries, as well as addressing the environmental impacts of fishing.

PANEL 1

THE STATE OF THE STOCKS AT GLOBAL AND REGIONAL LEVELS – WHERE ARE WE AND WHERE SHOULD WE BE HEADING?

KEYNOTE PRESENTATION

Assessing the sustainability of global fisheries.
Ray Hilborn, University of Washington (UW), United States of America

CHAIR

Ichiro Nomura, Japan International Cooperation Agency, Indonesia

PANELISTS

David Agnew, Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), Australia

Steven J. Cooke, Carleton University (CU), Canada

Carmen Fernández, Spanish Institute of Oceanography (IEO), Spain

Libby Logerwell, National Oceanic and Atmospheric Administration (NOAA), United States of America

Elayaperumal Vivekanandan, Bay of Bengal Programme International Organization (BOBP), India

PANEL 2

ACHIEVING SUSTAINABLE FISHERIES MANAGEMENT: A DEVELOPING WORLD PERSPECTIVE

KEYNOTE PRESENTATION

Evidence-based fisheries management: what is needed to achieve biological sustainability of global fisheries?
Ana M. Parma, National Patagonian Center (CENPAT – CONICET), Argentina

CHAIR

Ichiro Nomura, Japan International Cooperation Agency, Indonesia

PANELISTS

Graça Bauleth D'Almeida, Ministry of Fisheries and Marine Resources, Namibia

Paul de Bruyn, Indian Ocean Tuna Commission (IOTC), Seychelles

Macarena Cepeda, Industrial Fishing Association (ASIPES), Chile

Duto Nugroho, Agency for Marine and Fisheries Research and Development, Indonesia

Yemi Oloruntuyi, Marine Stewardship Council (MSC), United Kingdom of Great Britain and Northern Ireland

QUESTIONS

1 Fisheries science is well advanced, and more resources than ever are being devoted to the assessment and management of fisheries – yet a substantial proportion of stocks remain in an overfished state. **Why are we unable to revert this trend?**

2 Monitoring stock status and/or understanding the potential productivity of a stock is important to design management interventions and policy-making, yet most countries don't monitor their resources. **Where do the main limitations lie (collecting the data, analyzing the information, communicating the results, etc.). and what kind of solutions can be implemented?**

3 Stock assessment approaches are becoming more and more complex and data-demanding, but they're still not within reach for managers and scientists around the globe. In this context, **where should we focus and invest resources to reduce the proportion of unassessed and therefore unmanaged fisheries in the world?**

4 There are many new technologies that are being brought to fisheries management, particularly vessel tracking and automated observer systems with cameras. **Do you see a significant role for technology in improving fisheries performance, for example on the high seas?**

5 Shortage of information (particularly time series of fisheries data) and limited technical capacity are often used to justify limited management actions and decisions. In your experience, **is this justification acceptable? What can be done to sustainably manage fisheries under these limitations?**

6 Many organizations, including FAO, have implemented training programs to enhance the capacity of developing countries to assess and manage their fisheries. In your opinion, **have these been effective? If not, what can be done to ensure sustained and effective technical capacity?**

7 Achieving sustainable fisheries requires a series of coordinated efforts, including monitoring, assessment, management and compliance. In your experience, **which are the main bottlenecks in this process that preclude fisheries from being managed sustainably?**

8 Assistance programs for the development and sustainability of developing world and small-scale fisheries have been in operation for decades and in many cases without much success. **What can be done to engage decision makers to make sure policies for sustainable management are operational and effective?**

Session 2

Sustainable fisheries: linking biodiversity conservation and food security

FAO session lead: Vera N. Agostini

© John Cuyos

SESSION DESCRIPTION

Biological diversity and the complex interconnections between species and populations, their functions and the environment, underpin the food and livelihoods upon which our growing population depends. However, despite the inextricable linkages between food provisioning, ecological and socioeconomic systems, objectives for biodiversity conservation are often considered to be in competition with objectives for food security. This perception has been exacerbated by the fact that responsibilities for each are often mandated to different government departments and international agencies. In recent years we have seen a growth in the calls from national and international fora to better integrate these objectives, given their shared interest in and need for sustainability.

Fisheries goals are reflected in a range of normative instruments, guidelines and commitments. The 1995 FAO Code of Conduct for Responsible Fisheries (CCRF) and the Ecosystem Approach to Fisheries, for example, describe a range of fisheries actions in relation to biodiversity conservation. Internationally agreed targets have been set under the UN Sustainable Development Goals (SDG) and Convention on Biological Diversity (CBD) Aichi frameworks that orientate countries' fishery actions to delivering on biodiversity conservation objectives.

How do we ensure we are able to meet the nutritional needs of a growing world population while at the same time ensuring our marine ecosystems are not degraded and can support food production into the future?

This raises a number of key questions. How can we reconcile fisheries and biodiversity objectives? Do we have the necessary understanding and systems in place to support effective implementation and accountability to achieve delivery on joint or agreed objectives at multiple scales? How do we ensure we are able to meet the nutritional needs of a growing world population while at the same time ensuring our marine ecosystems are not degraded and can support food production into the future?

A greater understanding, effective communication, and novel tools to support management of common and/or complementary objectives, as well as mechanisms for shared accountability, are needed. Organizations and individuals working on fisheries and biodiversity conservation seem to be converging on a triple bottom line – ecosystem, social and economic sustainability – but how can we accelerate the achievement of these transformative goals? How can we move from describing and monitoring the health of fish stocks to the health of ecosystems – to engaging countries and international organizations in reporting the provisioning, supporting, regulating and social-cultural services that renewable marine resources offer?

This session will outline how the sustainability of fisheries and the maintenance of biodiversity are fundamentally interconnected and interdependent, and explore the changing nature of fisheries management within this context.

We will examine how multiple objectives can be combined, and consider questions such as: What are the frameworks available to analyze trade-offs, benefits and risks, and set appropriate targets? What messages and information should we be delivering to motivate effective action? What stakeholder groups should we be engaging? How can gender diversity and social inclusion help deliver more effective outcomes? What role can economic incentives play? What are the partnerships we need to make progress? By considering experiences to date, we will outline both the science and the practical management solutions needed and discuss the challenges and opportunities for bringing the critical mass of effort to deliver cooperative policy and action.

THE OUTCOMES OF THIS SESSION WILL SUPPORT:

SDG 1 – Reduce poverty, SDG 2 – Food security, SDG 3 – Health and wellbeing, SDG 8 – Economic growth, SDG targets 14.2 & 14.C, SDG – 15 Life on land, SDG 16 – Effective institutions, SIDS Samoa Pathways, Convention on Biological Diversity Aichi Targets, Post 2020-framework, United Nations Convention on the Law of the Sea, FAO Code of Conduct for Responsible Fisheries.

WHAT YOU NEED TO KNOW:

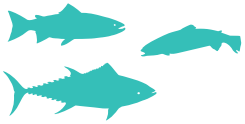
1 Capture fisheries is the only major food production industry that relies completely on the natural production cycles, and large taxonomic diversity, of wild aquatic ecosystems. The FAO production databases include data for 2 144 species items in capture fisheries and 608 in aquaculture production, with a total of 2 346 exploited species overall (as of 2019).

2 Aquatic biodiversity is therefore key to maintaining the contribution of fisheries to food security and nutrition, especially in developing countries. Healthy ecosystems are essential in order to meet the nutritional needs of a growing population but overexploitation, pollution and habitat destruction are already threatening the services provided by aquatic ecosystems, which are estimated to be worth USD 78.6 trillion, approximately equivalent to global GDP (Costanza et al., 2017).

3 Since 1970, an estimated 60 percent of the global vertebrate population and 40 percent of insect species have been declining (OECD, 2019). Habitat indicators also show worrying declines: since the 1870s, 50 percent of live coral cover and 85 percent of wetlands have been lost (IPBES, 2019).

4 Although the direct link between over-harvesting and high risk of extinction is well verified for terrestrial species (Benitez-Lopez et al. 2017, Science), there are very few global extinctions of aquatic species, and no fully marine fish species have gone extinct from fishing (McCauley et al., 2015). However, defaunation and biodiversity loss have been observed at local and regional levels, mostly caused by exploitation and/or habitat destruction (Dulvy et al., 2003).

5 On the other hand, shallow freshwater, estuarine and coastal wetland systems are some of the most endangered habitats in the world because of the diverse and demanding set of sectors that use and impact freshwater. This has significant consequences for biodiversity and the status of the ecosystems, and therefore the contributions of inland fisheries to food and livelihood security.



CAPTURE FISHERIES IS THE ONLY MAJOR FOOD PRODUCTION INDUSTRY THAT RELIES COMPLETELY ON THE NATURAL PRODUCTION CYCLES, AND LARGE TAXONOMIC DIVERSITY, OF WILD AQUATIC ECOSYSTEMS.

WOMEN USE AQUATIC BIODIVERSITY TO MAKE SIGNIFICANT CONTRIBUTIONS ALONG THE VALUE CHAIN, INCLUDING LEVERAGING THEIR LOCAL KNOWLEDGE ABOUT BIODIVERSITY, WHICH IS OFTEN DIFFERENT THAN MEN'S.

6 The management and conservation of habitats and fish stocks, including restoration and rebuilding efforts, have been proven to deliver multiple benefits. It has been estimated that every dollar used in coastal habitat restoration can potentially generate USD 15 in benefits (ABT, 2015), and every dollar invested in fish stock recovery can generate about USD 4.80 in benefits (Sumaila, 2012).

7 In many social-geographic contexts, women use aquatic biodiversity to make significant contributions along the value chain, including leveraging their local knowledge about biodiversity, which is often different than men's.

8 Biodiversity loss and ecosystem deterioration undermines progress for 35 of the 44 assessed targets for the Agenda 2030 goals related to poverty, hunger, health, water, cities, climate, oceans and land (SDGs 1, 2, 3, 6, 8, 11, 13, 14 and 15) (IPBES, 2019). Objectives and priorities that will help us ensure people's nutritional needs are met while ecosystem resilience is maintained need to be developed and measures put in place to ensure that they are achieved. The main drivers for biodiversity conservation and food provisioning from aquatic systems are similar, so substantial alignment between the objectives and priorities should be achievable.

9 A slow convergence towards joint objectives in the two complementary goals is happening (e.g. Worm et al., 2009; UNGA, 2015), but the pace of progress is slow and insufficient communication and incentives to work together frequently lead to conflicts and misunderstandings that cause serious setbacks.

10 To help address underlying drivers and support the convergence of food security and biodiversity conservation objectives we need more focus on the behavioral and economic incentives required across a range of stakeholder types, and stronger more diverse partnerships.

11 Focusing only on economic, equity or conservation outcomes will fail to achieve overall SDGs, but trade-offs exist between the three aspects (Halpern et al., 2019). Local, national and global understanding of the trade-offs and risks associated with jointly meeting biodiversity conservation and food security objectives is limited, and is therefore often not seriously taken into account. More direct consideration of the trade-offs is needed in planning and decision-making: this requires policies and institutions to address them and reconcile differences, as well as tools to effectively communicate them to stakeholders.

12 Formulation of joint targets is easiest when livelihoods are directly linked to multiple biodiversity components, but indirect linkages make joint formulations important more broadly (Salafsky and Wollenberg, 2000). Our formulation of joint targets needs to improve, as does the support for implementation, monitoring and reporting on these targets. Our existing platform/approaches to address joint objectives (e.g. Integrated Coastal Zone Management, Ecosystem Approach to Fisheries) provide a good basis, but have only rarely been thoroughly implemented and could also benefit from some enhancement and updating.

13 Meaningful action in implementation, monitoring and reporting on balanced targets needs to increase. Targets and action need to be gender-sensitive and inclusive. We need enhanced information systems and data able to describe and monitor progress on integrated ecosystem, social and economic goals and objectives, and implementation of well-developed plans to achieve them.

PANEL 1

PLANNING FOR A SUSTAINABLE FUTURE – SUPPORTING THE ADOPTION OF COMPLEMENTARY FOOD SECURITY AND CONSERVATION OBJECTIVES

KEYNOTE PRESENTATION

Juggling biodiversity and food security – keeping all the balls in the air.
Beth Fulton, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

CHAIR

Renée Sauvé, Directorate of Fisheries and Oceans (DFO), Canada

PANELISTS

Rod M. Fujita, Environmental Defense Fund (EDF), United States of America

Simon Jennings, International Council for the Exploration of the Sea (ICES), Denmark

Yunne Shin, Institut de Recherche pour le Développement (IRD), France

Nam So, Mekong River Commission (MRC), Cambodia

Beverly Wade, Fisheries Department, Belize

PANEL 2

MAKING IT HAPPEN – IMPLEMENTING JOINT FOOD SECURITY AND CONSERVATION OBJECTIVES

KEYNOTE PRESENTATION

Incentives for the joint provision of biodiversity and food from the sea.
Chris Costello, University of California Santa Barbara (UCSB), United States of America

CHAIR

Renée Sauvé, Directorate of Fisheries and Oceans (DFO), Canada

PANELISTS

Leandro Castello, Virginia Tech University (VT), United States of America

Stefan Gelcich, Pontífica Universidad Católica, Chile

Michel Kaiser, Heriot-Watt University (HW), United Kingdom of Great Britain and Northern Ireland

Sangeeta Mangubhai, Wildlife Conservation Society (WCS), Fiji

Nyawira Muthiga, Wildlife Conservation Society (WCS), Kenya

QUESTIONS

1. How are we doing in the formulation of joint objectives and targets for food security and conservation?
2. What are our existing platforms and approaches to address joint objectives, and where do new opportunities lie?
3. What are the challenges and opportunities on the horizon to nationally implement and report on established joint targets?
4. Can the priorities and approaches to plan for joint targets be universal?
5. What tools and approaches have been most successful in addressing both food security and conservation objectives?
6. What approaches for gender and social inclusion exist or should be enhanced to ensure more effective outcomes?
7. What information and messages should we be delivering and what stakeholder groups should we be engaging to motivate effective action?
8. What are the kind of partnerships we are going to need going forward to address joint objectives? What can we learn from existing partnerships?

Session 3

Fish in food security and nutrition: from tide to table

FAO session lead: Molly Ahern

SESSION DESCRIPTION

People have never consumed as much fish as they do today: per capita global fish consumption has doubled since the 1960s from 9.0 kg per year to 20.3 kg per year. Since 1961 the average annual increase in global apparent food fish consumption has outpaced population growth and growth in meat consumption from all terrestrial animals combined (FAO, 2018).

Peering below regional and national levels, many coastal and inland populations rely on fish as the primary protein source of a healthy diet, notably in rural settings and in poor communities with limited alternative sources of protein and essential micronutrients. Further, gendered social norms and male-dominated decision-making can lead to disparities in access to animal source foods (ASFs), often playing a role in household fish consumption patterns. Of the 34 countries where fish contributes more than one-third of the total animal protein supply, 18 are Low Income Food Deficit Countries (LIFDCs), and five are Small Island Developing States (SIDS), where fish serves as the backbone to a healthy diet. However, despite the long-standing significance of fish in diets worldwide, fish is strikingly inadequately represented in nutrition transformations, notably strategies for reducing micronutrient deficiency, precisely where it could have the largest impact.

Surprisingly, while nutrition stands high on the global political agenda, it only attracts a fraction of development aid globally.

The 2017 High Level Panel of Experts report, a report of the Committee on World Food Security (CFS), reiterated how fish remains one of the best sources of high-quality protein, omega-3 fatty acids and micronutrients, especially in lower-income communities that may lack access to alternative ASFs (HLPE, 2017). Furthermore, post-harvest loss and food safety issues with fish and other aquatic species pose challenges for ensuring availability and access to fish for human consumption. Using the HLPE report as a starting point, CFS members produced a negotiated set of Policy Recommendations on Sustainable Fisheries and Aquaculture for Food Security and Nutrition. These policy recommendations are used by governments and others around the world to strengthen the case for focusing more attention on fish and fisheries as a key component of food security, nutrition and healthy diets.

Fish production systems worldwide are threatened by, and can contribute to, freshwater and marine ecosystem degradation, in turn threatening access to one of the most important protein sources for a healthy diet in many nutritionally vulnerable areas. Recent reports on healthy diets from sustainable food systems provide new scientific targets for our global nutrition and food systems goals, recognizing that fish plays a unique role but that fish should not be separated from other parts of the food system. Yet defining an optimal level of consumption for fish and other ASFs has been a challenge, considering varied consumption patterns across countries and the complex impact of fish and other ASFs on both human and environmental health.

Surprisingly, while nutrition stands high on the global political agenda, it only attracts a fraction of development aid globally. In a world where an estimated 821 million people – approximately one out of every nine – are undernourished and require stable access to high-quality foods, it remains unclear how, where, and in what quantity fish can sustainably fit into the global food system.

This session takes the most recent research, investments and policy reforms into consideration, to highlight how fish is increasingly evidenced for its crucial contribution to nutrition, how that contribution could be optimized in the future, and the possible implications of the realization of fish's crucial role. Looking through the specific context

of countries facing the double and triple burden of malnutrition, where and how can strategic regional, national and community partnerships improve nutrition? Can fish play a primary role in healthy diets, becoming a possible major ASF consumed globally? Finally, the session aims to debate how to translate and scale up a vision of fish as a contributor to food security and nutrition across sectors historically less synchronized with fisheries.

Through the session, we will begin to refine messaging for fisheries in Agenda 2030 as an integral solution to food insecurity and malnutrition. Specifically, we will answer the following questions:

- What are the limiting factors or threats in achieving data generation for successful fish food systems or policy change?
- Why is fish still under-represented in food and nutrition security studies and policies? Where is this changing, and how?
- What research interventions can guide nutrition-sensitive fisheries and aquaculture policy?
- What does effective, accurate messaging on fisheries and aquaculture for improved nutrition look like?

The ultimate outcome of the session will be to suggest policy and institutional reforms that properly advocate for fish to be part of global, regional and national food and nutrition policy agendas.

THE OUTCOMES OF THIS SESSION WILL SUPPORT:

SDG 1 – Reduce poverty, SDG 2 – Food security, SDG 3 – Health and wellbeing, SDG 5 – Gender equality, SDG 10 – Reduce inequalities, SDG 16 – Effective institutions, SIDS Samoa Pathways, FAO Code of Conduct for Responsible Fisheries.

WHAT YOU NEED TO KNOW:

1 Fish plays a very significant role in our fight to secure food and nutrition for all. Today fish products provide 3.3 billion people with almost 20 percent of their average per capita intake of animal protein, and a further 1.5 billion people with about 15 percent of their per capita intake (FAO, 2019). This share can exceed 50 percent in some countries.

2 People have never consumed as much fish as they do today: apparent per capita global fish consumption has more than doubled since the 1960s from 9.0 kg per year to 20.3 kg per year in 2017 (FAO et al., 2019).

3 The importance of fish in food security and nutrition goes beyond its contribution to high-quality protein supply. The unique lipid composition of fish and its combination of essential micronutrients and minerals has many beneficial effects, particularly for child development and as part of a healthy diet.

3.3 BILLION

TODAY FISH PRODUCTS PROVIDE 3.3 BILLION PEOPLE WITH ALMOST

20%

OF THEIR AVERAGE PER CAPITA INTAKE OF ANIMAL PROTEIN, AND A FURTHER 1.5 BILLION PEOPLE WITH ABOUT

15%

OF THEIR PER CAPITA INTAKE

4 Fish is a particularly important contributor to a healthy diet in many communities with few affordable animal source alternatives. Of the 34 countries where fish contributes more than one-third of the total animal protein supply, 18 are LIFDCs (FAO, 2019).

5 There are significant differences in the access that men and women have to ASFs worldwide, often due to deep-rooted social norms that may play into (a) consumption patterns and (b) male-dominated decision-making over livestock or fish harvests, productive assets and income derived from fish harvesting. Improving women's access to fish as part of a stable, nutritious diet can drive many nutrition and health benefits, especially for women of reproductive age especially for women of reproductive age and in the first 1,000 days

6 Despite the very significant role fish and fish products play in our fight to secure food and nutrition for all, they are often separated from other parts of the food and agricultural systems in food security studies, debates and policy-making. With demand for food due to increase by 60 percent by 2050 (FAO, 2017), this needs to change (HLPE, 2014).

7 Reduction of food waste and post-harvest loss in the sector will lead to substantial increases in availability for human consumption. Innovative fish products, as well as improved and expanded preservation, preparation, re-utilization and distribution are essential. It is also important to stress that food that is not safe to eat should not be considered food. Food safety remains a challenge for aquatic foods in many parts of the world and needs to be addressed to maximize its potential in the global food system.

8 Targeted research and policy reform would strengthen the role of fish in global nutrition efforts, but linking the research and policy evades us to date. Evidence linking fish and nutrition has only recently received more global attention. Elevating the role of fish in nutrition and food security policy priorities, based on robust evidence, will help to ensure the sector fulfils its potential contribution to a sustainable future for food.

9 Knowing that fish is one of the most efficient converters of feed into high-quality food (Hall et al., 2011), and that fish products have a lower environmental impact than most land-based sources of animal protein (Hilborn et al., 2018), the role of fish in tomorrow's supply of food needs to be recognized and promoted. The competing uses of small fish in human diets as well as fish feeds for the aquaculture industry presents a complex issue – not only for producing enough fish, but making sure that the fish that we produce are nutritious.

10 In recent decades we have observed a shift in global diets towards more foods of animal origin (both terrestrial and aquatic). This has led to efforts to define an optimal level of consumption of such foods, but these efforts have often disregarded differential availability and access to food, cultural and traditional norms, and the complex impact of ASFs on both human and environmental health.

11 Finally, even though an estimated 822 million people – one in every nine – are undernourished (FAO et al., 2019), placing food security and nutrition high on global political agendas, nutrition attracts only a fraction of official development aid (below 1 percent in 2016). Adequate investment and international and national political will are essential to remedy this global injustice. Developing countries, especially LIFDCs, need to take action to ensure adequate budgetary allocations to food security, including the actual and potential roles of fish.

PANEL 1

PUTTING FISH ON THE TABLE: EVIDENCE AND OPPORTUNITIES FOR IMPROVED NUTRITION IN LOW-RESOURCE SETTINGS

KEYNOTE PRESENTATION

Aquatic foods improve diets and nourish nations.
Shakuntala Haraksingh Thilsted, WorldFish, Malaysia

CHAIR

Fiorenza Micheli, Stanford University, United States of America

PANELISTS

Raúl Castillo, Ministry of Production, Peru

Bibi Giyose, African Union Development Agency (AUDA-NEPAD), South Africa

Mimako Kobayashi, World Bank (WB), United States of America

Sveinn Margeirsson, International consultant, Iceland

Ahmed Khan, African Development Bank (AFDB), Ivory coast

PANEL 2

PATHWAYS FOR IMPROVED FISH FOOD SYSTEMS: ENVIRONMENT, POLICY AND TECHNOLOGY

KEYNOTE PRESENTATION

Turning the tide: sustainable aquatic food systems for food security and nutrition.
Christopher Deweir Golden, Harvard T.H. Chan School of Public Health (HSPH), United States of America

CHAIR

Fiorenza Micheli, Stanford University, United States of America

PANELISTS

Xianshi Jin, Yellow Sea Fisheries Research Institute (YSFRI), China

Joyce Kinabo, Sokoine University of Agriculture (SUA), Tanzania

Anna Lartey, Food and Agriculture Organization of the United Nations (FAO), Italy

Dave Little, University of Stirling, United Kingdom of Great Britain and Northern Ireland

Friederike Ziegler, Research Institute of Sweden (RISE), Sweden

QUESTIONS

1. Why is fish still underrepresented in nutrition and food security studies? Where is this changing, and how?
2. What are the limiting factors or threats in achieving data generation or policy change?
3. What research interventions can guide nutrition-sensitive fisheries and aquaculture for nourishing nations?
4. What does effective, accurate messaging on fisheries and aquaculture for improved nutrition look like?
5. What role does fish play, as a component of a 'healthy diet' and a 'sustainable food system'? (Specific contextualization given to double/triple burden of malnutrition, non-communicable diseases)
6. Can fish replace red meat in certain contexts? How will changes in fish supply (capture or culture) play a role in dietary substitution and the larger food system?
7. What would be the implications for the larger food system if fish were to take centre stage in diets, in agricultural investments, in policies etc.?

Session 4

Securing sustainable fisheries livelihoods

FAO session lead: Nicole Franz

SESSION DESCRIPTION

More than 40 million people around the world are engaged in the primary sector of capture fisheries. When adding the even larger number of people involved in pre- and post-harvest activities, it is clear that fisheries constitute a crucial source of income and livelihoods in the world today. The fisheries sector is very diverse and employs more people than all other ocean-based industries put together. In stark contrast to other ocean-based industries, women are particularly significant participants in both inland and marine fisheries value chains.

Fisheries often underpin the economic and social fabric of coastal and rural communities, and are thus crucial for community coherence and stability as well as for local economies. Livelihood dependency on fisheries is heterogeneous and very dynamic. While Europe and North America have experienced a decrease in the number of people engaged in fisheries in recent times, Africa and Asia, with higher population growth and increasing transformation and trade in fish, have shown generally upward trends. Almost 80 percent of those currently employed in capture fishing are in Asia and 13 percent in Africa.

Good governance is fundamental to securing the key ingredients of sustainable fisheries livelihoods, such as equitable access to resources and co-management, empowerment, inclusiveness and gender equity.

Maintaining the livelihoods and diversity of those dependent on inland and marine capture fisheries value chains requires addressing common vulnerabilities – to internal and external threats such as environmental degradation, pollution, competition from other sectors, and severe working conditions. Maintaining and improving the livelihoods of those working in small-scale fisheries, which make up 90 percent of the fishery sector, also requires improving the situation of fishers, fish workers and their communities – who are often economically poor and politically weak, and thus often marginalized.

Often such social complexities are not adequately considered, and nor are the impacts of decisions over fisheries governance. Good governance is fundamental to securing the key ingredients of sustainable fisheries livelihoods, such as equitable access to resources and co-management, empowerment, inclusiveness and gender equity. There are several global instruments and frameworks on good governance which support fisheries livelihoods (e.g. SDGs, International Labour Organization (ILO) instruments, the Small Scale Fisheries (SSF) Guidelines, Voluntary Guidelines on Tenure (VGGT)). Also important are the overarching instruments that are relevant to fisheries but often not implemented in fisheries (e.g. Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW), Beijing Declaration and Platform for Action of the 4th World Conference on Women; International Labour Organization C. 190: Convention Concerning the Elimination of Violence and Harassment in the World of Work). These and other relevant instruments need to be fully recognized and applied to ensure sustainable livelihoods in the sector.

Appropriate information in the form of traditional knowledge, women's knowledge and scientific data is needed as well as trans-disciplinary approaches and methods for data collection and analysis in order to deal with the fisheries sector and related livelihoods in a holistic manner, recognizing the roles of both women and men all along different value chains.

This session will focus on the challenge of achieving equitable and sustainable livelihoods for the millions of women and men who depend on marine and inland fisheries production and value chains for their livelihoods, and whose daily work helps feed billions of people around the world. Questions and issues to explore in this context include:

- How can the horizon of fisheries management and governance be expanded to better address fisheries-based livelihoods, including their social, cultural and equity dimensions? What good practices exist with regard to secure and equitable tenure and access rights, participation in decision-making and decent work?
- What innovative approaches are needed with regard to governance coalitions, cross-sectoral collaboration and engagement with fishers and fish workers?
- How can the implementation of existing international instruments – including specialized fisheries instruments and overarching instruments on labour, gender equality and social responsible value chains – be promoted and accelerated in support of sustainable fisheries-based livelihoods? What are the incentives for and benefits from implementing these instruments?
- What are the key knowledge needs to support equitable and sustainable livelihoods, what information exists already, and what are the gaps? What can be done, beyond current action, to achieve full coverage of sex-disaggregated data for all value chain activities, given that current efforts are focused only on production in value chains and cover very few countries?

Accordingly, this session will discuss existing experiences and showcase empirical examples of how fisheries livelihoods have been enhanced. It will also elaborate on policy options and practical strategies that should be sought for securing equitable outcomes for men and women in fisheries.

THE OUTCOMES OF THIS SESSION WILL SUPPORT:

SDG 1 – Reduce poverty, SDG 2 – Food security, SDG 3 – Health and wellbeing, SDG 5 – Gender equality, SDG 8 – SDG 10 – Reduce inequalities, SDG targets 14.4, 14.7 & 14.B, SDG 16 – Effective institutions, SIDS Samoa Pathways, FAO Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication, FAO Code of Conduct for Responsible Fisheries.

WHAT YOU NEED TO KNOW:

1 Ecological sustainability must go hand in hand with the sustainable livelihoods of the people who depend on fisheries for a living. Approximately 120 million full-time and part-time workers are directly dependent on commercial capture fisheries value chains (World Bank, FAO, World Fish, 2012). Combined with aquaculture workers and their dependents, it is estimated that 10-12 percent of the world's population rely on fish for their livelihoods (FAO, 2018). These people are key to making inland and marine fisheries more sustainable.

10–12%

OF THE WORLD'S POPULATION RELY ON FISH FOR THEIR LIVELIHOODS

AN ESTIMATED 5.8 MILLION FISHERS IN THE WORLD EARN LESS THAN USD 1 PER DAY

2 However, the sustainability of livelihoods in the fisheries sector is increasingly under threat. Competition and access to fish and other resources such as land, as well as to markets where the fish is sold, causes growing inequalities where many fishers and fish workers struggle to make ends meet. An estimated 5.8 million fishers in the world earn less than USD 1 per day, most of them operating in small-scale fisheries (World Bank, FAO, World Fish, 2012). Indigenous peoples are particularly dependent on fishery resources for food and livelihood security. To promote sustainable livelihoods, and thereby sustainable fisheries, these inequalities must be addressed.

3 An estimated 47 percent of the total workforce in small-scale fisheries are women, which in developing countries equates to 56 million jobs, primarily in post-harvest and trade activities (World Bank, FAO, World Fish, 2012). However, this estimate does not fully reflect the wide-ranging, often unseen activities of women in the fisheries sector. A consequence of being unseen is that fisheries policy and governance systems frequently overlook fisheries that are mainly exploited by women, disregard or under-estimate the contributions generated from their unpaid or low paid work, and undervalue the role of women in supporting fisheries livelihoods. The impacts on women of changes in fisheries remain largely unaccounted for both in policies and in research that informs such policies.

4 In order to break this vicious cycle fisheries data collection and analysis systems should include gender-differentiated information, in a manner that ensures gender-sensitive policy and management decision-making. Governments and stakeholders in the sector should strive to improve the participation and empowerment of women at all levels. Governments – and other actors – can help women be seen and heard, build skills, access technology, and take their place in fisheries as acknowledged professionals.

5 Truly understanding fisheries is crucial to making them more sustainable. Knowledge generation that brings together science and fishers' knowledge can paint a clearer picture of how social, economic and environmental drivers come together in fisheries, and this understanding can inform how fishing is managed and governed. Members of fishing communities – both women and men, young and old, and of different cultural backgrounds – are experts on their local situation. Their knowledge should therefore be part of any research in fisheries.

6 There is a rich range of global guidance and normative instruments in support of sustainable livelihoods in fisheries and their value chains. They include the FAO Code of Conduct for Responsible Fisheries, the ILO Fishing Labour Convention and the UN Convention on the Elimination of All Forms of Discrimination Against Women, the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication, relevant CFS instruments (e.g. Right to food/Tenure Guidelines, Principles for Responsible Investment in Agriculture and Food Systems) among others. All actors involved in fisheries need to understand and apply them, monitor and share performance and progress, and adapt them to new circumstances. This will mean that in order to truly embrace the three pillars of sustainable development fisheries actors must look beyond fisheries to design holistic policies and practices.

7 Finally, the impacts of climate change serve as a reminder of the critical importance of fisheries and aquaculture for millions of people struggling to maintain livelihoods through the sector. These are the people who are most vulnerable to the impacts of climate change, and particular attention needs to be given to them while designing adaptation measures if the sector is to continue to contribute to meeting global goals of poverty reduction and food security.

PANEL 1

HOW DO WE SECURE SUSTAINABLE FISHERIES-BASED LIVELIHOODS, INCLUDING THEIR SOCIAL, CULTURAL AND EQUITY DIMENSIONS?

KEYNOTE PRESENTATION

Sustain or transform: towards secure and equitable livelihoods in small-scale fisheries.
Philippa Cohen, WorldFish, Malaysia

CHAIR

Ratana Chuenpagdee, Memorial University (MUN), Canada

PANELISTS

Xavier Basurto, Duke University, United States of America
Courtney Cox, Rare, United States of America
Naseegh Jaffer, World Forum of Fisher Peoples (WFFP), South Africa
Sebastian Mathew, International Collective in Support of Fishworkers (ICSF), India
Kumi Soejima, National Fisheries University, Japan

PANEL 2

INNOVATIVE APPROACHES FOR INCLUSIVE FISHERIES GOVERNANCE COALITIONS, CROSS-SECTORAL COLLABORATION AND ENGAGEMENT WITH FISHERS AND FISH WORKERS – WOMEN AND MEN

KEYNOTE PRESENTATION

Sea through the eyes of fisher folk.
Mitchel Lay, Caribbean Network of Fisherfolk Organisations (CNFO) and Gulf and Caribbean Fisheries Institute (GCFI), Belize

CHAIR

Ratana Chuenpagdee, Memorial University (MUN), Canada

PANELISTS

Eddie Allison, University of Washington (UW), United States of America
Anthony Charles, Saint Mary's University (SMU), Canada
Unni Kløvstad, Ministry of Foreign Affairs, Norway
Editrudith Lukanga, World Forum of Fish Harvesters and Fish Workers (WFF), Tanzania
Vivienne Solis, CoopeSoliDar R.L, Costa Rica

QUESTIONS

1 Enabling environment: Fisheries livelihoods are under threat, especially among vulnerable communities. What is the role of governments, civil society organizations, academia and producers themselves in the creation of an enabling social and institutional environment for the participation of marginalized coastal populations (e.g. fishing communities) in decision-making processes?

2 Information, data, knowledge: All types of knowledge are critical in delivering a comprehensive picture of our fisheries. What information exists and what key gaps do we need to fill and why? What are the challenges we face in integrating user and indigenous knowledge with scientific knowledge for these integrated information systems, and where do the opportunities lie?

3 Good practices, lessons learned, experiences: There are often contested understandings of the problems and solutions that the sector faces. What are the design principles for the engagement of governments, civil society organizations and academia with fishing communities, so that interventions are more likely to lead to traditions of self-governance for sustainable fisheries livelihoods and not to long-term dependence?

4 Incentives, opportunities: While there is a rich range of global guidance and normative instruments in support of sustainable livelihoods in fisheries and their value chains, implementation of these instruments is uneven. What incentives and opportunities exist for governments, CSOs, academia and producers to work together to ensure that the implementation of these existing instruments truly works towards the support of sustainable fisheries-based livelihoods?

5 What are the most common capacity development needs related to these issues?

Session 5

The economics of fisheries

FAO session lead: Audun Lem

SESSION DESCRIPTION

The full contribution of the fisheries and aquaculture sector to the economy is often not adequately documented, especially in its wider and indirect impacts. Not only can such knowledge gaps lead to sub-optimal planning and decisions by policymakers, thereby causing misallocation of resources, but the lack of sufficient economic and socio-economic data also prevents the sector from making the necessary transformational changes to allow it to reach its full potential as a generator of long-term economic and social benefits. This is particularly the case for inland capture fisheries, where data is frequently missing or at least underestimated.

Understanding this contribution is fundamental for achieving inclusive economic growth and development. Fisheries and aquaculture value chains extend across all sectors of the economy, amounting to much more than the value of the product extracted from the water or processed subsequently. These value chains are often long, complex and difficult to measure empirically; yet they constitute the full contribution of the sector to national economies through physical capital, revenue and employment, amongst others.

More than 56 million people are directly employed in the primary fisheries and aquaculture sectors with many more engaged in post-harvest processing, marketing and distribution.

Ensuring that the sector is accurately measured and evaluated is essential for informing policymakers and decision-makers alike and requires examination of less-evident returns. It also includes consideration of the role of effective fisheries management and impacts from liberalization of trade. In particular, as part of blue growth strategies, the creation of value from capture fisheries is more likely to focus on the introduction of more effective management measures, reduction of over-capacity, harmful subsidies and Illegal, unreported, and unregulated (IUU) activities than on any increase in catches, especially in the short term.

When addressing the economic value of fisheries we should not disregard the sector's importance as a source of income and employment, particularly in coastal communities and in the developing world (see session 4). More than 56 million people are directly employed in the primary fisheries and aquaculture sectors with many more engaged in post-harvest processing, marketing and distribution. The structure of employment across subsectors varies widely, and requires a variety of approaches to achieve effective value and supply chain management that can equitably share the economic benefits within populations and stakeholder groups.

Equally, we must consider the importance of markets and trade for fish and fishery products. One-third of fish caught or farmed already enters international trade and the value of the sector's exports is roughly equivalent to that of cattle, pork and poultry combined. The volume and value of trade is expected to grow in step with rising world demand for fish and fishery products, creating immense opportunities for producers, exporters, importers, processors and distributors alike. Without access to international markets, producing countries will not be able to reap the full economic benefits from their aquatic resources, nor would import-dependent countries be able to satisfy local demand.

This session will focus on how the sector can reach its full potential as a long-term contributor of sustainable economic benefits. It will examine the sector's economic and social contribution to national economies. Economic evaluation of fisheries

cannot ignore the importance of good governance to ensure that current returns do not compromise future gains, and that overcapacity and overfishing put stocks under pressure. Equally, a stable and transparent trading environment is necessary to allow trade flows and provide positive externalities. Greater awareness of the role of fisheries in national economies can assist policymakers to enact effective and appropriate policies enabling it to reach its long-term potential as a generator of sustainable economic and social benefits.

Some of the issues to be addressed during the session include:

- What tools do we have, or need, to integrate the economic contribution of capture fisheries with measures of fisheries sustainability?
- How can we reach a better understanding of the sector's contribution to GDP?
- How can society address the social costs of industry structuring and reduction of effort?
- How can market access for fish and fishery products be maintained and improved?
- How can we guarantee access to sustainable economic and social benefits of fisheries to women and the most vulnerable communities?

THE OUTCOMES OF THIS SESSION WILL SUPPORT:

SDG 1 – Reduce poverty, SDG 2 – Food security, SDG 5 – Gender equality, SDG 8 – Decent work and economic growth, SDG 10 – Reduce inequalities, SDG 12: Responsible consumption and production, SDG targets 14.4, 14.6 & 14.7, SDG 16 – Effective institutions, SIDS Samoa Pathways, FAO Code of Conduct for Responsible Fisheries.

WHAT YOU NEED TO KNOW:

1 Although fisheries may represent a limited share of the overall national economy, they can be crucial for numerous coastal, riverine, insular and inland regions, including many Small Island Developing States (SIDS), which depend heavily on this sector (Barange et al., 2018) for their livelihood and food security.

2 The fisheries sector generates income for millions of people working in a range of industries and activities around the world – particularly in developing countries, which are the main producers (73 percent of total capture fisheries), consumers and also exporters.

3 Trade of fish and fish products generates major economic revenues in addition to playing an essential role in boosting fish consumption and achieving global food security. Fish and fish products are among the most internationally traded food commodities. About 38 percent of total fisheries and aquaculture production is exported (FAO, 2019), while 78 percent is exposed to international trade competition (Tveterås et al., 2012).

INTERNATIONAL TRADE HAS INCREASED IN RECENT DECADES, FROM USD 8 BILLION IN 1976, TO USD 156 BILLION IN 2017

38%

OF TOTAL FISHERIES AND AQUACULTURE PRODUCTION IS EXPORTED, WHILE

78%

IS EXPOSED TO INTERNATIONAL TRADE COMPETITION

4 The sector operates in an increasingly globalized environment, and products can cross national boundaries several times before final consumption. International trade has increased remarkably in recent decades, from USD 8 billion in 1976, to a record of USD 156 billion in 2017 (FAO, 2019).

5 In 2017, developing countries accounted for 54 percent of total fish export trade value (59 percent in quantity), with their net-export revenues (USD 41 billion, exports minus imports) being higher than those of all other agricultural commodities combined (FAO, 2019).

6 A well-functioning and smoothly operating value chain for fish and fishery products is crucial for the efficient flow of products from producers to consumers. While trade in fish and fish products is fairly liberalized compared to other food products, there are still certain trade barriers in place, in particular for regional trade in developing countries, and in processed products.

7 The economics of fisheries cannot be analyzed in isolation from wider societal trends in demographics, economic development, education, gender and urbanization. Although the sector's interlinkages with the overriding political, institutional and societal construct are real, these relationships are not always easily observed or appreciated.

8 Unfortunately, few countries collect statistics on economic activities directly or indirectly associated with fisheries. While data gathering is expensive, there is a need for more nuanced and substantive data on the economic contribution of the fisheries sector. These data must go beyond primary production and processing and include services and activities associated with the fisheries value chain. These data are particularly needed in relation to the small-scale sector's contribution in terms of employment, value-addition, export revenues and related services.

9 The significant contribution of women in the fisheries sector is seldom fully recognized and women are usually under-represented at decision-making levels, including in the private sector. This gender imbalance is a wasteful use of human capital and could also make it more difficult to recruit and retain talented women in the future. The sector should therefore strive to improve the inclusion and participation of women at all levels. This includes investments in training at the vocational level, providing access to professional careers; as well as, where and when possible, facilitating the recognition of women's roles and their inclusion through the provision of dedicated support services, taking into account regional specificities and needs.

10 There is no doubt that management reforms are needed to make the sector more sustainable overall, but attention must be paid to the socio-economic consequences of these reforms, especially if market-based and more economically-optimal solutions are considered. Flanking measures such as social support systems not only can serve to offset transition costs, but can also increase the acceptance of reforms among stakeholders.

11 The use of market-based fisheries management instruments has proven in some countries to be a powerful instrument in moving towards economically sustainable fisheries. Such instruments can increase earnings, while at the same reducing excessive capacity. However, it may be necessary to also consider policies to mitigate concentration of quota holdings, and to not preclude the entry of newcomers into the sector, including women, and to mitigate social and cultural impacts. In general, a degree of societal acceptance is necessary in order to make any fisheries management regime sustainable in the long run.

12 In addition to its consequences for the ecological sustainability of fish stocks, IUU fishing distorts global fish markets and prices. IUU fishing exists because it is a profitable business. It is therefore paramount that the legality of origin is properly documented, that illegally caught fish do not enter the value chain, and that IUU products are denied access to markets. Traceability can, in addition to other benefits, play a crucial role in ensuring the legal origin of product, including through the use of catch documentation schemes

13 Climate change is likely to have a significant impact on the distribution of fish stocks and on the conditions for aquaculture production. This may expose the physical supply chain to severe shocks, increasing investment needs in making it more robust and resilient, especially in maintaining the cold chain. Climate change will also cause demographic changes, creating disruptions in local, regional and international markets.

14 It is estimated that USD 20 billion of harmful subsidies are provided annually in fisheries, with consequences for overcapacity and overfishing, as well as causing market distortions. In addition to Fisheries Management reforms, harmful fisheries subsidies need to be eliminated to make fisheries more sustainable.

15 In SDG 8, the world community is explicit about the importance of decent work in its stated aim to "promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all". As in other sectors, in the fisheries and aquaculture sector promoting and ensuring decent work is the responsibility of all involved, including companies and consumers. The adoption and implementation of international instruments are key elements to enhance social responsibility in fisheries and aquaculture value chains. Social responsibility in the sector is now being addressed by FAO through the development of new guidance addressing fisheries and aquaculture value chains.

16 Fisheries, when properly managed, can contribute significantly to blue growth. To reach this goal, policymakers need to define precisely what they expect from the fisheries sector, acknowledging that stated objectives may at times be in conflict with each other. Trade-offs between economic efficiency, resource use and employment need to be better assessed, and include both their short-term and long-term consequences, ensuring that sustainability is not compromised while optimal benefits are obtained.

PANEL 1

ECONOMICS IN FISHERIES POLICY

KEYNOTE PRESENTATION

Fisheries Management at a crossroads: how economics can improve fisheries policy decisions.
Carl Christian Schmidt, Nordic Marine Think Tank (NMTT), Denmark

CHAIR

Zhengyong Yang, Shanghai Ocean University, China

PANELISTS

Frank Asche, University of Florida (UFL), United States of America

Elisa Calvo, International consultant, Argentina

Griffin Carpenter, New Economics Foundation (NEF), United Kingdom of Great Britain and Northern Ireland

Mohamed Naji, IAV Véterinaire Hassan II (IAV), Morocco

Ruangrai Tokrisna, Kasetsart University (KU), Thailand

PANEL 2

THE SOCIAL DIMENSION OF THE CONTRIBUTION OF FISHERIES AND AQUACULTURE TO THE ECONOMY

KEYNOTE PRESENTATION

The social dimension of the contribution of fisheries and aquaculture to the economy.
Claudia S. Beltran, International consultant, El Salvador

CHAIR

Rashid Sumaila, University of British Columbia (UBC), Canada

PANELISTS

JJingjie Chu, World Bank (WB), United States of America

Javier Garat, International Coalition of Fisheries Associations (ICFA) and Spanish Fishing Confederation (CEPESCA), Spain

Marie Christine Monfort, International Organisation for Women in the Seafood Industry (WSI), France

Katrina Nakamura, The Sustainability Incubator, United States of America

Nobuyuki Yagi, University of Tokyo, Japan

QUESTIONS

1. What tools do we have, or need, to integrate the economic contribution of capture fisheries with measures of fisheries sustainability?
2. How can we reach a better understanding of the sector's contribution to GDP?
3. How can society address the social costs of industry restructuring and reduction of effort?
4. How can market access for fish and fishery products be maintained and improved?
5. How can we guarantee access to sustainable economic and social benefits of fisheries to women and the most vulnerable communities?
6. What role can social responsibility play in improving conditions for men and women in fisheries and aquaculture value-chains?
7. Which economic tools can encourage responsible behaviour in fisheries?
8. And how can new WTO rules and disciplines on fisheries subsidies improve the sustainability of global capture fisheries?

Session 6

Fisheries management in the face of a changing climate

FAO session lead: Manuel Barange

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SESSION DESCRIPTION

Capture fisheries is the only major food production industry that relies upon the sustainable exploitation of wild populations. These fisheries are therefore affected by natural fluctuations in resource abundance as a result of complex physical, biological and ecological interactions. As our monitoring, understanding and ability to respond to these fluctuations are, and will always be, incomplete, uncertainties are a fact of life in fisheries management and operations.

The increasingly dominant climate change signal in all natural ecosystems, including heat spikes and waves (Oliver et al., 2017), adds a new super-challenge to fisheries management and to the way we deal with uncertainties. This is because fisheries management strategies have been largely constructed under the premise that populations fluctuate around a mean population size, where the biggest challenge is to formulate management actions that are sensitive to these natural and uncertain fluctuations and to the effects of fishing. If climate change results in unidirectional changes, for example in the abundance, distribution and life history of fishing resources, perhaps beyond the bounds of short-term variability, do we have the tools to adjust our management strategies accordingly?

What have we learned from addressing short-term uncertainty that would be helpful in managing resources in the era of climate change?

Fisheries management is the process through which acceptable trade-offs between conservation and sustainable utilization are reached, taking uncertainties into account. In recent years, we have developed increasingly effective methods, tools and systems to reduce and address uncertainties that relate to short-term population dynamics and responses of management. These have evolved into two major approaches:

- Robust management approaches designed to perform well under a wide range of uncertainties
- Adaptive management approaches, which favour a periodic evaluation and adjustment of decision-making tools, to take advantage of new knowledge.

In both approaches the application of the precautionary approach, in which greater precaution is applied to address higher levels of uncertainty, has been widely recognized as being essential to ensure sustainable use and reduced risks. Drawing from our treatment of uncertainty in fisheries management, this session will explore:

- How can fisheries management proactively adjust to take into account climate change-driven trends in time to minimize negative impacts and maximize opportunities?
- What lessons have we learned from addressing short-term uncertainty in assessment and management, in both large and small-scale fisheries, that would be helpful in the search for appropriate solutions to the challenge of managing natural resources in the era of climate change?
- Can our growing understanding of uncertainty in long-term projections of climate change effects be effectively incorporated into contemporary management?
- Are there effective early warning systems of extreme events, such as marine heat waves, that can be used to improve the sustainable management of vulnerable resources?

Furthermore, if fisheries management is about managing human activity:

- What are the larger consequences for not just determining catch levels and harvest strategies, but for the management of fisheries' value chains and the implications for humans dependent on a fishery?
- How do we develop solutions, or adapt existing approaches, for addressing climate change that are applicable to data-poor, capacity-limited fisheries?

- In the case of freshwater systems, how do we incorporate inland fisheries objectives in catchment, basin and regional water management plans to ensure this sector, and its dependent communities, are not left behind as climate change bites?

This session will focus on providing evidence on how to adjust fisheries management to account for gradual as well as non-linear climate change-driven changes in the abundance, distribution and seasonality of fish and fisheries resources, and the consequences of such adjustments for the sustainability of resources and dependent communities.

Examples may range from how to adjust management reference points to the development of new or existing co-management arrangements, including arrangements able to deal with new transboundary stocks, or consideration of shifts from species-based to assemblage-based output controls.

The session will not only deal with sophisticated solutions available to only a handful of resources and countries, but practical solutions that are applicable to inland as well as marine capture fisheries, and in data-poor situations. Specific examples of good practice, and of how to adjust strategies, will be particularly sought.

THE OUTCOMES OF THIS SESSION WILL SUPPORT:

SDG 1 – Reduce poverty, SDG 2 – Food security, SDG 3 – Health and wellbeing, SDG 8 – Economic growth, SDG 11 – Resilient Coastal Cities, SDG 13 – Climate Change, SDG targets 14.2 & 14.3, SDG 16 – Effective institutions, SIDS Samoa Pathways, UNFCC Paris Agreement, SENDAI, FAO Code of Conduct for Responsible Fisheries.

WHAT YOU NEED TO KNOW:

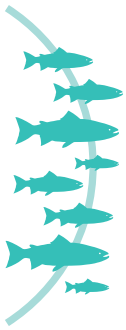
1 The ocean has absorbed 93 percent of the additional heat produced by anthropogenic climate change (IPCC AR5), and is thus at the forefront of the long-term impacts of climate change. These impacts are already affecting – and are expected to continue to affect – the distribution, productivity and seasonality of marine resources, with implications for marine and inland fisheries (Barange et al., 2018).

2 In the absence of fishing, mean global marine animal biomass is expected to decrease by 5–17 percent by 2100, depending on the emission scenario considered, driven primarily by increasing temperatures and decreasing primary production (Lotze et al., 2019). Biomass changes will result in decreases in maximum fish catch potential in the world's exclusive economic zones (EEZs) of 2.8–5.3 percent under a strong mitigation scenario, and 7.0–12.1percent under a business-as-usual scenario, by 2050 (Barange et al., 2018).

THE OCEAN HAS ABSORBED

93%

OF THE ADDITIONAL HEAT PRODUCED BY ANTHROPOGENIC CLIMATE CHANGE



BY 2100 UP TO 35 EEZS WILL RECEIVE NEW TRANSBOUNDARY STOCKS

3 Changes in marine fish catch potential vary by region. The biggest decreases can be expected in the tropics, while for the high latitude regions catch potential is projected to either increase or show less of a decrease than in the tropics. fisheries management has a very significant role to minimize impacts and maximize opportunities (Barange, 2019).

4 It is expected that by 2100 up to 35 EEZs will receive new transboundary stocks as a result of distributional changes, presenting new challenges and opportunities for fishing nations, and creating the potential for conflict over newly shared resources (Pinsky et al., 2018).

5 Reforming fisheries in ways that fix current inefficiencies, adapt to fisheries productivity changes, and create effective transboundary institutions will result in healthier, more resilient fishery resources, and could lead to a future with higher profits and yields compared to what is produced today (Gaines et al., 2018).

6 Approximately 50 percent of inland fish species are threatened by climate change impacts including increasing water temperatures, altered discharge and interactions between these and other stressors, such as invasive species, pathogens and hydropower (Reid et al., 2018). Projected or already documented effects have increased over time, with decreased abundance in coldwater and coolwater fish as the most common directional response (Myers et al., 2017).

7 Adapting inland fisheries management to climate change requires managing habitats, landscapes, and ecosystems through collaboration between fisheries management and a wide range of partners focused on land use, policy and human systems (Paukert et al., 2016).The largest impacts to inland fisheries are likely to be driven by competition for scarce water resources with other more valued economic sectors. Some positive impacts are also identified, like increased precipitation leading to the expansion of and improved connectivity between some fish habitats, but to take advantage of them new investments as well as flexibility in policies, laws and regulations, and post-harvest processes are needed (Funge-Smith, 2018).

8 There is growing confidence that the number and intensity of extreme events is on the increase in several regions, and is related to anthropogenic climate change. Climate-related disasters now account for more than 80 percent of all disaster events, with large social and economic impacts. The extent of their impacts on fisheries and aquaculture will depend on how exposed and vulnerable the socio-ecological systems are.

9 The impacts of climate change on the fisheries and aquaculture sector, including of extreme events, will largely be determined by the sector's ability to develop and implement adaptation strategies. These must include institutional and management adaptations, measures addressing livelihoods, and measures intended to manage and mitigate risks and thereby strengthen resilience.

10 Adaptation solutions need political commitment, stakeholder participation, technological innovation and behavioural change to succeed. A good understanding of the appetite for change in all sectors of society, what supports change and what hinders it is also required.

11 Efforts to adapt to and to mitigate direct and indirect impacts of climate change should be planned and implemented with full consideration of the multifaceted and interconnected complexity of fisheries, and be people-centered. Failure to do so would increase inefficiency and the likelihood of maladaptation, exacerbating rather than reducing impacts.

PANEL 1

INNOVATIVE TECHNICAL ADAPTATIONS OF MANAGEMENT SYSTEMS TO CLIMATE CHANGE

KEYNOTE PRESENTATION

Technical management measures to take account of climate change in fisheries.
Steve D. Gaines, University of California Santa Barbara (UCSB), United States of America

CHAIR

Hazel Oxenford, University of West Indies (UWI), Barbados

PANELISTS

Miguel Bernal, General Fisheries Commission for the Mediterranean (GFCM-FAO), Italy

John Hampton, Secretariat of the Pacific Community (SPC), New Caledonia

Kirstin Holsman, National Oceanic and Atmospheric Administration (NOAA), United States of America

Carl van der Lingen, Department of Agriculture, Forestry and Fisheries, South Africa

Ernesto Penas Lado, International fisheries policy consultant, Spain

PANEL 2

INTERVENTIONS TO MINIMIZE IMPACTS AND MAXIMIZE OPPORTUNITIES

KEYNOTE PRESENTATION

Adapting Fisheries Management for proactive, climate-ready dependent societies and economies.
Éva Plagányi, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

CHAIR

Hazel Oxenford, University of West Indies (UWI), Barbados

PANELISTS

Merrick Burden, Environmental Defense Fund (EDF), United States of America

Abigail Lynch, United States Geological Survey (USGS), United States of America

Flower Msuya, Zanzibar Seaweed Cluster Initiative (ZaSCI), Tanzania

John Pinnegar, Centre for Environment, Fisheries & Aquaculture Science (CEFAS), United Kingdom of Great Britain and Northern Ireland

Shyam S. Salim, Central Marine Fisheries Research Institute (ICAR), India

QUESTIONS

1. How does fisheries management proactively adjust to take into account climate change, and what are the consequences of not adjusting to it?

2. What are the difficulties in incorporating uncertainty in long-term projections of climate change into contemporary management, learning from the way fisheries management has treated uncertainty before?

3. What are the most practical management responses to changes in production, distribution and process seasonality of aquatic resources across data-rich and data-poor fisheries?

4. What are the implications of climate change for dependent communities, and what are adaptation strategies that can help minimize impacts and maximize opportunities for livelihoods, in particular for those who are most vulnerable, including gender issues?

5. How do we develop solutions, or adapt existing approaches, to help fishers proactively adjust to climate change?

6. How do we develop multi-scale approaches for fisheries systems that are able to capture regional, national and local adaptation strategies, in a way that maximizes opportunities and minimizes risks?

Session 7

Fisheries information systems and new technologies

FAO session lead: Marc Taconet

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SESSION DESCRIPTION

Sustainable fisheries need a decision-making process based on the best scientific evidence available (FAO, 1995). This premise implies a functional and effective supply chain of data and statistics operating through a variety of Fisheries Information Systems. As our global environment evolves with increasingly complex societal challenges (increased demand for fish, competition for resources, climate change, etc.), the demand for data and information also evolves. Today the Agenda 2030 for oceans (SDG 14) demands a better understanding of fish stocks to improve their sustainability status (SDG 14.4.1), more emphasis on minimizing detrimental effects of fisheries on habitats and ecosystems (SDGs 14.2, 14.5), a reduction of the extent of illegal fishing (SDG 14.4) and of ways to eliminate negative fisheries subsidies (SDG 14.6.1), better understanding of the contribution of small-scale fisheries to livelihoods (SDG 14.b.1), and a growing expectation on the economic contribution of sustainable fisheries to GDP (SDG 14.7.1), among others. In addition, climate change and the increasing need to develop risks-based adaptive management systems require close-to-real-time monitoring systems capable of guiding timely corrective actions (Barange et al., 2018). However, in spite of all these challenges, the fisheries sector generally remains a late adopter of novel information system technologies, and the capacity of many developing countries to adopt even basic technologies is often characterized as very low. Inadequate collection frameworks and major data gaps are still widely encountered, holding back many countries from properly assessing and tracking the status of their fisheries resources and designing effective fisheries management policies and schemes.

The need to improve availability and use of fishery data, statistics, and information has been clearly outlined in FAO's State of World Fisheries and Aquaculture (FAO, 2018). SDG targets, which rely on evidence and country-based quantitative assessments, constitute a unique opportunity to increase data generation, and improve their quality.

The need to improve availability and use of fishery data, statistics, and information has been clearly outlined in FAO's State of World Fisheries and Aquaculture (FAO, 2018). As SDG targets, which rely on evidence and country-based quantitative assessments, they constitute a unique opportunity to increase data generation, and improve their quality, availability and usage in sectoral monitoring systems for policy guidance (FAO, 2018b). While on one hand, incomplete and/or inaccessible national data must be better utilized, on the other hand increased attention is being placed on the opportunities that innovation in information technologies can provide, and how these have the capacity to change the way we generate, interpret and communicate fisheries sustainability issues. Examples of application of new proven technologies clearly show they can address important aspects of data collection for fisheries – the need for transparency (e.g. AIS on the conduct of fishing activity – Taconet et al., 2019), for multi-disciplinary science and/or community engagement (e.g. Virtual Research Environments, crowd sourcing), for close-to-real-time data (e.g. electronic monitoring systems in the uptake of catch quotas), or for engaging small-scale fishers in co-management – FAO, under press a). Use of appropriate international standards will be crucial for consistency across different national statistical systems.

This session will first seek to understand the effectiveness of current data collection and fisheries information systems and the new and proven technologies that may be applied to improve marine and inland fisheries. We will look at the problem as witnessed on the ground, from the perspectives of coastal communities and developing states, by striving to identify current issues and whether the diversity of information technologies make the information landscape more complex and challenging or instead offer opportunities and solutions to current problems: e.g. how well they reflect each sub-sector, particularly small-scale, subsistence and recreational fisheries; or how do they enable and facilitate the involvement of all stakeholders – including women and the most vulnerable – in fisheries policy and management decisions at all levels. We will also consider the growing belief that fisheries data will have become a public commodity in 10 years, that integrating sources and analytical services is a major challenge; and we will depict the likely obstacles that countries will

face along this pathway to open science when dealing with standards for consistency across statistical systems, data ownership, copyrights and terms of use, confidentiality rules, the resistance for transparency, and the sustainability of proposed solutions.

Having set up this grounded view of the issues to resolve and some techniques that could be applied and scaled, we will introduce and discuss a future-oriented global vision, looking at emerging technologies, their future role in scaling of currently available, proven technologies and in respect of what we see as vital to the management of fisheries and ocean conservation. While tracking every vessel is well within technical possibility, other innovations present exceptional challenges. For example, how will the assessment of fishing activity evolve as we explore technological innovations? How will disruptive technologies such as blockchain modify the traceability landscape and stakeholder behavior along the value chain? How will the availability of big data affect expectations of ecosystem-based and adaptive management in the face of uncertainty? Or what will be the role of artificial intelligence in providing integrated views coming from complex environmental, economic and social information streams, and/or articulating scenarios and solutions?

Across the session, we will seek to outline directions as to what major actions are necessary and the levels at which they should take place, the roles which various organizations and stakeholders (governments, industry bodies, non-governmental organizations, etc.) should pursue to ensure adoption of efficient information systems, and how to ensure that data and information developments are used effectively for sustainable fisheries locally and globally, and are accessible to the most vulnerable?

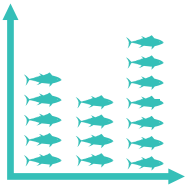
THE OUTCOMES OF THIS SESSION WILL SUPPORT:

SDG 1 – Reduce poverty, SDG 2 – Food security, SDG 8 – Economic growth, SDG 9 – Technology and innovation, SDG 13 – Climate Change, SDG targets 14.2, 14.4, 14.5, 14.6 14.7. 14.B & 14.A, SIDS Samoa Pathways, UNFCC Paris Agreement, FAO Code of Conduct for Responsible Fisheries.

WHAT YOU NEED TO KNOW:

1 Reliable, timely and detailed statistics play an essential role in supporting sound policymaking and providing information on the performance of the fishery sector and its sustainability that is essential for effective management (FAO, 1995).

2 Most countries have a system in place for the collection of at least partial fisheries statistics. However, inadequate collection frameworks and data gaps are still widely encountered, holding back many countries from properly assessing and tracking the status of their fisheries resources and designing and implementing effective fisheries management policies and schemes (FAO, 2018). There is an urgent need to improve availability, quality and use of fishery data, statistics and information particularly in developing countries (FAO, 2018), in order to support evidence-based decisions for sustainable fisheries at local, national and international levels.



THE AGENDA 2030 FOR THE OCEANS (SDG 14) DEMANDS A BETTER UNDERSTANDING OF FISH STOCKS TO IMPROVE THEIR SUSTAINABILITY STATUS

3 The fisheries sector has generally been a late adopter of innovative information technologies, and the capacity of many developing countries to adopt even basic technologies is often low, contributing to the data-poor nature of many fisheries. Existing initiatives indicate that new technologies and information systems, together with well-designed capacity-building and sustainability solutions, could provide major support to improve the collection and availability of high-quality fishery data and help enhance national statistical systems (FAO, under press a).

4 The Agenda 2030 for the oceans (SDG 14) demands a better understanding of fish stocks to improve their sustainability status (SDG 14.4.1), more emphasis on minimizing detrimental effects of fisheries on habitats and ecosystems (SDGs 14.2, 14.5), better understanding of the contribution of small-scale fisheries to livelihoods (SDG 14.b.1), a reduction in the extent of IUU fishing (SDG 14.4) and ways to prohibit harmful fisheries subsidies (SDG 14.6.1), and a growing expectation on the economic contribution of sustainable fisheries to GDP, among many other objectives. As SDGs rely on country-based quantitative assessments, they constitute a unique reason and opportunity to improve data collection systems and increase data generation, their quality, availability and usage, in sectoral monitoring systems for policy guidance. Use of appropriate international standards will be crucial for consistency across different national statistical systems.

5 The emergence of climate change and the increasing need to develop risk-based adaptive management systems require close-to-real-time monitoring and information systems (Barange et al., 2018) capable of guiding timely corrective actions. Such systems, designed to support management decisions and to make best use of new technologies, will facilitate more effective collection and analysis of relevant data than is commonly achieved at present.

6 New information technologies have the potential to change the way we generate, interpret and communicate fishery sustainability issues. Application of new technologies clearly shows they can address important aspects of data collection for fisheries, meeting, for example, the needs for transparency (e.g. AIS on the conduct of fishing activity – FAO, under press a); multi-disciplinary science and/or community engagement (e.g. Virtual Research Environments to foster collaboration, crowd sourcing); collection of close-to-real-time data (e.g. electronic monitoring systems on the uptake of catch quotas); or engagement of small-scale fishers in co-management (e.g. smartphone applications – Taconet et al., 2019). These highlight tremendous added value and potential to inform and influence the operations and management of fisheries locally.

7 While governments and agencies in charge of fisheries monitoring and management have been historically reluctant to open access to data systems, fish and fisheries data are rapidly becoming a public commodity, opening opportunities to many non-state actors to provide innovative services, and to state actors to make the most of the available technologies.

8 Information technology is a swiftly innovating industry, and beyond a five-year time frame it is difficult to predict what IT will look like and how far it will transform our monitoring and management processes. The emergence of new technologies such as blockchain, big data, artificial intelligence and deep learning is likely to significantly affect the established data value chain and to disrupt the sector's management in the short to medium term.

9 Major challenges remain, however, to fruitfully put these innovations to the benefit of the sector, and contribute to efforts to implement Agenda 2030 – these include copyrights, privacy and confidentiality boundaries, comprehensiveness and risks for biases, capacity to integrate sources and analytical services, costs of investments, disruptions on existing monitoring systems and actors' adaptation, and sustainability of proposed solutions.

10 The role that the public sector at national, regional and global levels plays in this arena remains crucial. By supporting strengthened governance and increased partnerships among data and technology providers, and strategies for sustainability, the public sector can help achieve comprehensive, neutral and sharable data feeds from local applications to global statistics and trends monitoring. While fulfilling this role, the public sector will have to ensure that inherent biases of private interests do not distort an objective assessment of the sector's reality. The public sector also plays a critical role in helping to counter the natural tendency to a digital divide, and ensure that all – including women and the most vulnerable – will have full access to these technology innovations.

STRENGTHENED GOVERNANCE AND INCREASED PARTNERSHIPS AMONG DATA AND TECHNOLOGY PROVIDERS CAN HELP ACHIEVE SHARABLE DATA FEEDS

PANEL 1

THE FUNDAMENTALS – WHAT CENTRAL SET OF ISSUES NEED TO BE ADDRESSED FOR FISHERIES DATA/INFORMATION TO BE A PUBLIC COMMODITY SUPPORTING SECTOR NEEDS?

KEYNOTE PRESENTATION

How ICTs can answer some of the big data questions about small-scale fisheries.
Serge Raemaekers, Abalobi, South Africa

CHAIR

Cisco Werner, National Oceanic and Atmospheric Administration (NOAA), United States of America

PANELISTS

Douglas Beard, United States Geological Survey (USGS), United States of America

Emmanuel Chassot, Seychelles Fishing Authority, Seychelles

Jeannette Mateo, Fisheries Resources at the Dominican Council for Fisheries and Aquaculture (CODOPESCA), Dominican Republic

Nyoman Radiarta, Institute for Marine Research and Observation (IMRO), Indonesia

Suzuette Soomai, Department of Fisheries and Oceans Canada (DFO), Canada

PANEL 2

A VISION FOR THE FUTURE – WHAT TECHNOLOGIES MUST BE SCALED AND ADOPTED, AND WHAT DO EMERGING TECHNOLOGIES NEED TO ADDRESS?

KEYNOTE PRESENTATION

Beyond Augmented Intelligence (while leaving no one behind).
Donatella Castelli, Italian National Research Council (CRN-ISTI), Italy

CHAIR

Cisco Werner, National Oceanic and Atmospheric Administration (NOAA), United States of America

PANELISTS

Bubba Cook, World Wide Fund for Nature (WWF), New Zealand

Lifeng Cui, China National Fisheries Technology Extension Center, General of China Society of Fisheries, China

Sara Iverson, Ocean Tracking Network (OTN), Canada

Tony Long, Global Fishing Watch, United Kingdom of Great Britain and Northern Ireland

Lida Teneva, California Ocean Science Trust, United States of America

QUESTIONS

1 What are the main obstacles preventing countries from developing efficient fisheries information and monitoring systems? And what are the new requirements that the SDGs demand from our information systems that we need to support?

2 Are major data gaps rather caused by countries lacking data collection, or countries unable to properly manage and analyze collected data? And what are the technical, financial and political hurdles to adopt either proofed or innovative technologies?

3 How can data and information become more openly accessible? And how do we increase transparency, particularly when data/information may be confidential or could be exploited in ways that undermine sustainable practices?

4 Will emerging technologies change the paradigms of fisheries management, or the way we address the challenges of food and livelihoods security? How can the various forms of knowledge, e.g. traditional/indigenous knowledge, be accommodated within emerging technologies?

5 How can data generated by new technologies for local needs contribute to global fishery sector accounting? What should be done to ensure that responsibly interpreted information remains a driver to decisions?

6 Considering the investments required, how can we avoid a digital divide outcome, and what can be the strategies inclusive of women and the most vulnerable?

7 What will an organization like FAO become (e.g. data provider, quality assurance and data standards setting body, delivering analysis to its members), how will its governing role evolve, and what will be the roles of other organizations and stakeholders?

Session 8

Policy opportunities for fisheries in the twenty-first century

FAO session lead: Amber Himes-Cornell

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SESSION DESCRIPTION

This session explores policy imperatives for the fisheries sector of the twenty-first century in the context of renewed emphasis on fisheries to meet the food demands of a growing human population, progressive changes in the overall productivity of marine systems, the international implications of reduced access to fisheries resources, and the redistribution of fished species in relation to management areas and fisheries as the climate changes.

Given the immense diversity of the economic, social and ecological characteristics of regions and their fisheries, there are wide variations in how fisheries are managed and to what extent management is deemed successful. Most national fisheries management policies focus on balancing conservation and sustainable use, with a particular emphasis on ecological rather than social or economic sustainability. However, the outcomes of these policies have varied, with some nations and regions largely meeting their management objectives while others have not.

Aquatic resources, although renewable, are not infinite and need to be properly managed if their contribution to the nutritional, economic and social well-being of the growing world's population is to be sustained.

Code of Conduct for Responsible Fisheries, 1995)

Many of the challenges to successful policy implementation are the result of high demand for limited resources, poverty and lack of alternatives to fishing, complexity and inadequate knowledge, inappropriate incentives and market distortions, lack of governance, and conflicts between the fisheries sector with other sectors and the environment. Thus, it is well recognized that national and international management of fisheries still faces a number of gaps and weaknesses that must be addressed so that the full potential of the world's fisheries can be unlocked.

Some of the primary challenges are:

- Finding suitable mechanisms for effective management in countries and regions that cannot, or choose not to, allocate adequate and human resources to developing and running management systems
- Managing different fisheries that may share the same biological resources
- Improving the effectiveness of international cooperation
- Managing fisheries in areas of high biological diversity
- Achieving the fair allocation of the world's fisheries resources
- Building constructive relationships with marine and inland biodiversity conservation initiatives and other sectors and uses of marine and freshwater resources
- Reconciling economic, social and environmental objectives
- Practical implementation and enforcement of existing management systems.

Although fisheries management is guided by a number of international policies and agreements including the United Nations Convention on the Law of the Sea (UNCLOS) (UN, 1994), UN Fish Stocks Agreement (UNFSA) (UN, 2001), the FAO Code of Conduct for Responsible Fisheries (FAO, 1995) and associated international plans of action and other instruments, the modern world is changing rapidly under the influence of climate change, economic and technological development and other factors. The relatively recent development and adoption of a range of new guidelines and approaches reflects extensive experience with addressing the challenges, and reinforces the need to consider the neesd and priorities for new policies for the future.

Furthermore, given the many trade-offs on the environmental-economic-social axes of the Sustainable Development Goals (SDGs), we cannot view fisheries policy through a purely sectoral lens. If we are to make progress beyond SDG 14 (Life below water) and towards the many other SDGs that are relevant to capture fisheries and fisheries stakeholders, and if we are to have a positive impact on society and to achieve such a sustainable future, then fisheries policy must be incorporated into the broader policy arena.

The keynote speakers and panel discussions in this session will help discern the policy opportunities for improving fisheries management in the twenty-first century. It will lay out how alternative policies for the sector in different regions of the world can help maintain or improve the performance of fisheries management and the wider goals of poverty alleviation, development, job creation, food security and nutrition, and the health of the oceans and freshwater resources. The session will conclude by laying out a vision for the sector and the contribution of fisheries to 'The future we want.'

THE OUTCOMES OF THIS SESSION WILL SUPPORT:

SDG 1 – Reduce poverty, SDG 2 – Food security, SDG 3 – Good health, SDG 5 – Gender equality, SDG 8 – Decent work and economic growth, SDG 10 – Reduced inequalities, SDG 13 – Climate Change, SDG targets 14.2, 14.4, 14.6 & 14.C, SIDS Samoa Pathways, United Nations Convention on the Law of the Sea, UN Fish Stocks Agreement, FAO Code of Conduct for Responsible Fisheries.

WHAT YOU NEED TO KNOW:

1 Awareness of the importance of our oceans and inland waters has been growing, both within governments and civil society; however, recognition of the many services they provide has only recently had a prominent presence in the agenda of high-level political leaders. There is now broad agreement that the governance frameworks for oceans and seas need to be reinforced to secure ocean-based goods and services for future generations and to develop a truly sustainable blue economy.

2 The power of the blue economy is driving the development of marine and maritime policies that create coherent approaches to the interconnected activities of shipping, energy generation, tourism, mineral resource extraction and fishing. The expectation of increasing demands on the blue economy has also led to calls to ensure the foundations of that economy – our oceans and seas – are used sustainably.

THE JOBS CREATED FOR BOTH MEN AND WOMEN AS FISH MOVE FROM DECK TO DISH HELP TO ELIMINATE POVERTY

3 The fisheries and aquaculture sectors in both marine and inland aquatic spaces have a long-standing presence and serve a wide range of objectives. They are key food-producing sectors, providers of livelihoods and sources of social and cultural values, despite traditionally having less economic and political power and priority than other sectors.

4 The Code of Conduct for Responsible Fisheries (the Code) recognizes that "aquatic resources, although renewable, are not infinite and need to be properly managed if their contribution to the nutritional, economic and social well-being of the growing world's population is to be sustained" (Preface, Code of Conduct for Responsible Fisheries, 1995). This 25-year-old statement – acknowledging the vital role of both marine and inland fish and fisheries in world food security, nutrition and economic and social development – holds more true than ever.

5 The international legal framework for the fisheries sector is now well established, both in areas under national jurisdiction and the high seas, following the calls from the Code for cooperation and coordination at regional and global levels. Through the Regional Fishery Body Secretariats Network (RSN) and other cooperation frameworks, the 53 Regional Fisheries Bodies around the globe and other competent organizations (e.g., the Regional Seas organizations, the International Maritime Organization and the International Seabed Authority) are strengthening the international ocean governance mechanisms covering the high seas and fisheries of the world.

53 REGIONAL FISHERIES BODIES AROUND THE GLOBE

6 However, implementation of fisheries policies at national, regional and global level is uneven and has met with mixed success. This is sometimes due to policy failures and sometimes due to implementation failures, including lack of capacity or lack of resources. There is a great need for collective reflection on this problem in order to find solutions for improving policy where objectives are not being met, while being mindful of not disrupting what is going well. In particular, there is the need to manage resource use in all fishing areas sustainably with targets that are more ambitious than recent conservation-focused targets (e.g. Aichi Biodiversity Target 11).

7 Landside, broader environmental policies that focus on flood protection, irrigation and water allocation, navigation or hydropower generation, still rarely consider the ensuing impacts on water quality, habitat coherence, freshwater availability and climate change that are crucial for inland fisheries. Indeed, inland fisheries issues have only recently started to be inserted into broader land and water dialogs, and inland fisheries management is still largely inwardly focused on managing access and on providing technical regulations.

8 Experience shows that open-access regimes are less successful in delivering sustainable environmental, economic and social results. fisheries management should therefore be based on fisheries tenure and user rights that appropriately reflect the different contexts in which they occur. Such management regimes should be designed to make fishing capacity commensurate with available fishing opportunities.

9 Policies for the fisheries sector are not only about fish (SDG 14, Life below water):

- The jobs created for both men and women as fish move from deck to dish help to eliminate poverty (SDG 1).
- The fish caught provide food security and nutrition (SDGs 2 & 3).
- Well managed fisheries operating on an ecologically sustainable basis can contribute to poverty eradication (SDG 1), economic well-being (SDG 8), cope with climate change (SDG 13), and facilitate peace and security (SDG 16).
- When access to these natural resources and markets is recognized and secured for small-scale artisanal fishers (SDG 14.b), the voices of competing sectors will be more equal (SDG 10), and gender equality will be better served (SDG 5).

10 The FAO Committee of Fisheries is the global forum for discussions and decisions on fisheries and aquaculture issues. It is through this forum that the future of fisheries policy will be debated and defined.

11 Widespread application of existing global instruments and frameworks – such as for human rights, the right to food, indigenous peoples, gender, labour, the responsible governance of tenure, securing sustainable small-scale fisheries, responsible agricultural investment, and food security and nutrition – to the fisheries sector is one of the greatest policy opportunities for strengthening fisheries governance in the twenty-first century.

PANEL 1

BEYOND THE CODE OF CONDUCT: POLICY OPPORTUNITIES FOR FISHERIES MANAGEMENT IN THE TWENTY-FIRST CENTURY

KEYNOTE PRESENTATIONS

Navigating new waters.
Lori Ridgeway, International consultant, Canada

Fisheries sustainability leaving none behind: three key policy opportunities for the twenty-first century.
John Kurien, Azim Premji University, India

CHAIR

Atsushi Sunami, Ocean Policy Research Institute, the Sasakawa Peace Foundation (OPRI – SPF), Japan

PANELISTS

Samantha Burgess, World Wide Fund for Nature (WWF), Belgium

Michael Copeland, Lucky Star Operations, Oceana Group Ltd, South Africa

Claire Delpeuch, Organization for Economic Co-operation and Development (OECD), France

Hamady Diop, African Union Development Agency (AUDA-NEPAD), South Africa

Sergei Leontev, Russian Federal Research Institute of Fishiries and Oceanography (VNIRO), Russia

Pamela Mace, Ministry for Primary Industries, New Zealand

Patrick McConney, University of West Indies (UWI), Barbados

Yi Tang, Shanghai Ocean University (SHOU), China

Veronika Veits, Directorate-General for Maritime Affairs and Fisheries of the European Commission, Belgium

Sally Yozell, Stimson Center, United States of America

QUESTIONS

1 What have been the main fisheries policy failures and successes since the endorsement of the Code of Conduct for Responsible Fisheries?

2 Reflecting on the key policy needs for the future, what policy innovations do you think will help us ensure sustainable fisheries in a world with increasing demands by multiple sectors on marine and freshwater resources?

3 What existing regional and international legal frameworks need to be strengthened to support fisheries policy and management in the future?

4 What trade-offs will society need to consider to balance the objectives and goals of multiple sectors that have an interest in oceans, rivers and lakes?

5 How can we collectively better support the implementation of fisheries policies and governance strategies to meet the needs of small-scale fishers, including securing their access and rights to marine and freshwater fisheries resources?

6 What should be considered in future policy discussions so that the growth of the blue economy can best contribute to securing livelihoods and food security?

REFERENCES

SESSION 1

Costello, C., Ovando, D., Hilborn, R., Gaines, S.D., Deschenes, O. & Lester, S.E. 2012. Status and solutions for the world's unassessed fisheries. *Science* 338 (6106): 517–20. (also available at https://doi.org/10.1126/science.1223389).

FAO. 2018. *The State of World Fisheries and Aquaculture 2018 – Meeting the sustainable development goals.* Rome, Italy, FAO. (also available at http://www.fao.org/documents/card/en/c/I9540EN/).

Ricard, D., Minto, C., Jensen, O.P. & Baum, J.K. 2012. Examining the knowledge base and status of commercially exploited marine species with the RAM legacy stock assessment database: The RAM Legacy Stock Assessment Database. *Fish and Fisheries* 13 (4): 380–98. (also available at https://doi.org/10.1111/j.1467-2979.2011.00435.x).

Rousseau, Y., Watson, R.A., Blanchard, J.L. & Fulton, E.A. 2019. Evolution of global marine fishing fleets and the response of fished resources. *Proceedings of the National Academy of Sciences* 116 (25): 12238–43. (also available at https://doi.org/10.1073/pnas.1820344116).

Ye, Y. and Gutierrez, N.L. 2017. Ending fishery overexploitation by expanding from local successes to globalized solutions. *Nature Ecology & Evolution* 1 (7). (also available at https://doi.org/10.1038/s41559-017-0179).

SESSION 2

ABT. 2015. *Estimating the change in ecosystem service values from coastal restoration.* (also available at https://www.abtassociates.com/sites/default/files/migrated_files/1d3da4ac-9f10-4583-90bf-0f6cb2eafdc0_0.pdf).

Benítez-López, A., Alkemade, R., Schipper, A.M., Ingram, D.J., Verweij, P.A., Eikelboom, J.A.J., & Huijbregts, M.A. J. 2017. The impact of hunting on tropical mammal and bird populations. *Science* 356 (6334): 180–83. (also available at https://doi.org/10.1126/science.aaj1891).

Costanza, R., Rudolf de Groot, L. B., Ida K., Lorenzo F., Paul S., Steve F. & Monica G. 2017. Twenty years of ecosystem services: how far have we come and how far do we still need to go? *Ecosystem Services* 28 (December): 1–16. (also available at https://doi.org/10.1016/j.ecoser.2017.09.008).

Dulvy, N. K., Yvonne S. & Reynolds, J.D. 2003. Extinction vulnerability in marine populations. *Fish and Fisheries* 4 (1): 25–64. (also available at https://doi.org/10.1046/j.1467-2979.2003.00105.x).

Halpern, B. S., Cottrell, R.S., Blanchard, J.L., Bouwman, L., Froehlich, H.E., Gephart, J.A., Jacobsen, N.S., Kuempel, C.D., McIntyre, P.B., Metian, M., Moran, D.D., Nash, K.L., Többen, J. & Williams, D.R. 2019. Opinion: Putting all foods on the same table: Achieving sustainable food systems requires full accounting. *Proceedings of the National Academy of Sciences* 116 (37): 18152–56. (also available at https://doi.org/10.1073/pnas.1913308116).

IPBES. 2019. *Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.* S. Díaz, J. Settele, J., Brondizio, E.S., Ngo, H.T., Guèze, M., Agard, J., Arneth, A., et al. (eds.). IPBES secretariat, Bonn, Germany. (also available at https://www.ipbes.net/global-assessment-report-biodiversity-ecosystem-services).

McCauley, D. J., Pinsky, M.L., Palumbi, S.R., Estes, J.A., Joyce F.H., and Warner, R.R. 2015. Marine defaunation: animal loss in the global ocean. *Science* 347 (6219): 1255641–1255641. (also available at https://doi.org/10.1126/science.1255641).

OECD. 2019. *Biodiversity: Finance and the economic and business case for action; report prepared for the G7 Environment Ministers' Meeting, 5-6 May 2019.* (also available at https://www.oecd.org/environment/resources/biodiversity/G7-report-Biodiversity-Finance-and-the-Economic-and-Business-Case-for-Action.pdf).

Salafsky, N., and Wollenberg, E. 2000. Linking livelihoods and conservation: A conceptual framework and scale for assessing the integration of human needs and biodiversity. *World Development* 28 (8): 1421–38. (also available at https://doi.org/10.1016/S0305-750X(00)00031-0).

Sumaila, U. R. 2012. Seas, oceans and fisheries: A challenge for good governance. *The Round Table 101* (2): 157–66. (also available at https://doi.org/10.1080/00358533.2012.661532).

UNGA. 2015. Resolution adopted by the General Assembly on 25 September 2015: 70/1 Transforming our world: The 2030 Agenda for Sustainable Development. (also available at https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_70_1_E.pdf).

Worm, B., Hilborn, R., Baum, J.K., Branch, T.A., Collie, J.S., Costello, C., Fogarty, M.J., Fulton, E.A., Hutchings, J.A., Jennings, S., Jensen, O.P., Lotze, H.K., Mace, P.M., McClanahan, T.R., Minto, C. Palumbi, S.R., Parma, A.M. Ricard, D., Rosenberg, A.A., Watson, R. & Zeller, D. 2009. Rebuilding global fisheries. *Science* 325 (5940): 578–85. (also available at https://doi.org/10.1126/science.1173146).

SESSION 3

CFS, 2014. *Sustainable Fisheries and Aquaculture for Food Security and Nutrition: Policy Recommendations.* Rome, Italy, FAO. (also available at http://www.fao.org/3/a-av032e.pdf).

FAO. 2017. *The future of food and agriculture – Trends and challenges.* Rome, Italy. (also available at http://www.fao.org/3/a-i6583e.pdf).

FAO. 2018. *The State of World Fisheries and Aquaculture 2018 – Meeting the sustainable development goals.* Rome. (also available at http://www.fao.org/documents/card/en/c/I9540EN/).

FAO. 2019. *FAO yearbook. Fishery and Aquaculture Statistics 2017 / FAO annuaire. Statistiques des pêches et de l'aquaculture 2017 / FAO anuario. Estadísticas de pesca y acuicultura 2017.* Rome/Roma. (also available at http://www.fao.org/3/ca5495t/CA5495T.pdf).

FAO, IFAD, UNICEF, WFP & WHO. 2019. *The State of food security and nutrition in the world 2019. Safeguarding against economic slowdowns and downturns.* Rome, FAO. (also available at http://www.fao.org/3/ca5162en/ca5162en.pdf).

Hall, S.J., Delaporte, A., Phillips, M.J., Beveridge, M. & O'Keefe, M. 2011. *Blue frontiers: Managing the environmental costs of aquaculture.* The WorldFish Center, Penang, Malaysia. (also available at http://pubs.iclarm.net/resource_centre/WF_2818.pdf).

Hilborn, R., Banobi, J., Hall, S.J., Pucylowski, T. & Walsworth, T.E. 2018. The environmental cost of animal source foods. *Frontiers in Ecology and the Environment* 16 (6): 329–35. (also available at https://doi.org/10.1002/fee.1822).

HLPE. 2014. *Sustainable fisheries and aquaculture for food security and nutrition. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome 2014.* (also available at http://www.fao.org/3/a-i3844e.pdf).

HLPE. 2017. *Nutrition and food systems. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security*. Rome. (also available at http://www.fao.org/fileadmin/user_upload/hlpe/hlpe_documents/HLPE_Reports/HLPE-Report-12_EN.pdf).

SESSION 4

World Bank, FAO & WorldFish. 2012. *Hidden harvest: The global contribution of capture fisheries.* World Bank, New York. (also available at http://documents.worldbank.org/curated/en/515701468152718292/pdf/664690ESW0P1210120HiddenHarvest0web.pdf).

FAO. 2018. *The State of World Fisheries and Aquaculture 2018 – Meeting the sustainable development goals.* Rome. (also available at http://www.fao.org/documents/card/en/c/I9540EN/).

REFERENCES

SESSION 5

Barange, M., Bahri, T., Beveridge, M.C.M., Cochrane, K.L., Funge-Smith, S. & Poulain, F. (eds.). 2018. *Impacts of climate change on fisheries and aquaculture: synthesis of current knowledge, adaptation and mitigation options.* FAO Fisheries and Aquaculture Technical Paper No. 627. Rome, Italy, FAO. (also available at http://www.fao.org/policy-support/resources/resources-details/en/c/1152846/).

FAO. 2019. *FAO yearbook. Fishery and Aquaculture Statistics 2017 / FAO annuaire. Statistiques des pêches et de l'aquaculture 2017 / FAO anuario. Estadísticas de pesca y acuicultura 2017.* Rome/Roma. (also available at http://www.fao.org/3/ca5495t/CA5495T.pdf).

Tveterås S., Asche F., Bellemare M.F., Smith M.D., Guttormsen A.G., Lem, A. Lien, K. & Vannuccini, S. 2012. Fish Is Food – The FAO's Fish Price Index. *PLoS ONE* 7(5): e36731. (also available at https://doi.org/10.1371/journal.pone.0036731).

SESSION 6

Barange, M., 2019. Avoiding misinterpretation of climate change projections of fish catches. ICES *Journal of Marine Science.* (also available at https://doi.org/10.1093/icesjms/fsz061).

Barange, M., Bahri, T., Beveridge, M.C.M., Cochrane, K.L., Funge-Smith, S. & Poulain, F. (eds.). 2018. *Impacts of climate change on fisheries and aquaculture: synthesis of current knowledge, adaptation and mitigation options.* FAO Fisheries and Aquaculture Technical Paper No. 627. Rome, Italy, FAO. (also available at http://www.fao.org/policy-support/resources/resources-details/en/c/1152846/).

Funge-Smith, S. 2018. *Review of the state of world fishery resources: inland fisheries.* FAO Fisheries and Aquaculture Circular No. C942 Rev.3. Rome, Italy. (also available at http://www.fao.org/inland-fisheries/resources/detail/en/c/1145511/).

Gaines, S.D., Costello, C., Owashi, B., Mangin, T., Bone, J., Molinos, J.G., Burden, M., Dennis, H., Halpern, B.S., Kappel, C.V., Kleisner, K.M. & Ovando, D. 2018. Improved fisheries management could offset many negative effects of climate change. *Science Advances 4*, eaao1378. (also available at https://doi.org/10.1126/sciadv.aao1378).

Myers, B.J.E., Lynch, A.J., Bunnell, D.B., Chu, C., Falke, J.A., Kovach, R.P., Krabbenhoft, T.J., Kwak, T.J. & Paukert, C.P. 2017. Global synthesis of the documented and projected effects of climate change on inland fishes. Reviews in Fish Biology and Fisheries. Volume 27, 339–361. (also available at https://doi.org/10.1007/s11160-017-9476-z).

Lotze, H.K., Tittensor, D.P., Bryndum-Buchholz, A., Eddy, T.D., Cheung, W.W.L., Galbraith, E.D., Barange, M., Barrier, N. Bianchi, D. Blanchard, J.L., Bopp, L., Buchner, M., Bulman, C.M. Carozza, D.A., Christensen, V., Coll, M. Dunne, J.P., Fulton, E.A., Jennings, S. Jones, M.C., Mackinson, S. Maury, O. Niiranen, S., Oliveros-Ramos, R., Roy, T., Fernandes, J.A., Schewe, J., Yunne-Jai, S. Silva, T.A.M., Steenbeek, J. Stock, C.A., Verley, P., Volkholz, J. Walker, N.D. & Worm, B. 2019. Global ensemble projections reveal trophic amplification of ocean biomass declines with climate change. *Proceedings of the National Academy of Sciences* 116, 12907–12912. (also available at https://doi.org/10.1073/pnas.1900194116).

Oliver, E.C.J., Benthuysen, J.A., Bindoff, N.L., Hobday, A.J., Holbrook, N.J., Mundy, C.N. & Perkins-Kirkpatrick, S.E. 2017. The unprecedented 2015/16 Tasman Sea marine heatwave. *Nature Communications* 8 (1). (also available at https://doi.org/10.1038/ncomms16101).

Paukert, C.P., Glazer, B.A., Hansen, G.J.A., Irwin, B.J., Jacobson, P.C., Kershner, J.L., Shuter, B.J., Whitney, J.E. & Lynch, A.J. 2016. Adapting inland fisheries management to a changing climate. *Fisheries* 41, 374–384. (also available at https://doi.org/10.1080/03632415.2016.1185009).

Pinsky, M.L., Reygondeau, G., Caddell, R., Palacios-Abrantes, J., Spijkers, J. & Cheung, W.W.L. 2018. Preparing ocean governance for species on the move. *Science* 360, 1189–1191. https://doi.org/10.1126/science.aat2360

Reid, A.J., Carlson, A.K., Creed, I.F., Eliason, E.J., Gell, P.A., Johnson, P.T.J., Kidd, K.A., MacCormack, T.J., Olden, J.D., Ormerod, S.J., Smol, J.P., Taylor, W.W., Tockner, K., Vermaire, J.C., Dudgeon, D. & Cooke, S.J. 2019. Emerging threats and persistent conservation challenges for freshwater biodiversity. Biological Reviews 94, 849–873. (also available at https://doi.org/10.1111/brv.12480)

SESSION 7

FAO. 1995. *Code of Conduct for Responsible Fisheries.* Rome, Italy, FAO. (also available at http://www.fao.org/documents/card/en/c/e6cf549d-589a-5281-ac13-766603db9c03/)

FAO. 2018. *The State of World Fisheries and Aquaculture 2018* – Meeting the sustainable development goals. Rome, FAO. (also available at http://www.fao.org/documents/card/en/c/I9540EN/).

Barange, M., Bahri, T., Beveridge, M.C.M., Cochrane, K.L., Funge-Smith, S. & Poulain, F. (eds.). 2018. *Impacts of climate change on fisheries and aquaculture: synthesis of current knowledge, adaptation and mitigation options.* FAO Fisheries and Aquaculture Technical Paper No. 627. Rome, Italy, FAO. (also available at http://www.fao.org/policy-support/resources/resources-details/en/c/1152846/).

Taconet, M., Kroodsma, D., & Fernandes, J.A. 2019. Global Atlas of AIS-based estimated fishing activity – opportunities and challenges

FAO (forthcoming). a. Information and communications technologies to secure sustainable small-scale fisheries in Asia: Successes and failures

SESSION 8

FAO. 1995. Code of Conduct for Responsible Fisheries. Rome, Italy, FAO. (also available at http://www.fao.org/documents/card/en/c/e6cf549d-589a-5281-ac13-766603db9c03/)

FAO. 2018. *The State of World Fisheries and Aquaculture 2018 – Meeting the sustainable development goals.* Rome. (also available at http://www.fao.org/documents/card/en/c/I9540EN/).

UN. 1994. *United Nations Convention on the Law of the Sea*. (also available at https://www.un.org/Depts/los/convention_agreements/texts/unclos/unclos_e.pdf)

UN. 2001. *United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks.* (also available at https://www.un.org/Depts/los/convention_agreements/convention_overview_fish_stocks.htm).

UNGA. 2012. *Resolution adopted by the General Assembly on 27 July 2012: 66/288 The future we want.* (also available at https://undocs.org/A/RES/66/288).

UNGA. 2015. *Resolution adopted by the General Assembly on 25 September 2015: 70/1 Transforming our world: The 2030 Agenda for Sustainable Development.* (also available at https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_70_1_E.pdf).

ANNEX A
Speakers and Panelists

OFFICIAL OPENING

Keynote speaker

Manuel Barange

Director, Fisheries and Aquaculture Policy and Resources Division of FAO (FIA), Italy

Professor Manuel Barange is Director of the Fisheries and Aquaculture Policy and Resources Division at the Food and Agriculture Organization, and an Honorary Professor at the College of Life and Environmental Sciences, University of Exeter, United Kingdom of Great Britain and Northern Ireland. Until May 2016, he was Deputy Chief Executive and Director of Science at the Plymouth Marine Laboratory, United Kingdom of Great Britain and Northern Ireland. In recent years, he has particularly focused his technical work on the impacts of climate change and economic globalization on marine-based commodities, and on the interactions between natural and social sciences in fisheries, ecosystems and climate change, in the developed and developing world. Manuel was awarded the 2010 UNESCO-IOC Roger Revelle Medal for his accomplishments and contributions to ocean science. Manuel has over 120 peer-reviewed publications.

SESSION 1 – THE STATUS OF GLOBAL AND REGIONAL FISHERIES SUSTAINABILITY AND ITS IMPLICATIONS FOR POLICY AND MANAGEMENT

Keynote speaker

Ray Hilborn

Professor, University of Washington (UW), United States of America

Dr Ray Hilborn is a Professor in the School of Aquatic and Fishery Sciences, University of Washington specializing in natural resource management and conservation. He has authored several books including Ocean Recovery: a sustainable future for global fisheries? (with Ulrike Hilborn) in 2019, Overfishing: what everyone needs to know (with Ulrike Hilborn) in 2012, Quantitative fisheries stock assessment with Carl Walters in 1992, and The Ecological Detective: confronting models with data with Marc Mangel, in 1997 and has published over 300 peer reviewed articles. He has received the Volvo Environmental Prize, the American Fisheries Society's Award of Excellence, The Ecological Society of America's Sustainability Science Award, and the International Fisheries Science Prize. He is a Fellow of the Royal Society of Canada, the American Academy of Arts and Sciences, the Washington State Academy of Sciences, and the American Fisheries Society.

Keynote speaker

Ana M. Parma

Principal Researcher, National Patagonian Center (CENPAT – CONICET), Argentina

Dr Ana Parma is a Principal Researcher of CONICET – the Argentine Council for Science & Technology, based at the National Patagonian Center in Puerto Madryn, Argentina. She earned her PhD in Fisheries Science in 1989 from the University of Washington, and worked as an assessment scientist at the International Pacific Halibut Commission until 2000, when she returned to Argentina, her home country. She has worked on different aspects of fisheries modelling, assessment and management, covering a diverse range of fisheries, from artisanal coastal fisheries targeting benthic shellfish to large-scale international fisheries targeting tunas. The main focus of her

research has been on the evaluation and design of harvesting strategies that can achieve sustainability in the face of the diverse technical and institutional challenges posed by these fisheries. She has always worked at the interface between science and management, being involved in several scientific and policy advisory boards and review panels both at the national and international levels.

Panelist

David Agnew

Executive Secretary, Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), Australia

Dr Agnew took up the post of Executive Secretary of CCAMLR in April 2018. His previous posts include Science and Standards Director at the Marine Stewardship Council (MSC), Fisheries Director at MRAG Ltd, Senior Lecturer at Imperial College London, and Data Manager at CCAMLR. He has taken a number of international leadership roles, including Chair of the CCAMLR Scientific Committee, Chair of the MSC Technical Advisory Board and Board member of the International Seafood Sustainability Foundation. Dr Agnew has extensive experience working with global fisheries science and management issues, including stock assessment, ecosystem-based fisheries management and fisheries governance. He has more than 20 years' experience working with CCAMLR, and is an acknowledged expert on Antarctic fisheries and Illegal, Unreported and Unregulated (IUU) fishing. He is a visiting Professor at the University of Florida and the University of Tasmania, and a Fellow of the Marine Biological Association.

Panelist

Graça Bauleth D'Almeida

Director of Resource Management, Ministry of Fisheries and Marine Resources, Namibia

Graça Bauleth D'Almeida has been the Director of Resource Management at the Ministry of Fisheries and Marine Resources in Namibia since April 2012, where she is responsible for the sustainable utilization of Namibia's living marine resources and the conservation of the marine environment. Ms Bauleth D'Almeida joined the Ministry in 1993, as a researcher on various living marine resources and oceanographic environments in the Benguela current system, and worked through the ranks. She has thereby acquired a vast experience, which equips her in the management of the resources. Ms Bauleth D'Almeida has also served on several committees dealing with ocean governance, as well as climate and mining impacts on the marine ecosystem. She has a BSc in Biology from Gettysburg College, Pennsylvania, United States of America (1990) as well as an MSc in Marine Estuarine and Environmental Sciences from the University of Maryland, United States of America (1998).

Panelist

Paul de Bruyn

Science Manager, Indian Ocean Tuna Commission (IOTC), Seychelles

Dr Paul de Bruyn is the Science Manager at the Indian Ocean Tuna Commission (IOTC) secretariat, which he joined in 2018. He started his career assessing small-scale inshore fisheries in Southern Africa and developing operational management procedures for invertebrate fisheries on the East Coast of South Africa. He then moved to Spain, where he worked for the Basque research foundation AZTI Tecnalia and was responsible for carrying out assessments for tuna and tuna-like species at both IOTC and the International Commission for the Conservation of

Atlantic Tunas (ICCAT) working parties, as well as advancing management strategy evaluations for temperate tuna stocks in the Atlantic Ocean. He later joined the ICCAT secretariat where for six years he was the By-catch Coordinator and later head of the Department of Research and Statistics. Paul holds a Doctorate in Marine Science with a focus on stock assessment and management strategy evaluation.

Panelist

Macarena Cepeda

President, Industrial Fishing Association (ASIPES), Chile

Macarena Cepeda Godoy is the President of the Industrial Fishing Association ASIPES, which represents more than 60 percent of the Chilean industrial captures. She is a Chemical Engineer, with seven years of experience in the Chilean fish industry. During her time with the Association, she has been able to promote good practices in the fishing industry, mainly in fish transport, odor mitigation solutions, clean production agreements, international fisheries certification and actions to fight against IUU fishing. Moreover, in order to achieve a sustainable process, permanent improvements have been incorporated in nets, vessels and technology used in industrial operations. Companies associated with ASIPES capture sardines, jack mackerel, giant squid, hake, prawns etc. for human consumption. Chilean jack mackerel and prawns have received MSC certification for sustainable fishing.

Panelist

Steven J. Cooke

Professor, Carleton University (CU), Canada

Dr Steven J. Cooke is Professor of Environmental and Interdisciplinary Science at Carleton University in Ottawa, Canada. He studies the ecology and management of wild fish in inland and marine systems. Specific topics of interest include recreational fisheries science, movement ecology, environmental stressors, hydropower and knowledge mobilization. He is also active in evidence synthesis in his role as Director of the Canadian Centre for Evidence-Based Conservation. Cooke is the Editor in Chief of the journal Conservation Physiology and serves on the editorial boards of seven other journals. He is Past President of the International Fisheries Section of the American Fisheries Society, is a founding member of InFish, and is the Secretary of the College of the Royal Society of Canada. He has received the Medal from the Fisheries Society of the British Isles and the Award of Excellence in fisheries management from the American Fisheries Society.

Panelist

Carmen Fernandez

Research Scientist, Spanish Institute of Oceanography (IEO), Spain

Dr Carmen Fernandez has an undergraduate degree in Mathematics and a PhD in statistics. Since 2006 she has worked as a Research Scientist at the Spanish Oceanographic Institute (Instituto Español de Oceanografia, IEO), with her work focusing on assessment of the status of fish stocks, evaluation of fisheries management strategies and the provision of scientific advice in these and related aspects. She regularly participates in the scientific and advisory work of international organizations such as ICES (International Council for the Exploration of the Sea), NAFO (Northwest Atlantic Fisheries Organization) and ICCAT (International Commission for the Conservation of Atlantic Tunas). During 2012-2017 she was on leave from the Spanish Oceanographic Institute to work as a vice-chair of the ICES Advisory Committee, with focus on the ICES scientific advice on fish stocks and fisheries in the Northeast Atlantic. Since 2018 she has been the vice-chair of the NAFO Scientific Council.

Panelist

Libby Logerwell

Research Fishery Biologist, National Oceanic and Atmospheric Administration (NOAA), United States of America

Libby Logerwell is a Research Fishery Biologist in the Recruitment Processes Program at the Alaska Fisheries Science Center (AFSC) and the co-chair of the Arctic Council PAME Joint Ecosystem Approach Expert Group. Her research interests include fisheries oceanography, fish early life history, Arctic benthic communities and ecosystem-based management. Libby received a BSc from Stanford University and PhD from the University of California Irvine, and was a post-doc at NOAA Southwest Fisheries Science Center and then the University of Washington before joining the AFSC in 2001.

Chair

Ichiro Nomura

Fisheries Policy Advisor, Ministry of Marine Affairs and Fisheries, Indonesia

Mr Ichiro Nomura is currently a Fisheries Policy Advisor to the Indonesia Ministry of Marine Affairs and Fisheries. He held, from April 2000 to August 2010, the position of Assistant Director-General and head of the FAO Fisheries and Aquaculture Department in Rome, where he was responsible for all FAO programmes and activities in the field of fisheries and aquaculture. Before coming to FAO, he had held various responsible positions in the Fisheries Agency of the Japanese Government for more than 25 years and is well known in various international fisheries fora, including the FAO Compliance Agreement negotiation, the UN Fish Stocks Agreement negotiation, etc. Mr. Nomura served as a member of the Board of Trustees of MSC (Marine Stewardship Council) from 2010 to 2016. He is currently a member of the Board of ISSF (International Seafood Sustainability Foundation).

Panelist

Duto Nugroho

Senior Researcher, Research Institute for Marine Fisheries (RIMF), Indonesia

Dr Nugroho is a Senior Researcher in the Agency for Marine and Fisheries Research and Development of Indonesia. He has an MSc in fisheries acoustics from the Bogor Agricultural University and a PhD in conservation biology from the University of Indonesia. He has been involved in fisheries-related research since 1978. His main research work is on the assessment of the status and trends of small pelagic and demersal groups of fish species using tropical analytical models. Currently, he is a member of different technical working groups developing baseline data to support national harvest control rules in Indonesia. His research has been published in numerous scientific journals.

Panelist

Yemi Oloruntuyi

Head of the Global Accessibility Program, Marine Stewardship Council (MSC), United Kingdom of Great Britain and Northern Ireland

Dr Yemi Oloruntuyi is Head of the Global Accessibility Program at the Marine Stewardship Council (MSC). She has a range of experience working on issues related to the sustainable use of fisheries resources. Her role involves leading the implementation of the MSC's strategy to increase the engagement of fisheries from the global south in the MSC's standard and certification programme. It also involves the evaluation, development and implementation of policies and tools to ensure that the MSC programme is applicable and accessible to developing country and small-scale fisheries. Prior to joining the MSC she worked at the Lagos State University, Nigeria, where she was involved in research and training on fisheries resource management, littoral ecology and aquaculture.

Panelist

Elayaperumal Vivekanandan

International Consultant, Bay of Bengal Programme International Organization (BOBP), India

Dr E. Vivekanandan works as a Consultant in the Bay of Bengal Programme Intergovernmental Organization, Chennai, India. Until 2012, he belonged to the Agricultural Research Service and worked in various capacities including Head of Division and Principal Scientist in the Central Marine Fisheries Research Institute (ICAR, Government of India). He has more than 40 years of experience in marine fisheries research and development. He holds a PhD from Madurai University. He has pioneered research on marine fish population dynamics, stock assessment, climate change and marine ecosystem modelling in India. He has authored several research papers, book chapters and books in different areas of marine fisheries. He has travelled widely and is associated with several regional organizations on fisheries research and management. He has conducted multinational training programmes on fish stock assessment, the ecosystem approach to fisheries management and science communication.

SESSION 2 – SUSTAINABLE FISHERIES: LINKING BIODIVERSITY CONSERVATION AND FOOD SECURITY

Keynote speaker

Chris Costello

Professor and director, University of California Santa Barbara (UCSB), United States of America

Dr Christopher Costello is a Professor of Resource Economics at the University of California, Santa Barbara, co-director of the Sustainable Fisheries Group, director of the Environmental Markets Solutions Lab, and a Research Associate with the National Bureau of Economic Research. Costello received his PhD from UC Berkeley in 2000 and conducts research on natural resource economics and policy concerning property rights, decision-making under uncertainty, and natural resource scarcity. His work combines theoretical micro-economics with modelling and empirical analysis to inform policy on fisheries management, biological diversity and marine policy. With partners, Costello applies his research in several countries including Peru, Chile, Mexico, Indonesia, China and Cambodia. Costello serves on the Board of Trustees for Global Fishing Watch and Environmental Defense Fund, and has published more than 100 papers in journals such as Science, Nature and PNAS. He is the 2016 winner of the Peter Benchley Award in Ocean Solutions.

Keynote speaker

Beth Fulton

Research Group Leader, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

Dr Beth Fulton is a Principal Research Scientist with CSIRO Oceans and Atmosphere, where she leads the Marine Systems and Informatics Group. Beth is also an Adjunct Professor at the Centre of Marine Socioecology, a collaboration between University of Tasmania, CSIRO and the Australian Antarctic Division. Beth has been with the CSIRO for the past 18 years, where she has developed various system modelling tools for looking at marine ecosystems and sustainability. The models developed by Beth's team are some of the first to give equal attention to biophysical and human components of marine and coastal ecosystems. They underpin CSIRO's research into sustainably managing potentially competing uses of marine environments and adaptation to global change and have been used to consider effective means of conserving and monitoring marine and coastal ecosystems.

Panelist

Leandro Castello

Associate Professor, Virginia Tech University (VT), United States of America

Dr Leandro Castello investigates how people affect fish populations through overfishing and habitat alteration and how they can work to establish sustainable fisheries. With a focus on tropical marine and freshwater systems, his interdisciplinary research addresses varied topics and often pursues questions that can impact policy. His work on the conservation of Arapaima spp. developed a method to count the fish at the moment of obligate air-breathing, allowing growing numbers of fishers to assess stocks and set sustainable harvest quotas. He also performed multifaceted assessments of human impacts on Amazonian freshwater ecosystems that underpin the policy strategy of WWF in the basin. He is currently investigating the effects of changes in hydrology and land cover on large river fisheries, and developing a method to estimate past catch-effort data based on fishers' memories, as part of a Pew Marine Conservation Fellowship.

Panelist

Rod Fujita

Director of Research and Development, Environmental Defense Fund, United States of America

Rod Fujita is a marine ecologist focusing on processes that support biodiversity. He co-founded the Environmental Defense Fund's Ocean Program in 1990 and since then has worked on improving fisheries and implementing marine reserves to increase food production and profits by maintaining or recovering system productivity and resilience. Rod has worked with partners on several effective approaches, including MPAs covering over 25,000 sq km, a private buyout of trawl vessels in return for no-trawl zones, a loan fund to help fishermen transition to more sustainable practices, and a framework for assessing and managing data-limited fisheries (fishe.edf.org). Rod supports EDF Ocean Program staff in 12 geographies around the world. Current research interests include: behavior change interventions for improving fishery outcomes; systems analysis of fisheries to find high leverage interventions; ways to reduce trade-offs between aquaculture and small-scale fisheries with the aim of increasing food production and reducing biodiversity and ecosystem impacts.

Panelist

Stefan Gelcich

Professor, Pontífica Universidad de Chile, Chile

Stefan Gelcich is a Professor at the Pontifica Universidad de Chile where he studies the socio-ecological dimensions of environmental conservation and marine fisheries management. Much of Stefan's work is focused on the interplay between ecological and governance determinants in implementing and effectively managing protected areas. He is a regional councillor for Global Green Grants, an environmental NGO that awards small grants to grassroots movements engaging in environmental issues, and was awarded a Pew Fellowship in Marine Conservation.

Panelist

Simon Jennings

Science Committee Chair, International Council for the Exploration of the Sea (ICES), Denmark

Dr Simon Jennings is a Marine Scientist and Adviser. Through international collaboration he seeks to advance and shape scientific understanding of marine ecosystems and their interactions with people and the environment — with a focus on creating stronger links between fundamental, applied and translational research and improving monitoring, assessment and management. He currently chairs the Science Committee of the International Council for the Exploration of the Sea and the Technical Advisory Board of the Marine Stewardship Council.

Panelist

Michel Kaiser

Professor, Heriot-Watt University (HW), United Kingdom of Great Britain and Northern Ireland

Michel Kaiser is currently the Professor of Fisheries Conservation at Heriot-Watt University in Edinburgh. He holds a number of public appointments. He is a member of the IUCN-Fisheries Expert Group and is an independent Member of the United Kingdom Marine Science Coordination Committee, he is a member of the Technical Advisory Council to Fisheries Innovation Scotland, and he chairs the International Scientific Advisory Committee for the pulse trawling project (Holland). His research interests focus on techniques to achieve sustainable use of marine resources while seeking to minimize impacts on the marine environment. He is best known for his expertise on the ecosystem of fishing on the seabed, data-poor fisheries and the use of spatial management measures to achieve conservation and fisheries objectives. Throughout his career he has worked at the scientific interface between fisheries and conservation.

Panelist

Sangeeta Mangubhai

Director Fiji Country Program, Wildlife Conservation Society (WCS), Fiji

Dr Sangeeta Mangubhai is currently the Director of the Wildlife Conservation Society's Fiji Country Program. Originally from Fiji, she has worked on marine science and conservation in Australia, East Africa, Indonesia and the South Pacific. She works on community-based management, coastal fisheries, payment for ecosystem services, gender inclusion in fisheries, marine protected areas, marine spatial planning, environmental policy, and climate change. She has authored more than 120 publications including 45 journal articles on a wide diversity of topics. Sangeeta sits on multiple government committees and chairs the Marine Working Group for the Fiji National Protected Areas Committee. She is currently an editor for the journal Pacific Conservation Biology and the Pacific Community's Women in Fisheries Information Bulletin. She was awarded a 2018 Pew Fellowship in Marine Conservation to work on mainstreaming gender and human rights-based approaches into coastal fisheries management in Melanesia.

Panelist

Nyawira Muthiga

Director and Conservation Scientist of the Kenya Marine Program, Wildlife Conservation Society (WCS), Kenya

Dr Nyawira Muthiga has spent more than 30 years dedicated to the management and conservation of marine ecosystems in the Western Indian Ocean (WIO) through research, training and conservation. She is currently the Director of the Wildlife Conservation Society's (WCS) Marine Program in Kenya coordinating a portfolio of work that includes research on marine protected areas and their effectiveness, sustainable small-scale fisheries, coral reefs and climate change as well as capacity-building for community conservation areas. Her work has appeared in numerous peer-reviewed publications and she also contributes to building marine science capacity in East Africa through supervision of students and served as President of the Western Indian Ocean Marine Science Association (WIOMSA). Dr Muthiga also coordinates and participates in other regional and professional initiatives and has received several awards including the National Geographic/Buffet award for achievements in Conservation and the Kenyan Presidential award, the Order of the Grand Warrior.

Chair

Renée Sauvé

Senior Director, External Relations Directorate of Fisheries and Oceans Canada (DFO), Canada

Ms Sauvé is currently a Senior Director in the External Relations Directorate of Fisheries and Oceans Canada. Ms Sauvé represents Canada at numerous multilateral negotiations in marine biodiversity and ocean governance. In 2018, Ms Sauvé was Head of the Canadian Secretariat of the November Sustainable Blue Economy Conference held in Nairobi, co-hosted by the Government of Canada. In 2017, she was Canada's lead negotiator for the UN Ocean Conference 'Call to Action' outcome document, as well as for the marine component of the 2002 World Summit of Sustainable Development. Ms Sauvé also led Canada's engagement in the Convention on Biological Diversity on marine issues. From 2014-2019, Ms Sauvé served as international Chair of the Arctic Council Working Group for the Protection of the Arctic Marine Environment (PAME). Ms Sauvé holds a BSc degree in Natural Sciences from the University of Manitoba (1985). Ms Sauvé resides in Ottawa, Canada with her family.

Panelist

Yunne Shin

Senior Researcher, Institut de Recherche pour le Développement (IRD), France

Yunne Shin is a marine ecologist, Senior Researcher at IRD (Institut de Recherche pour le Développement, France) and Honorary Research Associate at UCT (University of Cape Town, South Africa). Her research focuses on marine biodiversity and the integrated functioning of fish communities and marine ecosystems under global change. She has been developing ecosystem models (coord. www.osmose-model.org), data and indicator analyses of marine biodiversity (coord. www.indiseas.org, panel www.goosocean.org/biology) and scenarios (coord. FRB Emibios, BIODIVERSA Sombee) to quantify global change impacts on marine biodiversity. She served as a coordinating lead author of the IPBES Global Assessment of Biodiversity and Ecosystem Services.

Panelist

Nam So

Chief Environment Management Officer, Mekong River Commission Secretariat (MRCS), Cambodia

Dr Nam So has nearly 25 years of working experience in environment, fisheries and aquaculture research, development, management and governance in various countries in the Mekong region and around the world, including Cambodia, Lao People's Democratic Republic, Thailand, Viet Nam, Belgium, the Netherlands, France, United States of America and Canada. He has written more than 100 technical reports related to fisheries, environment and aquaculture, including over 50 peer-reviewed journal publications, and recently he has jointly published two papers in Science and one in the Proceedings of the National Academy of Science on the impacts of hydropower projects on fish species diversity in the Amazon, Congo and Mekong rivers. He has a PhD in Biology from the Catholic University of Leuven, Belgium, an MSc in Aquaculture from the University of Ghent in Belgium and the Wageningen University of Agriculture in the Netherlands, and a BSc in Fisheries Science from the Royal University of Agriculture in Phnom Penh, Cambodia.

Panelist

Beverly Wade

Fisheries Administrator of the Belize Fisheries Department, Belize

Ms Beverly Wade is the Fisheries Administrator of the Belize Fisheries Department. Ms Wade has been involved in fisheries management for the last 24 years, and as the Fisheries Administrator for the past 18 years has been directly involved in the implementation of measures to facilitate the sustainable development of Belize's marine resources. She has represented Belize at various international fora which impact and regulate the national development of local fisheries. Ms Wade has been a member of the executive committee of the Caribbean Regional Fisheries Mechanism and OSPESCA for the last seven years, which are the regional organizations for CARICOM and Central America charged with assisting governments in the sustainable development of their fisheries and aquaculture sectors. Ms Wade has been the focal point for the UNESCO World Heritage sites in Belize since 2013 and works closely with her government and stakeholder counterparts to coordinate the management and conservation of these areas.

SESSION 3 – FISH IN FOOD SECURITY AND NUTRITION: FROM TIDE TO TABLE

Keynote speaker

Christopher Golden

Assistant Professor, Harvard T.H. Chan School of Public Health (HSPH), United States of America

Dr Christopher Golden is an Assistant Professor of Planetary Health and Nutrition at the Harvard T.H. Chan School of Public Health. As an ecologist and epidemiologist, his research investigates the nexus of trends in global environmental change and human health. He received his BA from Harvard College where he created his own curriculum integrating courses in ecology, medical anthropology and development studies. He then received two graduate degrees from UC Berkeley: an MPH in Epidemiology with a focus on Nutrition, and a PhD in Environmental Science, Policy and Management. Golden has been conducting research in Madagascar for the past 20 years, and has recently begun research in West Africa and the South Pacific. He has served as lead investigator on several research efforts: 1) the investigation of climate-driven impacts of marine fishery collapses across the globe on food security and human nutrition; 2) examining the role of coral reef management in Kiribati in increasing access to seafood and reducing diabetes and metabolic disease; and 3) a global mapping exercise of the role of coral bleaching and forecasting its future impacts on human nutrition.

Keynote speaker

Shakuntala Haraksingh Thilsted

Research Program Leader, WorldFish, Malaysia

Shakuntala Haraksingh Thilsted is Research Program Leader, Value Chains and Nutrition at WorldFish, stationed in Penang, Malaysia. Her work focusses on nutrition-sensitive fish agri-food systems, in particular the potential of increased production and consumption of nutrient-rich small fish in combating and preventing vitamin and mineral deficiencies in low- and middle-income countries. She works with developing and testing fish-based products for women and children in the first 1,000 days of life. She plays a pivotal role

in promoting the agenda of fish for nourishing nations as well as the importance of the fisheries sector in contributing to achieving the Sustainable Development Goals (SDGs) in many international, regional and national fora. She has recently been selected to join the Steering Committee of the High Level Panel of Experts on Food Security and Nutrition (HLPE) of the United Nations Committee on World Food Security.

Panelist

Boitshepo "Bibi" Giyose

Special advisor, African Union Development Agency (AUDA-NEPAD), South Africa

Boitshepo Bibi Giyose is a Senior Nutrition Officer for Policy and Programmes in the Nutrition and Food Systems Division at FAO, but currently on secondment to NEPAD as special advisor to the CEO. Her work focuses on integrating and mainstreaming nutrition into agriculture and related development agendas, and promoting a multisector approach for addressing all forms of malnutrition. She holds an MSc in International Nutrition from Cornell University, and a BSc in Nutrition and Dietetics from Appalachian State University, United States of America. Ms Giyose was awarded a Distinguished Alumna Award in recognition of exceptional professional achievement by Appalachian State University in 2007. She was also named Senior Policy Scholar in 2011 by the Global Child Nutrition Foundation (United States of America) for her work on home grown school feeding. She has served on numerous international scientific technical and policy advisory committees and boards.

Panelist

Xianshi Jin

Senior Scientist, Yellow Sea Fisheries Research Institute (YSFRI), China

Dr Xianshi Jin is the senior scientist and general director of the Yellow Sea Fisheries Research Institute (YSFRI), Chinese Academy of Fishery Sciences (CAFS). He was awarded his doctorate in 1996 by the University of Bergen, Norway. His research interests include stock assessment, fisheries ecology, fisheries management and high sea fisheries, and has focused on long-term changes in species composition, population dynamics, stock enhancement and food web for the high trophic levels in the ecosystem of the Yellow Sea, Bohai Sea and East China Sea. He finished more than 40 projects as PIs, such as the major programs from the National Natural Science Foundation of China, the National Basic Research Program, Hi-Tech Research Program, and many others. He has published more than 200 papers and 14 monographs as editor/compiler.

Panelist

Ahmed Khan

Chief Fisheries Officer and Blue Economy Flagship Coordinator, African Development Bank (AfDB), Ivory Coast

Dr. Ahmed Khan has more than 15 years' experience in fishery resource management, seafood trade, and the governance of fisheries resource systems at regional and global levels. He obtained his PhD from Memorial University of Newfoundland and Labrador in Canada. As Chief Fisheries Officer and Blue Economy Flagship Coordinator at the AfDB, he covers both lending and non-lending portfolios seeking programs and projects that link, and prioritize aquatic resource

sustainability, nutritional well-being, competitive fish value chains, and economic development to meet the goals of the Feed Africa Strategy and other High 5s. Prior to joining the AfDB, he was highly engaged with research for development and policy entrepreneurship with government agencies, policy think tanks, consulting firms and academia. He has published more than 40 scientific contributions with featured articles in Ambio, Bioeconomics, Coastal Management, Climate Policy, Fisheries Research, Marine Policy, and Science. He is a foodie and enjoys seafood medley.

Panelist

Joyce Kinabo

Professor, Sokoine University of Agriculture (SUA), Tanzania

Dr Joyce Kinabo is a Professor of Human Nutrition in the Department of Food Technology, Nutrition and Consumer Sciences at the Sokoine University of Agriculture in Morogoro, Tanzania. She obtained her PhD in Nutrition Physiology from Glasgow University in 1990. Her research activities have focused mainly on energy balance studies (thermic effect of food), maternal and child nutrition, adolescent nutrition, food body interactions and nutritional status. Some of these research activities have included development and testing of eco-nutrition guidelines to enable communities to best respond to the challenges of food insecurity, inadequate care and inadequate environmental quality in the context of climate change. Dr Kinabo is also a member of the IFPRI Independent Advisory Committee (since 2014), President of the Federation of Africa Nutrition Societies (FANUS) (2011-15), a Fellow at the International Union of Nutritional Sciences (FIUNS) and a member of the Society for Implementation Science in Nutrition. She is the current chair of the Board of Tanzania Food and Nutrition Centre.

Panelist

Mimako Kobayashi

Senior Environmental Economist, World Bank (WB), United States of America

Mimako Kobayashi is a Senior Environmental Economist in the Environment, Natural Resources and Blue Economy Global Practice at the World Bank. Throughout her professional career as an applied economist, she has studied interactions between environment and behavior of people in various natural resource management problems around the world. Her core responsibilities in the global blue team include managing analytical work targeted for both global audience and World Bank operations. Analytical work she co-authored at the World Bank includes Fish to 2030 and The Sunken Billions Revisited. Prior to joining the Bank, she was an assistant professor at the University of Nevada, Reno, United States of America. She obtained her PhD in Agricultural Economics from the University of California, Davis, United States of America.

Panelist

Anna Lartey

Director of Nutrition and Food Systems Division, Food and Agriculture Organization of the United Nations (FAO), Rome

Anna Lartey is the Director of Nutrition and Food Systems Division at the Food and Agriculture Organization of the United Nations, Rome, Italy (2013 to present). Prior to that, she was a Professor of Nutrition at the University of Ghana (1986-2013). She pursued her doctoral studies as a Fulbright Scholar, from the University of California, Davis, USA. She worked as a researcher in Sub-Saharan Africa for 27 years. Her research focussed on maternal and child nutrition. At FAO, she oversees the technical work on

Food systems for healthy diets and improved nutrition. Anna won the University of Ghana's "Best Researcher Award for 2004". She was the recipient of the Sight and Life Nutrition Leadership Award for 2014. Anna Lartey was the President of the International Union of Nutritional Sciences (IUNS, 2013-2017). Anna was recently awarded a Doctor of Science degree, honoris causa, by McGill University in June 2018.

Panelist

Dave Little

Professor, University of Stirling, United Kingdom of Great Britain and Northern Ireland

Dr David Little is currently the Chair of Aquatic Resource Development at the Institute of Aquaculture, University of Stirling, and is leading a newly formed Seafood Consumption Initiative with national and international partners. He has more than 35 years' professional experience in the sector. Research and educational interests focus around the societal impacts of aquaculture and, increasingly, highlighting the importance of seafood in food systems. He has developed and coordinated a wide range of research with a focus on Asia and Africa. He has published widely on the interface between aquatic food production, broader natural resource management and development, and has been a vocal advocate and practitioner of interdisciplinary systems research. He has been involved in many expert reviews and consultations such as those relating to Food Futures (UK Government), the potential for innovative feed sourcing strategies (WorldFish Centre), Sustainable Intensification (FAO-NACA), aquaculture certification (WWF, FAO) and the roles of aquaculture in poverty alleviation (DFID).

Panelist

Sveinn Margeirsson

International consultant, Iceland

Dr Sveinn Margerisson grew up on an organic farm in North Iceland. He holds a BSc in Food Science, a PhD in Industrial Engineering and a General Management Program at Harvard Business School. As the CEO of Matis in Iceland (2010-2018), and now as an independent consultant, he has put emphasis on increasing the value of our resources, by viewing different value chains from a creative and holistic perspective. He has led and participated in several projects on issues including optimization of seafood value chains, regional development, technological disruptions in the food industry and science communication. He has supervised numerous MSc and PhD students. He has presented results and visions for a wide range of audiences, including Icelandic and international food industry representatives, ministers from several countries, different parts of the European Commission, and industry delegations.

Panelist

Fiorenza Micheli

Co-director of Stanford's Center for Ocean Solutions, Stanford University, United States of America

Fiorenza Micheli is co-director of Stanford's Center for Ocean Solutions, and a marine ecologist at the Hopkins Marine Station of Stanford University, where she is the David and Lucile Packard Professor of Marine Science. Micheli's research focuses on the processes shaping marine communities and coastal social-ecological systems, and incorporating this understanding in marine management and conservation. She investigates climatic impacts on marine ecosystems, particularly the impacts of hypoxia and ocean acidification on marine species, communities and fisheries, marine predators' ecology

and trophic cascades, the dynamics and sustainability of small-scale fisheries, and the design and function of Marine Protected Areas. Her current research takes her to Mexico, Italy, and Palau, in addition to California. She is a Pew Fellow in Marine Conservation, a fellow of the California Academy of Sciences, research advisor to the Monterey Bay National Marine Sanctuary, Seafood Watch and the Benioff Ocean Initiative, and senior fellow at Stanford's Woods Institute for the Environment.

Panelist

Friederike Ziegler

Senior Scientist, Research Institutes of Sweden (RISE), Sweden

Friederike Ziegler is a Senior Scientist at Research Institutes of Sweden, leading the research and contract work of the RISE seafood sustainability group. Her PhD research pioneered the field of life cycle assessment (LCA) applied to fisheries systems both with regard to typical LCA environmental impact categories like greenhouse gas emissions, and quantifying more fisheries-specific impacts on stocks, by-catch and seafloor habitats. After finishing her PhD, her research has concerned both fisheries and aquaculture systems around the world, focusing on North Atlantic fisheries and Nordic aquaculture systems. Recently, she has collaborated with nutritionists to describe and quantify the highly variable nutritional characteristics of different seafoods to more fully reflect the function of seafood in LCA studies and to provide guidance for production and consumption to go towards more nutritious and broadly sustainable types of seafood.

SESSION 4 – SECURING SUSTAINABLE FISHERIES LIVELIHOODS

Keynote speaker

Philippa Cohen

Research Program Leader, WorldFish, Malaysia

Philippa (Pip) is an interdisciplinary Fisheries and Social Scientist (aligned most closely to Political Ecology) with research interests in equitable governance of fisheries systems in the face of ocean, water and agricultural transformations. Pip's research is frequently embedded in, and/or critically observant of, management and development processes. Pip has been working in fisheries development for 15 years, starting in the small island developing nations of Tonga, Fiji, Solomon Islands and Timor Lest. Pip is now based in Penang, Malaysia where she heads up WorldFish's global small-scale fisheries research program working with small-scale fisheries researchers and managers embedded in 10 countries across Africa, Asia and the Pacific.

Keynote speaker

Mitchel Lay

Fisher and Program Coordinator, Caribbean Network of FisherFolk Organisations (CNFO) and Gulf and Caribbean Fisheries Institute (GCFI), Belize

Mitchell Lay was born in Antigua. He has been fishing commercially from 1988 as a small-scale fisher. He is involved in fisherfolk organizations in Antigua and Barbuda and is currently involved in regional fishers' initiatives, including the Caribbean Network of FisherFolk Organisations (CNFO) and the Gulf and Caribbean Fisheries Institute (GCFI). Mr Lay participates in fisheries-related meetings and workshops throughout the Caribbean region and is an advocate for sustainable utilization and responsible stewardship in relation to marine resources.

Panelist

Eddie Allison

Professor, University of Washington (UW), United States of America

Professor Allison's work spans research, policy and practice in both fisheries science and international development. He has worked on the coasts and inland waters of sub-Saharan Africa, Asia, Oceania, Latin America and Europe, principally on the contribution of fisheries and aquaculture to food and nutrition security and to coastal livelihoods, the governance of small-scale fisheries and aquaculture production, and people's vulnerability and adaptation to climate change. Since working in Malawi for the United Kingdom of Great Britain and Northern Ireland Department for International Development in the early 1990s he has held a faculty appointment in the School of International Development, University of East Anglia, Norwich, United Kingdom of Great Britain and Northern Ireland, and a Professorship in Marine and Environmental Affairs at the University of Washington, Seattle, United States of America. He was Director of Policy, Economics and Social Science at the WorldFish Center, Malaysia in 2007-2010 and has recently returned to WorldFish as a principal scientist. He has authored or co-authored more than 200 academic articles, agency reports and policy briefings and contributed to many others.

Panelist

Xavier Basurto

Associate Professor, Duke University, United States of America

Xavier is Associate Professor of Sustainability Science at the Nicholas School of the Environment and director of the Coasts and Commons Co-Laboratory at Duke University. His expertise lies in the governance of the commons, particularly in the context of inshore fisheries. He has developed large-scale collaborations between academia, practitioners and fishing organizations to co-design studies aimed at diagnosing the performance of different types of fishing organizations. He is also interested in how biophysical factors affect the performance of diverse governance arrangements. Prior to Duke, Xavier worked for two years with Elinor Ostrom at Indiana University and has published more than 50 articles in a diversity of outlets including Science, Science Advances and Nature. His work has been funded by the US National Science Foundation and a diversity of philanthropic organizations based in the US and Europe.

Panelist

Anthony Charles

Professor, Saint Mary's University (SMU), Canada

Dr Anthony Charles is a Professor at Saint Mary's University (Halifax, Canada) in the School of the Environment and the School of Business. He is a transdisciplinary researcher on fisheries, coasts and oceans, notably themes such as ecosystem-based management, sustainability, marine protected areas, community-based management, poverty and food security, and climate change adaptation. Dr Charles leads the Community Conservation Research Network (www.communityconservation.net), a global initiative on the links of conservation and sustainable livelihoods within coastal communities. He wrote the book Sustainable Fishery Systems and co-edited several volumes including Governance of Marine Fisheries and Biodiversity Conservation, Governing the Coastal Commons and The Future of Ocean Governance and Capacity Development. Dr Charles is a Pew Fellow in Marine Conservation and a member of the Fisheries Expert Group in IUCN's Commission on Ecosystem Management. He has served as an advisor to FAO, OECD, the World Trade Organization, the Canadian government, and many fishery and indigenous organizations.

Chair

Ratana Chuenpagdee

Professor, Memorial University of Newfoundland (MUN), Canada

Ratana Chuenpagdee is a Professor in Geography at Memorial University of Newfoundland, in St. John's. She is leading a major global research partnership, Too Big To Ignore (TBTI), which aims to elevate the profile of small-scale fisheries and rectify their marginalization in national and international policies. As part of this project, she's coordinating research and activities to support the implementation of the Small-Scale Fisheries Guidelines and transdisciplinary research for fisheries and ocean governance around the world. Ratana also co-leads a research module on informing governance responses in a changing ocean for the Ocean Frontier Institute, another major collaborative research initiative between universities, governments, private sectors and communities. Together with colleagues, she co-edits three TBTI books about small-scale fisheries governance (2015), Small-Scale Fisheries Guidelines (2017) and transdisciplinarity for fisheries sustainability (2018).

Panelist

Courtney E. Cox

Director of Applied Marine Science, Rare, United States of America

Dr. Courtney Cox is a marine ecologist leading Rare's Fish Forever central science team in developing strategies for implementing and evaluating community-based co-management of coastal fisheries across ten countries. Her team assesses the impact of the Fish Forever program on ecological systems, behavior adoption, fisheries recovery, and community livelihoods. Dr. Cox has 10 years of experience evaluating the effects of fisheries management strategies, identifying drivers of success, and determining appropriate scales for management. She conducts large-scale assessments integrating ecology, socioeconomics, genomics, population connectivity modeling, and fisheries science to generate innovative tools for solving complex conservation and fisheries problems. Dr. Cox holds a PhD in Biology with an emphasis in coral reef ecology from the University of North Carolina. Prior to joining Rare, she served as the technical lead at the Marine Conservation Program of the Smithsonian National Museum of Natural History.

Panelist

Naseegh Jaffer

Secretary General and Co-chairperson, World Forum of Fisher People (WFFP), South Africa

I grew up in apartheid South Africa where people of different races, classes and ethnicity were forcefully segregated in all spheres of life. It was a period that heightened the quest for social justice, equality and equity. I participated in many efforts at national, continental and global levels to realise the Small-scale Fisheries Guidelines of the Committee on Fisheries of the United Nations. From 2004 to 2017, I occupied senior leadership positions Secretary General and Co-chairperson, of the World Forum of Fisher People (WFFP). Currently I am still active in various roles within the WFFP, International Planning Committee on Food Sovereignty (IPC). This work extends to various intergovernmental platforms on the African continent. I work at Masifundise, in South Africa, which is an organisation that advocates for the rights of small-scale fishing communities. Masifundise is an active member of the World Forum of Fisher Peoples – WFFP.

Panelist

Unni Kløvstad

Special Advisor and Head of the Ocean Team, Ministry of Foreign Affairs, Norway

Unni Kløvstad is a career diplomat who has served in the Norwegian Foreign Service since 1993. She has extensive multilateral experience serving at Norwegian missions to the UN, NATO and EU, and has worked in a wide variety of foreign policy areas. Most recently, she was the Norwegian Ambassador to Australia, New Zealand and Oceania. Prior to 2014 she held the position as director, head of section for Security Policy and North America at the Norwegian MFA. As head of the Ocean team in the Ministry of Foreign Affairs, she oversees coordination of Norwegian international ocean policies,

including in bilateral, regional and international relations and special initiatives such as hosting the Our Ocean Conference in Oslo 23-24 October and Norwegian development programmes in ocean-related sectors focussing on knowledge programmes on fisheries and ocean management.

Panelist

Editrudith Lukanga

Co-President, World Forum of Fish Harvesters and Fish Workers (WFF), Tanzania

Editrudith Lukanga is the founder and Executive Director of the Environmental Management and Economic Development Organization (EMEDO), a public interest organization addressing environmental, social and economic challenges in Tanzania. She is the Co-President of World Forum of Fish Harvesters and Fish Workers (WFF), an international organization that brings together 42 national organizations of small-scale fishers from around the world to advocate for sustainable coastal communities and fisheries and uphold human rights and social justice for fishers and fish workers, both men and women. As a Secretary General of the African Women Fish Processors and Traders Network (AWFISHNET) with membership in 28 African countries and a Convenor of the Tanzania Women Fish Workers Association (TAWFA), Ms Lukanga supports women fish workers in Africa to get organized, advocate, participate and influence policy and decision-making processes. Ms Lukanga participated in the development of the Small-Scale Fisheries Guidelines and is currently spearheading its implementation in Tanzania.

Panelist

Sebastian Mathew

Executive Director, International Collective in Support of Fishworkers (ICSF), India

Mr Sebastian Mathew, Executive Director, International Collective in Support of Fishworkers (ICSF), has been engaged in fisheries policy processes, research and documentation, communication and information dissemination for nearly three decades, valorising small-scale fisheries, especially the knowledge and institutions of fishers and fishworkers. On behalf of ICSF, since the 1990s Mr Mathew has followed major international policy processes that concern small-scale fishers and fishworkers. Mr Mathew has undertaken studies on topics such as gear conflicts, tenure rights, fishers' knowledge, labour (migrant, forced and child labour in fisheries in developing countries), social protection and fisheries subsidies. Mr Mathew has organized several workshops and conferences on various aspects of small-scale fisheries. On behalf of ICSF, Mr Mathew is currently engaged in implementing the Small-Scale Fisheries Guidelines within a human rights-based approach towards improving governance and inclusive conservation and sustainable use of marine, coastal and inland fishery resources.

Panelist

Kumi Soejima

Senior Lecturer, National Fisheries University, Japan

Dr Kumi Soejima is a Senior Lecturer at the National Fisheries University of Japan. She received her PhD from Hiroshima University, Japan. Her work has focused on women's roles and issues in small-scale fisheries. She was awarded a fellowship by the Co-operative Research Programme: Biological Resource Management for Sustainable Agricultural Systems of OECD from May 2018 to September 2018. The title of her research fellowship was 'Using Gender Perspectives in Small-Scale Fisheries Research to Improve Policy'. Next, she worked at Innovative Fisheries Management (IFM), Aalborg University, Denmark as a guest researcher. She and two other

Japanese researchers have been trying to create networks called 'Umi Hito Kurashi Forum' (roughly translated as 'Forum for Sea People and Life') for fisherwomen in Japan since 2003. She is also trying to build collaborative relationships not only with researchers, but also with small-scale fishery-related bodies such as AKTEA (network of fisherwomen's organizations in Europe).

Panelist

Vivienne Solis

Biologist, CoopeSoliDar, Costa Rica

Vivienne Solis Rivera is a biologist with a Master's in Systematics and Ecology from the University of Lawrence, Kansas, United States of America. She is part of CoopeSoliDar R.L, a Cooperative for Social Solidarity based in Costa Rica that promotes the conservation of biological and cultural diversity as a main asset for the resilience of local communities to new challenges and opportunities. At a regional level the cooperative promotes actions strengthening the capacity of small-scale fisheries and their sustainable management in a framework that promotes a human rights-based approach to conservation of marine resources and a fair and just distribution of the benefits derived from their use. From this organizational platform, Ms Solis has oriented her professional work towards the community-based management of natural resources, protected area governance and local communities' participation in conservation, with a particular interest in gender. In recent years she has worked on the promotion of community-based and shared governance models for the management of marine resources, and has promoted civil participation in policymaking that responds to the strengthening of a human rights-based approach to marine conservation and small-scale fisheries.

SESSION 5 – THE ECONOMICS OF FISHERIES

Keynote speaker

Claudia Beltran

International Consultant, El Salvador

Claudia Beltran is a Colombian citizen, resident in El Salvador since 2007. She is an economist with a specialization in marketing management and project management. Ms Beltran has a 28-year career in socioeconomic planning of fisheries and aquaculture and experience in 15 Latin American and Caribbean countries. Since 2014, she has been the president of the Scientific Advisory Group of the Western Central Atlantic Fishery Commission (WECAFC) of FAO. She has worked as a national and international consultant at FAO, OECD, Organization of the Fisheries and Aquaculture Sector of the Central American Isthmus (OSPESCA), Caribbean Regional Fisheries Mechanism (CRFM), Economic Commission for Latin America and the Caribbean (ECLAC), Inter-American Development Bank (IDB), Regional Center for the Promotion of Micro, Small and Medium Enterprises in Central America (CENPROMYPE), and for the governments of Colombia and Panama, among other appointments.

Keynote speaker

Carl Christian Schmidt

Chair, Nordic Marine Think Thank (NMTT), Denmark

Until July 2015, Carl-Christian held the post as OECD's Head of the Fisheries Policies Division and Head of the Co-operative Research Programme on Biological Resources Management for Sustainable Agriculture Systems. Since July 2015, Carl-Christian has been working as a consultant on projects for the FAO, ICTSD, OECD and the Nordic Marine Think Tank (www.nmtt.org). Presently he is Chair of the Nordic Marine Think Tank. Additional details and links to activities can be found at www.ccmrschmidt.com. During his tenure with the OECD and now the NMTT, Carl-Christian has contributed to advancing understanding of sustainable and responsible fisheries, covering a wide range of issues related to fisheries management, trade, fisheries services, food security, green/blue growth and regional economic development. He has a wide international exposure to fisheries and aquaculture, natural resource management and ocean policy issues.

Panelist

Frank Asche

Professor, University of Florida (UFL), United States of America

Frank Asche holds a PhD from the Norwegian School of Economics and Business Administration (1996). He is currently a Professor at the University of Florida, president of the International Association of Aquaculture Economics and Management, editor for Aquaculture Economics and Management and associate editor for Marine Resource Economics. He has been a visiting scholar at the University of British Columbia, the University of Rhode Island and a Fulbright scholar at Duke University. His research interests focus on aquaculture and seafood markets, but he has also been doing work in fisheries management and energy economics. Professor Asche has published numerous articles in international journals in economics as well as leading multi-disciplinary journals like Science and PNAS. He has also undertaken a number of research projects in Norway as well as for international organizations like the FAO, OECD and WTO.

Panelist

Elisa Calvo

International Consultant, Argentina

Elisa Calvo has been Director of Fisheries Economics in the Fisheries Administration at a national level in Argentina for 10 years. She's an international expert in projects with FAO funding in Central America. She has acted as a representative of Argentina at meetings of the COFI-FAO, Subcommittee of Fish Trade FAO, COFI-OECD and rounds on fisheries subsidies at the WTO; and participated in FAO expert consultations in economic and social fishing subjects. Elisa has prepared documents for use in FAO projects, and is in charge of commercial issues in the preparation of bilateral and multilateral agreements with third countries.

Panelist

Griffin Carpenter

Senior Researcher, New Economics Foundation (NEF), United Kingdom of Great Britain and Northern Ireland

Griffin Carpenter is an Economic Modeller specializing in environmental policy and natural resource management. His current work focuses on the socio-economics of European fishing fleets. Other work areas include energy, climate change, agriculture, food systems, and health. Griffin has made media appearances on Al Jazeera, the BBC, Sky News and Nieuwuur, and is frequently interviewed for print publications. He has published in the peer-reviewed journals Marine Policy, Fish and Fisheries and Nature.

Panelist

Jingjie Chu

Senior Natural Resource Economist, World Bank (WB), United States of America

Dr Jingjie Chu is a Senior Natural Resource Economist at the World Bank. She received her PhD in Environmental and Natural Resource Economics from University of Rhode Island in 2009 and MSc in Environmental Economics and Policy from Peking University, China in 2004. She worked in United States of America NOAA in 2008 and joined the World Bank in 2009. She currently manages an investment portfolio in excess of USD 140 million focusing on fishery resource projects in African and East Asian countries and has provided economic expertise support for various projects in several countries. In addition, she has been working with colleagues from the University of Florida and University of Washington to develop Fishery Performance Indicators (FPIs), a quick assessment tool to determine how fisheries management systems are performing in order to achieve community, economic and ecological sustainability. Recently, she has also been involved in promoting the adoption of energy-efficient fish processing technology among women in Africa, to improve product quality, reduce carbon and smoke emission, increase income and reduce health risks.

Panelist

Javier Garat

President International Coalition of Fisheries Associations (ICFA) and Secretary General, Spanish Fishing Confederation (CEPESCA), Spain

Javier Garat is the Secretary General of the Spanish Fishing Confederation, CEPESCA. He is also currently President of the Association of National Organizations of Fishing Enterprises in the European Union (Europêche), President of the International Coalition of Fisheries Associations (ICFA), member of the board of directors of the International Seafood Sustainability Foundation (ISSF) and member of the European Bioeconomy Stakeholders Panel. Last year he was appointed as a member of the Spanish Royal Academy of the Sea. He is Expert and Alternate of the Spanish Fisheries Counselor of the European Economic and Social Committee, member of several Advisory Councils (ACs), member of the Management Board of the Spanish Institute of Oceanography, member of the Advisory Committee for the Spanish Fisheries Sector, Counselor of the General Council of the Marine Social Institute and member of the Spanish Maritime Cluster. In September 2010 he was appointed Knight of the Brotherhood the Golden Fleece.

Panelist

Marie Christine Monfort

Co-founder and president of the International Organization for Women in the Seafood Industry (WSI), France

Co-founder and president of the International Organization for Women in the Seafood Industry, Marie Christine Monfort works to promote gender equality in the seafood industry. For over 20 years, she operated as a seafood market analyst advising private businesses, national public institutions and international organizations. During this period immersed in the industry she witnessed its gender organization and sometimes discrimination, and understood that things could be done differently. She is the author of the FAO report The role of women in the seafood industry (2015). In 2016 she co-founded the International Organization for Women in the Seafood Industry, a non-profit NGO which alerts seafood stakeholders to the often invisible role of women in this vast industry. Marie Christine Monfort graduated in economics from the Sorbonne, Paris and from the Norwegian Fishery Economics Institute (NHH), Bergen, Norway (MSc in economics). She was awarded the French Légion d'Honneur for her achievements in the fishing industry in France.

Panelist

Mohamed Naji

Teacher-Researcher, Hassan II Institute of Agronomy & Veterinary Medicine (IAV), Morocco

Dr Mohamed Naji is a Fisheries Economist in the Department of Fisheries and Aquaculture of the Agronomic and Veterinary Institute of Rabat (Morocco). He has 28 years of experience in teaching, research and development in the fields of fisheries and aquaculture in Morocco and in the Arab and African region. He has expertise in market studies, the international fish trade, the fish value chain, the steering of development projects and fisheries management. He has also collaborated with several international agencies and programs, including FAO and the EU, on issues of the blue economy, international fish trade, and ecolabelling of fish and fishery products.

Panelist

Katrina Nakamura

Founder, Sustainability Incubator, United States of America

Katrina Nakamura PhD is founder of the Sustainability Incubator (sustainability-incubator.com), which offers methodology for sustainable seafood worldwide. She has worked for seafood sustainability for 20 years, starting with wild salmon gillnetters in the Pacific Northwest, near Alaska, and co-founding the Quality Fishing Expo in 1998. As a rural planner, scientist and entrepreneur she has contributed to oyster farming and processing, new commercial fisheries and co-management institutions, fleet strategies for crew well-being, and human rights due diligence to produce better products. Nakamura operated sushi bars and traded wild salmon before obtaining a doctorate looking into the industry's stake in sustainable seafood. Recently she led the development of the Labour Safe Screen (laboursafescreen.com) for food companies to use to learn the working conditions behind their products and fulfill their duty to uphold all workers' rights. She is currently preparing guidance on social responsibility for the fish sector in a collaborative process led by the FAO.

Chair

Rashid Sumaila

Professor and Canada Research Chair, University of British Columbia (UBC), Canada

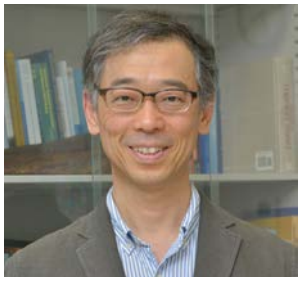
Dr Rashid Sumaila is Professor and Canada Research Chair in Interdisciplinary Oceans and Fisheries Economics at the Institute for the Oceans and Fisheries & School of Public Policy and Global Affairs, the University of British Columbia. He specializes in bioeconomics, marine ecosystem valuation and the analysis of global issues such as fisheries subsidies, illegal fishing, climate change and oil spills. Sumaila is widely published and cited. He is on the editorial boards of several journals, including Science Advances, Scientific Reports and Environmental & Resource Economics. He is winner of several awards, including the 2018 UBC President's Award for Public Education Through Media, the 2017 Volvo Environment Prize, the 2017 Benchley Oceans Award in Science, and the 2016 UBC Killam Research Prize. Sumaila was named a Hokkaido University Ambassador in 2016. He has given talks at the UN Rio+20, the WTO, the White House, the Canadian Parliament, the African Union, St James's Palace and the British House of Lords.

Panelist

Ruangrai Tokrisna

Professor, Kasetsart University (KU), Thailand

Dr Ruangrai Tokrisna holds a PhD in Economics from the University of Hawaii, United States of America, 1979. She is a Professor in the Department of Agricultural and Resource Economics of the Kasetsart University. Ms Tokrisna has been the team leader for several projects on development policy, strengthening capacity and collective management in fisheries and aquaculture in Thailand. Ms Tokrisna has been the principal investigator in projects related to aquaculture investment liberalization and has published in numerous peer-reviewed journals, books and technical reports on different fisheries and aquaculture-related topics such as marine resources management, shrimp culture and public policy for sustainable development in Thailand.



Panelist

Nobuyuki Yagi

Professor, The University of Tokyo, Japan

Nobuyuki Yagi is Professor at the University of Tokyo and Member of the Science Council of Japan. His area of study includes socio-economic aspects of small-scale fisheries, micro-finance, and value chain analysis on food products. He received his MBA from the Wharton School of University of Pennsylvania, Philadelphia, United States of America, and his PhD from the Graduate School of Agricultural and Life Sciences, the University of Tokyo, Japan. He has been a member of the Executive Committee of IIFET (International Institute of Fisheries Economics & Trade) from 2014 to 2018 and an expert of IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) at its group on values from 2014 to 2018. He also serves as a member of the Scientific Advisory Group (SAG) of the Globally Important Agricultural Heritage System (GIAHS) Program of the Food and Agriculture Organization of the United Nations (FAO) from 2019 to 2020.

Chair

Zhengyong Yang

Professor, Shanghai Ocean University, China

Dr Yang Zhengyong is the Executive Vice President and Secretary General, Committee of Economics of Fisheries, China Society of Forestry Animal Husbandry and Fishery Economics. He is the senior industrial economist of the National Marine Fish Industry Technology System, and the member of the Project Executive Panel. He is also the member of the National Aquaculture and Fisheries Expert Group, the member of the Academic Committee of Shanghai Ocean University. He has received honors of "Excellent Textbook Award of China Agricultural Science and Education Fund", "Outstanding Teachers of Baogang Education Fund", "Shanghai Outstanding Young Teachers", and "Shanghai Education Award". His research focuses on aquaculture economy, quota-based governance of fisheries, environmental and natural resources economy and industrial economic policies. He presides over 20 projects founded by the National Natural Science Foundation, Ministry of the Agriculture, etc.

SESSION 6 – FISHERIES MANAGEMENT IN THE FACE OF A CHANGING CLIMATE

Keynote speaker

Steven D. Gaines

Dean & Distinguished Professor, University of California Santa Barbara (UCSB), United States of America

Steve Gaines is Dean of the Bren School of Environmental Science & Management at the University of California, Santa Barbara. He is a marine ecologist who seeks conservation solutions by linking innovations in ocean science to more effective marine policy and management. His science explores the design of marine reserve networks, climate change impacts on ocean ecosystems, sustainable fisheries management using market-based reforms, and the role of aquaculture in meeting the future demand for food. In each of these science endeavours, he has been a strong promotor of more effective communication of ocean science to enhance its impact. Steve holds a PhD from Oregon State University. He has been awarded a Pew Fellowship, the inaugural Marc Hirshman Award for excellence in student mentoring, a fellowship from the American Association for Advancement of Science, and the Peter Benchley Prize for Ocean Science.

Keynote speaker

Éva Plagányi

Principal research scientist, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

Dr Éva Plagányi is a senior principal research scientist based at CSIRO Ocean and Atmosphere, Brisbane, Australia. She is responsible for methods to reliably and effectively manage marine natural resources, as well as to progress towards an ecosystem approach to fisheries management, including MICE (Models of Intermediate Complexity for Ecosystem assessment). Her research involves stock assessment modelling, ecosystem modelling, management strategy evaluation (MSE) and climate change impacts and adaptations. She works closely with traditional owners in Torres Strait to integrate biological, social, cultural and economic factors.

As a member of the Lenfest forage fish task force, she contributed to research on global management recommendations for forage fish. She has a dual biological and mathematical background, is an Australian Women in STEM superstar, has collaborated broadly and served on several scientific working groups, and published 96 articles including a FAO technical report on ecosystem approaches to fisheries management.

Panelist

Miguel Bernal

Fishery Resource Officer, General Fisheries Commission for the Mediterranean (GFCM-FAO), Italy

Dr Miguel Bernal is the leading Fisheries Expert within the Secretariat of the General Fisheries Commission for the Mediterranean (GFCM) of FAO. He is responsible for planning and coordinating the production of scientific advice related to fisheries and marine ecosystems in the Mediterranean and Black Sea, as well as the dissemination of results in support of decision-making, including through the publication of the biennial FAO-GFCM report on the State of Mediterranean and Black Sea fisheries. He has previously worked in a number of top-level universities and fisheries research institutes across the world, publishing numerous scientific contributions in the fields of stock assessment, ecosystem modelling and climate change.

Panelist

Merrick Burden

Director Resilient Fisheries, Environmental Defense Fund (EDF), United States of America

Merrick serves as the Director, Resilient Fisheries at Environmental Defense Fund (EDF) where he works to advance fishery management in ways that achieve desired economic, social, and environmental outcomes, and to ensure those outcomes are durable in the face of climate change. His particular focus is on the identification of fishery management challenges created by climate change and the design of solutions and processes for addressing those problems. His work spans multiple continents, including North America, South America, Asia, and Europe. Prior to working at EDF, Merrick worked in a couple of different capacities, including time spent as fishery management staff, and as the Executive of a large fishery stakeholder group in Alaska. Merrick serves on several non-profit boards and committees related to ocean fisheries and climate change.

Panelist

John Hampton

Senior Fisheries Scientist, Secretariat of the Pacific Community (SPC), New Caledonia

Dr John Hampton has worked for more than 30 years in the area of tuna biology and ecology, stock assessment and fisheries management. He joined the Secretariat of the Pacific Community (SPC) in 1987 after having worked for seven years at CSIRO (Australia) on southern bluefin tuna stock assessment. He has been instrumental in the implementation of formal assessments for WCPO tuna stocks. Since 2002, John has led the Oceanic Fisheries Programme (OFP) at the Pacific Community, one of the world's most respected pelagic fisheries research programs and the key provider of scientific services and advice regarding tuna fisheries to the island states and territories of the Pacific, the Forum Fisheries Agency and the Western and Central Pacific Fisheries Commission.

Panelist

Kirstin Holsman

Fisheries Research Biologist, National Oceanic and Atmospheric Administration (NOAA), United States of America

Dr Holsman is a Fishery Research Biologist with the Resource Ecology and Ecosystem Modeling Team at the NOAA Alaska Fisheries Science Center in Seattle, United States of America. Her research is focused on the development of quantitative methods for ecosystem-based fisheries management and methods to assess and manage for climate change impacts on Arctic fish and fishing communities. This includes multiple collaborations to develop and implement climate-specific stock assessment models for Alaska (United States of America) fish species, Integrated Ecosystem Assessments, bioenergetics and food-web models, and field studies of climate and fishery effects on marine ecosystems. She is co-lead investigator on the Alaska Climate Integrated Modeling Project (ACLIM), a multidisciplinary collaboration to project climate change impacts on Bering Sea fish and fishing communities and evaluate the performance of alternative management strategies under future climate scenarios.

Panelist

Abigail Lynch

Research Fish Biologist, United States Geological Survey (USGS), United States of America

Abigail (Abby) Lynch is a Research Fish Biologist with the United States of America Geological Survey's National Climate Adaptation Science Center. She also currently serves as an adjunct/affiliate faculty member at Michigan State University, New Mexico State University, and North Carolina State University; on the executive committee for the International Fisheries Section of the American Fisheries Society; and as coordinator for the international 'InFish' research network. Working primarily in inland systems, Abby's research examines the impacts of global change on fish at local, national and global scales using field-collected and remotely-sensed data. Abby received her PhD in Fisheries and Wildlife from Michigan State University, MSc in marine science at the Virginia Institute of Marine Science, College of William & Mary, and BSc in biology and BA in English literature from the University of Virginia.

Panelist

Flower E. Msuya

Founder and Chairperson, Zanzibar Seaweed Cluster Initiative (ZaSCI), Tanzania

Dr Flower Ezekiel Msuya is a world-renowned seaweed farming, integrated aquaculture and innovation expert. She holds a PhD on seaweeds in integrated aquaculture from Tel Aviv University, Israel and a Master's degree in Fisheries and Aquaculture from University of Kuopio, Finland. She conducted the first study on the socio-economic and environmental impacts of seaweed farming, and pioneered the start of seaweed farming in southern Tanzania and other places. Recently, she has focused in research and training on seaweed farming technologies and value addition, and integrating seaweed with culture animals such as sea-cucumbers to cope with the effects of climate change. Dr Msuya is Founder and Chairperson of the Zanzibar Seaweed Cluster Initiative (ZaSCI), working with seaweed farmers in innovative farming and value addition and linking them with universities/research institutions, government departments and markets. Her work has especially helped marginalized women in Tanzania increase their income through production of seaweed value-added products. She has published 40+ papers.

Chair

Hazel Oxenford

Professor of Marine Ecology and Fisheries, University of West Indies (UWI), Barbados

Professor Hazel Oxenford is an internationally recognized expert in applied marine biology and marine management with a focus on coral reefs and pelagic fisheries, particularly in small island developing states. She obtained a BSc in Zoology from the University of Exeter, a PhD in Fisheries Science from the University of the West Indies (UWI), and joined the staff at the Centre for Resource Management and Environmental Studies, UWI in 1991. She has extensive Caribbean research and teaching experience, and serves as an expert on many national, regional and international boards, committees and working groups. As both a fisheries scientist and marine ecologist, she has a particular interest in marine resource management in a changing world. Professor Oxenford's research has been published in numerous peer-reviewed journals, books and technical reports.

Panelist

Ernesto Penas Lado

International Consultant, Spain

Ernesto Penas Lado was born in Galicia, Spain in 1952. After 10 years working as a marine and fisheries biologist, he joined the European Commission where he worked for 30 years, 28 of which were in the Directorate General for Fisheries, where he was responsible for a variety of files on fisheries management, both at European and international level. As a Director, he was responsible for the last reform of the Common Fisheries Policy in 2013. He was also Director General for fisheries and aquaculture in the regional government of Galicia, Spain, from 1990-93, and between 2016 and 2017 he spent an academic year as a visiting professor at the University of Washington in Seattle, United States of America. He is the author of various publications on fisheries science and policy, among them the book The Common Fisheries Policy: the quest for sustainability published in 2016. At present he is retired from the European Commission.

Panelist

John K. Pinnegar

Centre for Environment, Fisheries & Aquaculture Science (CEFAS), United Kingdom of Great Britain and Northern Ireland

John is a Principal Scientist and lead advisor on climate change at Cefas, the UK government fisheries laboratory. John is director of the Collaborative Centre for Sustainable Use of the Seas (CCSUS), a joint initiative between Cefas and the University of East Anglia, and he is a co-chair of the ICES/PICES Strategic Initiative on Climate Change Impacts on Marine Ecosystems (SICCME). Dr Pinnegar's research interests include long-term changes in marine ecosystems, the impacts of future climate change and ocean acidification on marine animal populations, as well as marine food-webs and fisheries modelling. He has a particular interest in the development of socio-political scenarios for the oceans as well as public understanding of maritime climate change issues. John has worked all around the world, including most recently in a number of Caribbean Small Island Developing States (SIDS). He is a Lead Author for the Intergovernmental Panel on Climate Change (IPCC) 6th Assessment Report (AR6) chapter on 'small islands', scheduled to be published in 2021.

Panelist

Shyam S Salim

Principal Scientist, Central Marine Fisheries Research Institute (ICAR), India

Shyam S Salim has over 20 years of research experience in niche areas on marine fisheries economics, domestic marketing, international trade, climate change, women empowerment, policy research and management. Shyam S Salim has a doctorate in Agricultural Economics and a Post Graduate Diploma in Business Administration. He has been collaborating and expanding networks within and outside the institute for supporting and implementing state/country fisheries management and fishers' welfare actions and initiatives with significant resource mobilization. He has developed considerable international research and development linkage with Australia India Strategic Research Fund (AISRF), Michigan State University (MSU) and Belmont Forum. He leads the international climate change research project and its implications on food security and livelihoods. Mr Salim has completed around 40 research projects and has published more than 100 research articles in peer-reviewed journals. He has collaborated in CMFRI's significant contributions to global and regional flagship studies, and forged strategic partnerships.

Panelist

Carl van der Lingen

Specialist Scientist, South African national Department of Agriculture, Forestry and Fisheries South Africa

Carl David van der Lingen was awarded his PhD in Zoology in 2000 by the University of Cape Town, South Africa, for research on the trophic ecology of sardines in the Southern Benguela upwelling ecosystem. He is presently a Specialist Scientist in the Chief Directorate: Fisheries Research and Development of the Branch: Fisheries Management of the South African National Department of Agriculture, Forestry and Fisheries. His research is focused primarily on the biology, ecology and population structure of small pelagic fishes off South Africa and their role in ecosystem functioning, and he contributes to the ecosystem approach to management of the fisheries for these species. Carl is a member and previous chair of several Scientific Working Groups within the Chief Directorate: Fisheries Research and Development, and sits on several other national and regional Task Teams and Working Groups. He is also an Honorary Research Associate at the University of Cape Town.

SESSION 7 – FISHERIES INFORMATION SYSTEMS AND NEW TECHNOLOGIES

Keynote Speaker

Donatella Castelli

Researcher Director, Italian National Research Council (CNR-ISTI), Italy

Dr Doanatella Castelli's research activity has been mainly focused on data management. She started working on conceptual models for databases, then she moved to knowledge representation and digital libraries. Since 2004, she has primarily been working in the area of data infrastructures. She has been the Principal Investigator of several European and international funded projects in this area, with a particular emphasis on infrastructures supporting research activities. Among these projects are IMarine and BlueBRIDGE, dedicated to supporting the implementation of the ecosystem approach to fisheries management and conservation of marine living resources, and the decision-

making and educational activities in these areas. These projects have allowed her to acquire considerable experience on the IT needs of the scientific communities in these domains. Her scientific interests are centred on data interoperability and intelligent data-driven services for collaborative knowledge production.

Keynote speaker

Serge Raemaekers

Managing Director, Abalobi, South Africa

Dr Serge Raemaekers is a specialist in fisheries management systems. His research work engages with systems thinking and fisheries governance practice with the aim of recommending governance models and management approaches that are more applicable to small-scale fishers' realities. He works closely with fishworkers and fisher leaders along the coast as he aims to champion and transform stakeholder-driven processes of knowledge generation. Most of his work is centred on social learning processes with local small-scale fishers, with the aim of ensuring that the communities' knowledge, needs and vision are adequately captured and incorporated in any planning and decision-making processes. In 2015, Dr Raemaekers launched the 'Abalobi' initiative in South Africa (www.abalobi.org). Dr Raemaekers leads the research and development process of Abalobi, from natural and social sciences to research on Information and Communication Technologies that can empower fishers in all aspects of small-scale fisheries governance, and most notably enable fishers to be stewards of marine resources.

Panelist

Douglas Beard

Chief of the National Climate Adaptation Science Center, United States Geological Survey (USGS), United States of America

Dr Doug Beard is the Chief of the United States Geological Survey's (USGS) National Climate Adaptation Science Center. Prior to moving to the National Climate Adaptation Science Center, Doug held positions coordinating the nationwide Fisheries program within USGS and as a staff biologist with the Wisconsin Department of Natural Resources. He has focused his research on recreational inland fisheries and ways to better understand the value of the world's inland fisheries. He has worked extensively in the United States and South East Asia. He has served as the President of the World Council of Fisheries Societies and the American Fisheries Societies International Fisheries Section. Doug holds a bachelor's degree in biology from the University of Wisconsin-Eau Claire, a master's degree in fish and wildlife sciences from Penn State University, and a doctorate in zoology from the University of Wisconsin-Madison.

Panelist

Emmanuel Chassot

International Consultant, Seychelles Fishing Authority, Seychelles

Emmanuel Chassot is a Quantitative Fisheries Scientist interested in the ecology of tuna and the fisheries they support. Since 2008, he has been involved in the monitoring of high-seas fisheries targeting tropical tunas in the eastern Atlantic and western Indian Ocean. He has been actively participating for some years in the scientific work conducted within tuna Regional Fisheries Management Organizations, specifically the International Commission for the Conservation of Atlantic Tunas (ICCAT) and the Indian Ocean Tuna Commission (IOTC). His research focuses on the impact of tuna fisheries on pelagic fish communities and ecosystems with a particular interest in conservation and sustainable management.

Panelist

Alfred Lee Cook

Programme Manager of the Western and Central Pacific Tuna, World Wide Fund for Nature (WWF), New Zealand

Alfred "Bubba" Cook has spent a lifetime on the ocean and 17 years working in fisheries. He began his career in the US Navy, which took him around the world and sparked an interest in international fisheries. Troubled by fishery declines he observed, he secured a BSc in Fisheries from Texas A&M University followed by a J.D. in Environmental Law from Lewis & Clark College. He then worked for the United States National Marine Fisheries Service in Alaska, where he led implementation of the Bering Sea crab quota programme. He later joined WWF's Arctic Programme supporting fisheries projects in Russia and Alaska. In 2010 he joined the United States Peace Corps in Fiji, where he supported small-scale marine conservation projects. Since 2012, he has served as the Western and Central Pacific Tuna Programme Manager for WWF out of New Zealand, where he supports sustainable tuna fishing through policy improvements, market tools and technological innovation.

Panelist

Lifeng Cui

Director General, China National Fisheries Technology Extension Center and Vice Chairman and Secretary General, China Society of Fisheries, China

Mr Cui lifeng is currently the Director General of China National Fisheries Technology Extension Center, the Vice Chairman and Secretary General of China Society of Fisheries. He has been engaged in fisheries administration, international fisheries cooperation, fishery management and fishing port superintendency, fishery development and industrial policy research, as well as fishery science and technology management work. He has in-depth studies on fishery resources and ecological environmental conservation, fishing vessel and fishing port management, policy on construction and development of modern fisheries, international fisheries and other related fields. He served as Deputy Director General of the Bureau of Fishery Management and Fishing Port Supervision in South China Sea Region of the Ministry of Agriculture of China, Deputy Director General of the Bureau of Fisheries of the Ministry of Agriculture of China, and President of the Chinese Academy of Fishery Sciences.

Panelist

Sara Iverson

Professor and Scientific Director Ocean Tracking Network, Dalhousie University (DAL), Canada

Dr Sara Iverson is a Professor of Biology and the Scientific Director of the global Ocean Tracking Network (OTN), an international aquatic animal tracking, technology, data management and partnership platform, and a Canadian National Research Facility, headquartered at Dalhousie University, Halifax, NS. OTN uses electronic tracking technologies and robotic underwater vehicles to provide state-of-the-art capacities in ocean observation and knowledge on aquatic animal movements, habitat use, interactions and survival, in the face of changing environments in order to advance the governance and sustainability of the ocean's resources and fisheries. Sara received her PhD jointly from the Smithsonian Institution and University of Maryland, United States of America, and leads an interdisciplinary research program that has advanced the understanding of marine animal physiological ecology; roles of fat in mammalian reproduction, survival and life history strategies; and marine animal movement and foraging ecology. She is a Fellow of the Royal Society of Canada, Academy of Science.

Panelist

Anthony Long

CEO, Global Fishing Watch, United Kingdom of Great Britain and Northern Ireland

Tony Long is CEO of Global Fishing Watch, an independent non-profit that aims to improve sustainability in our ocean resources through increased transparency in commercial fishing activity. Previously, he led the Pew Charitable Trusts' work to end illegal fishing. Global Fishing Watch is evolving to deliver in four key areas: the public and free technology platform monitoring fishing activity; research and innovation to promote data sharing for better science; provision of a Data and Analysis Cell to support the wider understanding of fishing activity and benefits of transparency; and the transparency program designed to bring more vessel tracking data into the public realm, improve compliance and make plain the global footprint of fishing. He entered into ocean conservation after 27 years in the Royal Navy. He commanded a mine-hunter and a frigate, and served on the head of the Navy's strategy team, providing ministerial-level defence planning and policy support.

Panelist

Jeannette Germania Mateo Pérez

Director, Fisheries Resources at the Dominican Council for Fisheries and Aquaculture (CODOPESCA), Dominican Republic

Jeannette is biologist, researcher and professor graduated from Universidad Autónoma de Santo Domingo, with a MSc from the University of Puerto Rico; completed studies on aquaculture (PISIE-Italy, Best Student Award by ICDF-Taiwan), and on Caribbean International Relations at the Latin-American Faculty for Social Sciences. She serves as Director of Fisheries Resources at the Dominican Council for Fisheries and Aquaculture since 2008. More than 20 years of experience working in aquatic resources management and research, designing and implementing management plans in coastal and protected areas in her home country and supervised the implementation of coastal community-based projects for Guatemala and Panamá. She has performed her duties within the framework of complex organizations such as CARICOM, The Nature Conservancy, Academia and the Dominican Republic's government. Currently, a CITES Scientific Authority of fauna. Member of the Latin American Net of Women in Fisheries. Member of the Directors of Fisheries Commission of SICA/OSPESCA.

Panelist

I Nyoman Radiarta

Director, Institute for Marine Research and Observation (IMRO), Indonesia

I Nyoman Radiarta is the Director of the Institute for Marine Research and Observation of the Ministry of Marine Affairs and Fisheries in Indonesia. He received his PhD in satellite oceanography from the Faculty of Fisheries Science of Hokkaido University, Japan, in 2009. From 2009–2011, he was appointed as a post-doctoral fellow at Laboratory of Marine Bioresources and Environment Sensing at the Faculty of Fisheries Sciences of Hokkaido University. He was awarded the best presentation from North Pacific Marine Science Organization (PICES) during its International Annual Meeting in Jeju, Korea November 2009. He is acting as co-principal investigator of the SATREPS project on optimizing mariculture based on big data with a decision support system in Indonesia. His research interests are the application of GIS and remote sensing for marine and coastal environmental aquaculture development in terms of site selection, and marine/coastal spatial planning.

Panelist

Suzuette Soomai

Regional Senior Fisheries Management Officer, Canada Department of Fisheries and Oceans, Canada

Dr Suzuette Soomai is a fisheries manager with the Canada Department of Fisheries and Oceans at the Bedford Institute of Oceanography, and an Adjunct faculty member in the School of Information Management, Dalhousie University, since 2018. Ms Soomai is also an interdisciplinary researcher with the Environmental Information: Use and Influence research program at Dalhousie University since 2008, studying the science-policy interface from social science perspectives. From 1994 to 2009, Suzuette was the lead government fisheries scientist in Trinidad and Tobago working with small-scale multi-gear fisheries for shrimp and groundfish, and with Caribbean regional fisheries management organizations and the FAO in stock assessments, in-land aquaculture, and bycatch reduction programs. With 25 years' experience in coastal and ocean management, sustainable fisheries and information management that spans public sector and academic settings within North America and the wider Caribbean region, Ms Soomai has contributed to increased understanding of enablers and challenges to evidence-based decision-making.

Panelist

Lida Teneva

Science Officer, California Ocean Science Trust, United States of America

Dr Lida Teneva is a Marine Conservationist and Ecologist, with experience in climate change science, fisheries management and coastal management, ocean policy, protected areas, and ecosystem services. She served as OceanX's Science Officer, building ocean exploration research programs and partnerships. Prior to OceanX, she built fisheries management and marine protected area (MPA) projects for Conservation International and the Wildlife Conservation Society in Hawaii and Fiji. As an ocean explorer, she has also been an expedition guide for National Geographic Expeditions around the world. Lida has a PhD in marine ecology from Stanford University and a Master's in climate science and oceanography from Columbia University.

Chair

Francisco Werner

Chief Science Advisor and Director of Science Programs, National Oceanic and Atmospheric Administration (NOAA), United States of America

Francisco "Cisco" Werner is Chief Science Advisor and Director of Scientific Programs of U.S. NOAA's National Marine Fisheries Service (NMFS). He leads NMFS' efforts to provide the science needed to support sustainable fisheries and ecosystems, ending overfishing, rebuilding fish populations, saving critical species, and preserving vital habitats. Mr Werner supervises the planning, development and management of a multidisciplinary scientific enterprise of basic and applied research, and he oversees NMFS' Science Centers and Office of Science and Technology. His research has included the development of numerical models of ocean circulation, the effects of physical forcing on lower trophic levels, and the subsequent effect on the structure, function and abundance of commercially and ecologically important species. Mr Werner was Director of NOAA's Southwest Fisheries Science Center, and Director and Professor of Rutgers University's Institute of Marine and Coastal Sciences. He has a PhD in Oceanography from the University of Washington.

SESSION 8 – POLICY OPPORTUNITIES FOR FISHERIES IN THE TWENTY-FIRST CENTURY

Keynote speaker

John Kurien

Visiting Professor, Azim Premji University, India

John Kurien has an academic background in statistics, business management and social sciences and started professional life in the early 1970s helping small-scale fishers to organize their fish marketing cooperatives. Later he joined the Centre for Development Studies, Trivandrum, India and retired from there as Professor. He was founder member of the International Collective in Support of Fishworkers. He served as Vice-Chair of the FAO/UN Advisory Committee for Fisheries Research for a decade. He has worked closely with fishing communities in Cambodia and Aceh Province, Indonesia to organize co-management initiatives. Currently he is Visiting Professor at the School of Development, Azim Premji University, Bengaluru, India and also Honorary Fellow of the WorldFish Centre with headquarters in Penang, Malaysia. His research, publications and practice relate primarily to the socio-economics, management and political ecology of small-scale fisheries. He strives to be a reflective practitioner.

Keynote speaker

Lori Ridgeway

International Consultant, Canada

Ms Ridgeway became actively involved in domestic and international fisheries and oceans policy in 1999 in Canada's Department of Fisheries and Oceans (DFO), first as Director General of Economic and Horizontal Policy, and then as Director General of DFO's International Policy and Integration Branch (fisheries policy integration, oceans policy/governance, international trade and international business development, including a focus on science-policy integration). She led DFO/Coast Guard's strategy for the Arctic and small-scale freshwater fish processing issues, prior to retiring in 2013. Ms Ridgeway was a 6-year Chair of the OECD Fisheries Committee, 3-year Chair of the UN Informal Consultative Process on Oceans and the Law of the Sea, and Chair of many other international meetings and processes. Similarly, she was Head of Canada's Delegation to fisheries and oceans-related international meetings and negotiations at OECD, UN (various), FAO, WTO and others. Ms Ridgeway has published in journals and books, and is currently on the editorial Board of the Journal of Marine Science.

Panelist

Samantha Burgess

Head of Marine Policy, World Wide Fund for Nature (WWF), Belgium

Dr Samantha Burgess is head of marine policy for WWF in Europe. A marine scientist, Ms Burgess works at the interface between science and policy. Previous positions have included chief scientific advisor and research director in government, private sector and academia combining expertise in ocean and climate sciences to support implementation of effective ocean governance and a sustainable blue economy globally. In recent years, Ms Burgess has focused on ocean recovery and increasing ocean resilience, particularly to the impacts of climate change. She holds a PhD in marine geochemistry from the Australian National University and has worked in global fisheries and ocean ecosystems ranging from hydrothermal vents and deep-sea reefs on the high seas, to tropical coral reefs, temperate and Antarctic ecosystems.

Panelist

Michael Dudley Copeland

Executive, Lucky Star Operations, Oceana Group Ltd, South Africa

Michael Dudley Copeland graduated from the University of Cape Town in 1972 with a BSc (Chemical Engineering). He entered the fishing industry in 1974 and has been active in various sectors including small pelagics, hake, rock lobster, squid, tuna and shrimp in both operational and sales activities. He is currently employed by Lucky Star Ltd, wholly owned subsidiary of Oceana Group Limited, Cape Town, South Africa. He sits on the Board of IFFO (The Marine Ingredients Organization) and is currently Chairperson of the South African Pelagic Fishing Industry Association (SAPFIA) and a member of the Management Committee of FishSA (association representing the fishing industry in South Africa). He's also a member of the Small Pelagic Scientific Working Group of the Department of Environment, Forestry and Fisheries in South Africa, which is the committee responsible for making recommendations on TACs in the small pelagic sector in South Africa.

Panelist

Claire Delpeuch

Policy Analyst, Organization for Economic Cooperation and Development (OECD), France

Claire Delpeuch is a policy analyst with the fisheries and aquaculture team of the OECD agriculture and resources policies division. She oversees the production of the OECD Review of Fisheries and manages co-operation with developing and emerging countries, helping governments identify smart policies that promote sustainable growth, reduce poverty and enhance food security while preserving the ecosystems on which the seafood sector depends. An international economist by background, she has worked on a range of trade and development issues, including food security, agricultural market regulation and aid for trade, both at the OECD and in academia. She was also a lecturer at Sciences Po Paris, where she obtained her PhD.

Panelist

Hamady Diop

Principal Fisheries Officer, African Union Development Agency (AUDA-NEPAD), South Africa

Dr Hamady Diop is a Mauritanian national currently working as Principal Fisheries Officer of AUDA-NEPAD, South Africa. He was previously the head of the Programme Natural Resource Governance Food Security and Nutrition of NEPAD. With NEPAD, Dr Hamady supported the implementation of the African Union Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa. He supported the African Regional Group (ambassadors accredited to Rome-based UN agencies) to develop common positions during statutory meetings of the FAO Committee on Fisheries. He secured funding for various projects and supported their implementation. Dr Diop has also served as Director of Research and Information Systems for the West Africa Sub-regional Fisheries Commission, a position that coordinates fisheries management issues, policy development, capacity-building and development of common voices at international fora for a seven-country area of West Africa. Dr Diop has been a recipient of many grants and his research has been published widely in many scientific journals.

Panelist

Sergey Leontiev

Head of the Department of marine fish species, European seas of Russia, Russian Research Institute of Fisheries and Oceanography (VNIRO)

Sergey Leontiev is the Head of the Department of marine fish species, European seas of Russia, at the Russian Research Institute of Fisheries and Oceanography (VNIRO). He has a background in ichthyology and a D.Sc. in biology. Dr Leontiev has specialized in the problems of the state of commercial fish stocks distributed in the European seas of Russia (Kara, Barents, Black, Azov, Caspian and Baltic), as well as in other areas of the world's oceans. His daily activities are related to the development and improvement of fishing regulations of Russian fishing in the European seas of Russia. Dr Leontiev has repeatedly participated in the work of international fishing commissions as a member of the Russian delegation or as an invited international expert. Dr Leontiev has published more than 60 scientific papers.

Panelist

Pamela Mace

Chief Scientist, New Zealand Ministry of Fisheries, New Zealand

Dr Pamela Mace is the former Chief Scientist of the New Zealand Ministry of Fisheries and the current Principal Science Advisor Fisheries at Fisheries New Zealand. Her key responsibilities in both positions have included oversight of the quality and integrity of the Ministry's fisheries research, stock assessment and environmental assessment programmes. During the last several years, Dr Mace has been heavily involved in the national and international development of harvest control rules for fisheries management; the development and implementation of national standards for overfishing definitions and rebuilding plans; investigation of methods for defining and implementing ecosystem approaches to fisheries; development of criteria for defining species at risk; and various science quality assurance projects for reviewing and improving fish stock assessments in the United States, Canada and New Zealand. Dr Mace has chaired numerous working groups and task forces and published papers and technical reports on these and related topics.

Panelist

Patrick McConney

Senior Lecturer, University of the West Indies (UWI), Barbados

Patrick McConney is Senior Lecturer in Marine Resource Management Planning and Director of the Centre for Resource Management and Environmental Studies (CERMES) at the University of the West Indies (UWI) Cave Hill Campus in Barbados. His work covers many aspects of small-scale fisheries and marine protected areas, especially governance, livelihoods, socio-economics, gender and developing adaptive capacity within the contexts of resilience and social-ecological systems.

Chair

Atsushi Sunami

President and Executive Director, Ocean Policy Research Institute, the Sasakawa Peace Foundation (OPRI – SPF), Japan

Dr Atsushi Sunami is the President of the Ocean Policy Research Institute of the Sasakawa Peace Foundation (OPRI-SPF) as well as an Executive Advisor to the President and adjunct professor of science and technology policy at the National Graduate Institute for Policy Studies (GRIPS) in Tokyo. He is currently a member of the Advisory Board for the Promotion of Science and Technology Diplomacy in the Ministry of Foreign Affairs, Japan, and the Council for Science and Technology in the Ministry of Education, Culture, Sports, Science and Technology, Japan. He was previously a researcher in the Department of Policy Research at Nomura Research Institute, Ltd. (1989-1991), a fellow at the Research

Institute of Economy, Trade and Industry, Japan (2001-2003), and a visiting researcher at the Science Policy Research Unit, University of Sussex, United Kingdom of Great Britain and Northern Ireland, and Tsinghua University, China. He was also a Special Advisor to the Cabinet Office responsible for Science and Technology and Innovation (2015-2018).

Panelist

Yi Tang

Professor and Dean, Shanghai Ocean University (SHOU), China

Dr Tang Yi is the professor and Dean of the College of Marine Culture and Law at Shanghai Ocean University. His teaching and research focus on marine and fisheries laws, policies and management. He conducted field research and production on sea with distant-water fisheries for four years. In 2003, he served in a temporary position in the Bureau of Fisheries and participated in the development of the Programme of Action on the Conservation of Living Aquatic Resources of China. He also served as the Deputy Director of Yangpu Environmental Protection Bureau of Shanghai from 2005 to 2006. Since 2003, he has led over 40 research projects funded by the National Planning Office of Philosophy and Social Science, Ministry of Agriculture, State Oceanic Administration and others, and is now leading the efforts to amend the Fisheries Law of China, and the Regulations on the Management of Fishing License.

Panelist

Veronika Veits

Director, Directorate on Fisheries Policy, Mediterranean and Black Sea and Directorate on International Ocean Governance and Sustainable Fisheries of the Directorate-General for Maritime Affairs and Fisheries of the European Commission

Veronika Veits started her career in the European Commission in 1996. She was appointed Head of Unit for Structural Policy in the Directorate-General for Maritime Affairs and Fisheries in 2005. For the next five years, she oversaw the implementation of 17 Member States' Fisheries Fund programmes, and monitored the administration of all Member States' Data Collection programmes. In 2011, she took over the management of the Unit responsible for International Affairs, Law of the Sea and Regional Fisheries Management Organisations in the same Directorate-General, and represented the EU at multilateral and bilateral level. In 2016, Veronika Veits was appointed Director for Fisheries Policy, Mediterranean and Black Sea in the Directorate-General for Maritime Affairs and Fisheries. On 1 September 2019, Veronika Veits was appointed Director for International Ocean Governance and Sustainable Fisheries. This includes Regional Fisheries Management Organisations, Sustainable Fisheries Partnership Agreements and Fight against IUU Fishing.

Panelist

Sally Yozell

Senior Fellow and Director of the Environmental Security Program, the Stimson Center, United States of America

Sally Yozell is a Senior Fellow and Director of the Environmental Security program at the Stimson Center. Her work focuses on ocean security, climate security and wildlife protection. Yozell leads a team who explore the links between environmental crime and security and develop global security strategies to address IUU fishing, thwart illicit networks and increase transparency along the seafood supply chain. She also devises resiliency strategies to address climate and ocean risk. Yozell serves in an advisory role for the Our Ocean Conferences. Yozell served as a Senior Advisor to Secretary of State John Kerry where she advanced United States policies in the international arena related to ocean, climate, and wildlife protection. During her career she also was the Director of Policy and Deputy Assistant Secretary at NOAA; a Regional Director for Marine Conservation at The Nature Conservancy; a VP at Battelle Memorial Institute; and she worked for a decade in the U.S. Senate.

ANNEX B
Abstracts

SESSION 1 *– The status of global and regional fisheries sustainability and its implications for policy and management*

PANEL 1.1

THE STATE OF THE STOCKS AT GLOBAL AND REGIONAL LEVELS – WHERE ARE WE AND WHERE SHOULD WE BE HEADING?

KEYNOTE: ASSESSING THE SUSTAINABILITY OF GLOBAL FISHERIES

Ray Hilborn, School of Aquatic and Fishery Sciences, University of Washington, United States of America

Sustainability is widely agreed to have three components: social, economic and environmental. The "Brundtland" definition is perhaps the most widely accepted: "A development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs." A more specific definition (Matson, Clark, Anderson): "inclusive human well-being does not decline." In the world of fisheries, sustainability has been measured most commonly by the abundance of exploited fish populations, but also by fishing pressure, the production of yield in relation to potential, by the management system and by the impacts of fishing on the ecosystem structure. The abundance and fishing pressure of fisheries has been measured by publically available scientific assessment for fish stocks that constitute half of the global marine fish production (Ricard et al. 2012). For the other half of world fisheries, assessment of abundance and fishing pressure is at the most evaluated by expert judgement using various indicators. For monitored stocks, FAO (2018) suggests that there has been a gradual increase in the percentage of stocks overfished rising from 10 percent in 1974 to 33 percent in 2015. This is based solely on the abundance of stocks relative to a MSY target.

When we look more closely at the assessed stocks of the world, we find fishing pressure in the last 20 years has on average been declining and abundance increasing, and fish stock abundance is now, on average, above MSY targets and fishing pressure below MSY targets. It is estimated that 3–5 percent of potential yield is now lost by excess fishing pressure on these assessed stocks. In general, in regions where there is research, assessment and management plans fisheries are performing better than where there is less of these elements. We see a positive trend in many parts of the world where there has been increasing fisheries management and declining fishing pressure. However, we do see some regions of the world with continued excessive fishing pressure – the Mediterranean and Black Sea and demersal species in NW Africa stand out as having poor biological status.

The unassessed stocks of the world largely come from developing regions with low management intensity and, based upon the relationship we have seen in the assessed stocks between management intensity and stock status, we would expect to see these low management regions to have poor stock status. FAO SOFIA does not suggest this for all regions, and for some regions there appears to be a conflict in information.

For instance Pacific Ocean Western Central and Indian Ocean Eastern both show no more than average fraction overfished in FAO (2018), yet have very low management intensity.

The major challenge is to bring scientific assessment, fisheries management and stock rebuilding to the places in the world where fishing pressure remains too high. Most of Asia, Africa and Central America do not have scientific assessment of fish stock status and have relatively ineffective fisheries management measures, but they are also places where fisheries are particularly important for food security and employment. Inland and small-scale fisheries are particularly poorly understood.

There is no systematic analysis of the social and economic sustainability of global fisheries but the data that are available suggest that environmental, social and economic performance are not necessarily highly correlated: some fisheries continue to provide major social benefits while having relatively low biological status.

PANEL 1.2

ACHIEVING SUSTAINABLE FISHERIES MANAGEMENT: A DEVELOPING WORLD PERSPECTIVE

KEYNOTE: EVIDENCE-BASED FISHERIES MANAGEMENT: WHAT IS NEEDED TO ACHIEVE BIOLOGICAL SUSTAINABILITY OF GLOBAL FISHERIES?

Ana M. Parma, Patagonian National Center (CENPAT – CONICET), Argentina

The ability of fishery management systems to maintain fishing pressure at levels that can sustain productive fisheries depends on: (i) the availability of information on resource status and trends relative to desirable levels, (ii) the capacity to adjust harvest controls in response to changes in stock abundance, and (iii) the ability to implement and enforce regulations. The approaches that have proved effective in many large-scale industrial fisheries from developed countries have relied on the use of complex stock assessment methods to determine catch quotas, and a centralized 'command-and-control' model to implement them. Such approaches cannot be expected to work in small-scale fisheries and/or in regions with limited economic and technical resources, and weak governance systems.

The quest for suitable alternatives has often focused on the limited information typically available in these situations to underpin management decisions. Many new stock assessment methods and harvest control rules based on simple indicators have been shown to work reasonably well in data-limited situations. However, such technical progress has yet to produce positive on-the-ground impacts at scale. This is because data limitations tend to go hand in hand with resource and technical capacity limitations that hamper all three components of the management system. The design of monitoring programs and suitable harvest control rules, even if they are simple, still requires expertise that is often lacking in developing countries. Data sometimes exist but are not standardized and there is limited capacity to analyze them. In addition, factors such as remoteness of landing sites or budget restrictions, that make it difficult to collect data at the appropriate scale, commonly also lead to weak capacity to enforce regulations. Thus, the entire management strategy for monitoring, assessment and harvest regulation needs to be considered within the practical constraints of each fishery. The over-riding compounding problem is often the political difficulty of managing excess access and effort in the face of poverty and few alternatives for sustaining livelihoods.

Integrated frameworks proposed for achieving sustainable small-scale fisheries go beyond the specific assessment and management tools to emphasize the institutional processes leading to management decisions. These frameworks call for the involvement of the fishing communities in all stages of management (data collection and interpretation, decision-making and enforcement) and contemplate a key role for the agents that provide local technical support, who have to be equipped with appropriate tools, and have good analytical and communication skills.

Such participatory assessment and management approaches have resulted in positive outcomes in many places, but no quick fixes exist and the specific tools that have worked are highly context-dependent. Thus, local successes cannot be scaled up simply by replication. Rather, sustained efforts need to be devoted to building local technical capacity to collect, curate and analyze data, and to identify and fine-tune suitable harvest control rules for each fishery. Different organizations have developed tools to aid in such processes, but sustained support from governments and funding agencies will be needed to maintain long-term engagements with local stakeholders and to foster communities of practice that learn from experience across fisheries. Finally, a critical aspect of ensuring sustainable and productive fisheries will be finding suitable alternatives for the excess fishing capacity.

SESSION 2 *– Sustainable fisheries: linking biodiversity conservation and food security*

PANEL 2.1

PLANNING FOR A SUSTAINABLE FUTURE – SUPPORTING THE ADOPTION OF COMPLEMENTARY FOOD SECURITY AND CONSERVATION OBJECTIVES

KEYNOTE: JUGGLING BIODIVERSITY AND FOOD SECURITY – KEEPING ALL THE BALLS IN THE AIR

Elizabeth Fulton, CSIRO Oceans and Atmosphere, University of Tasmania, Australia

Global change, particularly expanding population numbers and increasing footprints on all Earth's ecosystems means that buffers surrounding food provision capacity and biodiversity are both dwindling. Historically, food provisioning and biodiversity conservation have been the focus of different groups, sometimes with conflicting objectives. It is now well appreciated that in aquatic systems they are closely tied and for healthy and sustainable futures neither can be neglected. While ecosystem approaches have been discussed and, in some places, attempted much still needs to be done to operationalise and jointly service both biodiversity and food security. The path is made more challenging by two facts. The first is that there will be no single solution, different ecosystems and different nations (with their own desired biodiversity and food security outcomes) will have different options and solutions available. The second is that we are in a period of transition, new data collection technologies, new analytical methods and new management perspectives are beginning to revolutionise approaches to supporting sustainable fisheries, aquaculture and conservation. This is broadening the options for many systems. However, the technologies are not yet mature – eDNA, close kin population estimates, autonomous (and opportunistic) sampling, and blockchain, for example, are all tangible technologies. Similarly, near-real-time and multi-decadal forecast capacity is beginning to extend from environmental variables more directly into natural resources and fish

communities (still with substantial uncertainties attached). The accelerating capacity of artificial intelligence and machine learning (and associated computational and statistical fields) is only beginning to be realised. The capacity of these technologies and forecast tools to deliver at the scales required is still firming up and has some way to go. Moreover, there are currently different national and regional capacities to leverage these technologies, narrowing the options available in some locations. This is being mitigated to some degree by efforts, happening in parallel, to define and test empirical ecosystem thresholds and indicators of structure and function. Pragmatic and tractable approaches to taking currently available data and shaping up useful ecosystem-based approaches to fisheries management are also beginning to be realised, though the number of implementations is still small. The newness of all of these options means their exact forms and the full list of their associated strengths and weaknesses is not completely clear. However, this is true of all new approaches and should not be used to defer their thoughtful use; indeed they are beginning to see use and the coming years will (a) allow for wider use as costs of implementation drop; (b) rapid learning on their most effective applications; (c) transitions from older approaches to the use of these new tools (as appropriate); and (d) the development of further tools, which leverage off the current expansion of capacity, but also developments in other fields. Altogether this means a sensible approach to navigating between what is possible now and what may be possible in the future must be negotiated if food provisioning and biodiversity conservation are both to be successfully supported in the near, medium and long term. These tools and technologies should not be considered as only being available to developed economies. Just as mobile telephone technology has allowed for communications networks to leapfrog the need for fixed infrastructure, these new technologies and approaches to assessment and management have the potential to deliver straight to these joint objectives. This is important as each nation faces its own task of defining and implementing its own acceptable combination of biodiversity and food security objectives. The key to management in this context will be to continue to retain flexibility – to shape the overall system (the ecosystem and users dependent upon it) in the context of local needs and objectives, as well as the current potential production and stressors upon the system. This will involve recognising the ongoing need for flexibility and diversity of approaches – systems evolve, as do objectives and flexibility to modify plans as needs and tools change will be fundamental to success given current rates of change.

PANEL 2.2

IMPLEMENTING JOINT FOOD SECURITY AND CONSERVATION OBJECTIVES

KEYNOTE: INCENTIVES FOR THE JOINT PROVISION OF BIODIVERSITY AND FOOD FROM THE SEA

Christopher Costello, UC Santa Barbara's Environmental Market Solutions Lab (emLab), United States of America

Biodiversity conservation and food security are two of the most widespread objectives of ocean management, yet concerns are mounting about the ocean's current provision of these ecosystem services and its ability to provide them in the coming years. In this discussion I will provide new insights on the global distribution and overlap of these important ecosystem services, and will use these to illuminate the underlying challenges that have led biodiversity, food security, and often both, to be underprovided by existing institutions. Turning then to the question of what to do about it, I will spell out a number of incentive-based mechanisms – from purely local to global, that can align the interests of fishers, communities, regional governments and even international bodies, with the preservation of biodiversity and food security. Some of the solutions are well established in some locales and could be readily applied

to other places, while others are novel and will require new research and possibly institutional design. For a non-trivial class of cases, I will conclude that biodiversity and food security already go hand-in-hand; for that important class, the focus of implementation should be on bolstering governance and institutions. Importantly, though, these objectives do not always go hand-in-hand, thus necessitating making difficult trade-offs and putting in place a set of incentives to achieve desired outcomes. The challenges of jointly providing biodiversity and food security fundamentally arise from differences in objectives (e.g. one country favors food security, another favors biodiversity), incentives (e.g. insecure tenure may disadvantage both objectives and favour rapid and damaging extraction), timing (e.g. short-term vs. long-term views that are perpetuated by governance problems), and uncertainty (e.g. we may not know which components of biodiversity are crucial for food security). Given these challenges, we cannot rely only on 'centrally planned' solutions that attempt to regulate every margin of ocean use – instead we must focus on implementing mechanisms that establish a set of incentives that will give rise to the joint provision of these goods. Effective mechanisms will align the private incentives of fishers, fishing communities and sovereign countries with the provision of global public goods now and into the future. I will discuss existing mechanisms (such as UN processes and technical transfer of information) and less-employed mechanisms (such as payments for ecosystem services and transferable conservation credits) that may be useful in a global conversation about the joint provision of biodiversity and food security.

SESSION 3 *– Fish in food security and nutrition: from tide to table*

PANEL 3.1

PUTTING FISH ON THE TABLE: EVIDENCE AND OPPORTUNITIES FOR IMPROVED NUTRITION IN LOW RESOURCE SETTINGS

KEYNOTE: TURNING THE TIDE: IMPACTS OF ENVIRONMENTAL CHANGE ON AQUATIC FOOD SECURITY AND NUTRITION

Shakuntala Thilsted, WorldFish, Cambodia

The high levels of many nutrients in fish and other aquatic foods – minerals and vitamins, essential fatty acids and animal protein, with high bioavailability – underpin the necessity of having fish on the plate of diverse, nutritious foods for improving diets. For example, fish is a rich source of vitamin B12, only found in animal-source foods, which is essential for multiple functions, e.g. growth, brain function and nervous system maintenance. Dried small fish powder provides a dense source of multiple essential nutrients for young children who eat small quantities. In addition, fish enhances the uptake of micronutrients from plant-source foods on the plate. Nutrient composition of fish species varies widely, typically with small indigenous species from capture fisheries having much greater concentrations of micronutrients than large species from aquaculture. Many small fish species are eaten whole, thus reducing loss in cleaning and as plate waste. Also, they are cooked with vegetables and spices, thus increasing dietary diversity and nutrient contribution. Using a nutrition-sensitive food systems approach, with multiple entry points for increasing the intake of diverse, nutritious and safe aquatic foods in vulnerable population groups, including pregnant and lactating women and young children – the first 1 000 days of life – will enhance the potential of the fisheries sector to improve diets and nourish nations.

PANEL 3.2

PATHWAYS FOR IMPROVED FISH FOOD SYSTEMS: ENVIRONMENT, POLICY AND TECHNOLOGY

KEYNOTE: TURNING THE TIDE: SUSTAINABLE FISH FOOD SYSTEMS FOR FOOD SECURITY AND NUTRITION

Christopher Golden, Harvard T.H. Chan School of Public Health, United States of America

What is the current role of fish and seafood in providing important micro- and macro-nutrients for populations around the world? How will projected environmental changes, such as rise in sea temperature, affect the contribution of fish to global and regional food and nutrition security? This presentation will focus on answering these questions, as well as look at which populations are expected to be most vulnerable to changes in diet and nutrition associated with potential changes in environment and fish catch. Some have projected a decline in capture fisheries in areas with poor, vulnerable populations dependent on capture fisheries for food and nutrients. Two different intervention pathways for addressing these issues are proposed: 1) environmentally-sensitive fisheries management and marine conservation, and 2) technology improvements in aquaculture to better serve the most nutritionally vulnerable populations. The centrepiece of these efforts is the introduction of an analytic framework for decision-makers to calculate the health and nutrition implications of various marine management strategies, using case studies from Madagascar, Bangladesh, Cambodia and Kiribati as a backdrop for estimating shifts in disease burden associated with decreased access to seafood in the diet.

SESSION 4 – Securing sustainable livelihoods

PANEL 4.1

HOW DO WE SECURE SUSTAINABLE FISHERIES-BASED LIVELIHOODS, INCLUDING THEIR SOCIAL, CULTURAL AND EQUITY DIMENSIONS?

KEYNOTE: SUSTAIN OR TRANSFORM: TOWARDS SECURE AND EQUITABLE LIVELIHOODS IN SMALL-SCALE FISHERIES

Philippa Cohen, WorldFish, Malaysia

In this session, I will discuss the livelihoods of around 100 million women and men in developing countries, and many millions more that benefit from the food and nutrition they provide. Small-scale fisheries livelihoods are depicted in a multitude of – at times starkly contrasting – ways, including the height of economic inefficiency, a poverty trap, a social security safety net, a provider of irreplaceable nutrient-rich food, and a hidden driver of local and national economies. I briefly summarize contexts where each of these narratives hold truth or contention, and discuss where there may be merit from each narrative for helping to navigate towards secure and equitable livelihoods in a changing world.

A range of policy instruments and investment strategies are in play – including the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication – that are intended to create conditions that will enable improvements within and for small-scale fisheries. Using evidence from global to local research, I present new knowledge and innovations 'beyond techno fixes'. First, a recent global analysis illustrates the potential for making substantial gains in addressing malnutrition and livelihood security with a shift in policies towards small-scale fisheries. Second, I share a local initiative that addressed gender inequality in fisheries livelihoods and post-harvest losses using an integrated and participatory approach. These examples bring to action the principles laid out in the Guidelines, and demonstrate the expanding horizons of fisheries research, management and governance.

But what is the relevance of small-scale fisheries livelihoods and these innovations in the face of Blue Growth, 'transformation of the food system', finite fisheries resources, a climate-changed world and the apparent explosion of aquaculture? Amidst these transformations, are such innovations fit to address food and nutrition security, social and gender equity, and broader human well-being outcomes through small-scale fisheries livelihoods? I present a series of recommendations for management and governance to be more transformative in the way we are thinking about and planning for small-scale fisheries livelihoods, and provide a series of challenges for the research community to find a new role as these transformations are navigated.

PANEL 4.2

INNOVATIVE APPROACHES FOR INCLUSIVE FISHERIES GOVERNANCE COALITIONS, CROSS-SECTORAL COLLABORATION AND ENGAGEMENT WITH FISHERS AND FISH WORKERS – WOMEN AND MEN

KEYNOTE: SEA THROUGH THE EYES OF FISHER FOLK

Mitchel Lay, Caribbean Network of Fisher Folk Organisations and Gulf and Caribbean Fisheries Institute, Belize

'Abstract coming - Busy fishing!'

SESSION 5 – *The economics of fisheries*

PANEL 5.1

ECONOMICS IN FISHERIES POLICY

KEYNOTE: FISHERIES MANAGEMENT AT A CROSSROADS: HOW ECONOMICS CAN IMPROVE FISHERIES POLICY DECISIONS

Carl Christian Schmidt, Nordic Marine Think Tank, Norway

While fisheries economics is a several decades old science, it is still the case that in many countries throughout the world economics is disregarded, or, at best, an unknown factor in fisheries management. Meanwhile, some fisheries have incorporated economic instruments, such as market-based fisheries management models, and we have notable success stories to learn from. However, when introducing market-based economic instruments, fisheries policymakers often face perceived trade-offs between efficient fisheries and various social considerations, thus creating a discussion platform for stakeholders to enter to claim their particular understanding of the objectives of fisheries. For the fisheries policymaker this is challenging and has rendered the public policy discourse on the subject difficult. Combined with poor statistics on economic variables this situation has made fisheries management decisions opaque, and consequently fisheries have often been left economically unsustainable. Many fisheries therefore continue to be in poor economic health, fishers are being left in poverty and, equally worrying, society at large has left large amounts of potential economic benefits untouched.

To improve economic efficiency in fisheries management it is central to start by addressing "who owns the fish?". Is it the fishers, the local communities dependent on the fisheries' activities, or do the fisheries' resources belong to society? And more generally, how do we ensure that the fisheries sector at large, from capture to international trade, contributes to our economic welfare?

On the route to more efficient fisheries management several challenges will arise, including do we have sufficient data on the economics of fisheries, how to improve communication within the sector and whether our governance structures are aligned with economic efficiency requirements. These are just a few areas we need to better understand before fisheries economics will be a successful science and can usefully contribute to a more sustainable fisheries economy.

PANEL 5.2

THE SOCIAL DIMENSION OF THE CONTRIBUTION OF FISHERIES AND AQUACULTURE TO THE ECONOMY

KEYNOTE: THE SOCIAL DIMENSION OF THE CONTRIBUTION OF FISHERIES AND AQUACULTURE TO THE ECONOMY

Claudia Beltrán, El Salvador

Human behavior has a high influence on the success or failure of fisheries sustainability. Problems such as overfishing, illegal fishing or insufficient protection of aquatic ecosystems depend fundamentally on human decisions.

Fisheries management requires an interdisciplinary and intersectoral approach to obtain better tools for decision-making processes. This concept is also included in the Ecosystem Approach to Fisheries (EAF). Given that fisheries sustainability face medium- and long-term issues and challenges, its road map should be based on state policies, international rules and guidelines, but with enough flexibility to adapt it and respond to the development plans formulated by each government. In any case, for its proper formulation, interdisciplinary scientific information should be used.

From the social perspective, the generation of employment throughout the entire value chain, under conditions of decent work and gender equity, can be a top goal. For that, it is important to count on accurate and updated statistics, as well as to apply national and international instruments of social responsibility in the fisheries and aquaculture sector. In addition, women's contribution to the value chain is significant, although seldom fully recognized. Women are underrepresented in decision-making processes at governmental and private sector levels, which could mean a significant loss or underuse of women's knowledge and experiences. They have been more active in processing and marketing than in production, administration and direction.

If consumers are aware that the fisheries products they acquire encourage responsible or irresponsible capture practices, and that fisheries sustainability depends on them, they may be more interested in learning about the species, their origin and degree of threat, to put new demands on vendors in favor of sustainable development. In the same way, if merchants are aware that part of their offer does not comply with sustainability rules and buyers' demands, they will be more demanding with their suppliers about sustainability, traceability and quality. The combination of technical training and social work can be more effective than mere intervention from the technical/environmental perspective.

Fisheries sustainability is not just a matter of regulations, monitoring and surveillance, but it is also about fisherfolk's commitment and responsible behavior. Appropriate technical training (about regulations, responsible fishing and climate change), effective dialogue and awareness of fisherfolk and communities regarding their role in achieving fisheries sustainability, could be key to achieving better results in management and co-management strategies.

SESSION 6 – Fisheries management in the face of climate change

PANEL 6.1

INNOVATIVE TECHNICAL ADAPTATIONS OF MANAGEMENT SYSTEMS TO CLIMATE CHANGE

KEYNOTE: MANAGEMENT AND POLICY OPTIONS TO REDUCE RATHER THAN EXACERBATE THE FISHERIES IMPACTS OF CLIMATE CHANGE

Steven Gaines, Bren School of Environmental Science & Management, University of California, Santa Barbara, California, United States of America

Projected climate impacts on fisheries have been widely studied. The looming challenges, however, have received far more attention than the potential solutions. Clearly, the net effects of climate change on global fisheries are negative even under the most optimistic scenarios. The biggest challenge, however, is that many of the negative effects of climate change will likely be enhanced by maladaptive responses of both fishers and the institutions who manage them. We view the future effects of climate change on fisheries falling into three broad categories. First, the productivity of the ocean will change. Some locations will experience enhanced productivity, but declines in productivity from changes in temperature, pH, oxygen concentrations and other physical characteristics will more than offset any benefits. As a result, global productivity is projected to decline, and the magnitude of the declines escalates dramatically with the scope of climate change. Second, in addition to these projected changes in mean productivity, the variability in productivity among years is also projected to grow dramatically. Greater variance in interannual returns creates significant economic and food security challenges. Finally, species are on the move. The moderate projected changes in global productivity mask far more dramatic changes in different places. Some geographies will experience catastrophic declines in fisheries productivity, while others will experience dramatic growth. The geographies of winners and losers is quite predictable with dramatic fisheries losses at low latitudes and dramatic potential fisheries gains at high latitudes.

As challenging as these climate impacts are likely to be, they could each be dramatically exacerbated by maladaptive human responses. Progressive changes in species demographics from climate change can enhance species declines when management adopts policies that assume species are not changing. Second, enhanced interannual variability can have disproportionately negative effects, since the presumption of ecosystem constancy among years ignores the greater impacts of bad years relative to good years. Finally, shifting species distributions to higher latitudes is likely to invoke a wide range of maladaptive human responses. In settings where species are currently well managed otherwise, the prospect of stocks leaving the region reduces all local incentives to continue managing well. In addition, in regions where stocks are entering, the fishery is typically unregulated. Therefore, even the broad range of fisheries that are currently well managed and projected to have high productivity in the future are likely to deteriorate significantly without new innovations.

We address these challenges by asking what management and policy strategies reduce rather than exacerbate these climate impacts. In each of these categories there are significant options that would likely enhance future fisheries in the face of climate change.

PANEL 6.2

INTERVENTIONS TO MINIMIZE IMPACTS AND MAXIMIZE OPPORTUNITIES

KEYNOTE: ADAPTING FISHERIES MANAGEMENT FOR PROACTIVE, CLIMATE-READY DEPENDENT SOCIETIES AND ECONOMIES

Éva Plagányi, CSIRO Oceans & Atmosphere, Australia

Climate change impacts on aquatic resources extend beyond fisher livelihoods through value chains to feed over a billion reliant human consumers. Yet research on adaptation strategies to reduce impacts on fishery-dependent societies or prepare for positive changes has lagged behind biophysical considerations. Although there is a long history of fishers and fishing communities adapting to environmental variability, the pace and scale of climate change means a step change in interventions is needed. There is a growing body of evidence demonstrating the inadequacy of contemporary responses to climate events, but also important lessons for reforms. The equilibrium-based underlying theory and use of static management reference points is failing. Changing baselines, assemblages and increasing variability demand a more dynamic approach to efficiently track the optimum balance between conservation and sustainable utilisation.

Dependent fishers almost universally cite the need to reduce variability as a key objective of fisheries management because of the flow-on impacts on livelihoods, logistics and economies. Adapting to increasing variability will entail responding to changes in catch composition, fishing practices and technologies, and expanding diet preferences and markets. Optimal sustainable utilisation and maximum economic returns will most likely only be possible through collaborative approaches between industry, society, government and non-government sectors that consider changes in assemblages rather than individual stocks and collectively build dynamic value chains that are resilient to climate shocks. Management strategies and governing systems that promote inclusive development are advantageous: fisherwomen can play a positive role in the food supply chain, environmental awareness, enhancing community cohesion plus injecting much-needed conflict resolution skills. Well-resourced nations or stocks with reliable monitoring systems are better placed to proactively adjust management responses or fishing location than less well-resourced nations or data-poor stocks, but the latter group typically has more flexibility to focus on assemblages rather than single stocks, and less rigid market institutions.

Successful future fisheries management will hinge on how well human activities are adaptively aligned with unprecedented changes in the future abundance, distribution and seasonality of fish and fisheries resources. Combining diverse knowledge and value-systems can be used to create possible system trajectories and adaptation options as part of planning processes to prioritise and stage actions and identify opportunities and bottlenecks. The importance of good governance and stakeholder buy-in increases further under a changing climate due to complexities such as non-stationary management rules, the need for precautionary approaches, the need for cooperative management of transboundary stocks, and more complex scientific reasoning underpinning the adjustment of human activities. To build resilience and buy-in, reforms are needed to improve stakeholder engagement or co-management. Examples of good practices include embracing multidisciplinary fisheries management groups, acknowledging indigenous customary knowledge and management practices, developing transparent adaptable harvest strategies in close consultation with stakeholders and strengthening approaches through consideration of principles of equity and inclusiveness. Bottom-up impacts of climate change on aquatic systems will reverberate from local scales through to global, underscoring the urgent need for multi-scale practical interventions to sustain not only wild stocks but also the communities, societies and economies that depend on them.

SESSION 7 – Fisheries information systems and new technologies

PANEL 7.1

THE FUNDAMENTALS – WHAT CENTRAL SET OF ISSUES NEED TO BE ADDRESSED FOR FISHERIES DATA/INFORMATION TO BE A PUBLIC COMMODITY SUPPORTING THE SECTOR'S NEEDS?

KEYNOTE: HOW ICTS CAN ANSWER SOME OF THE BIG DATA QUESTIONS ABOUT SMALL-SCALE FISHERIES

Serge Raemaekers, Abalobi, South Africa.

Worldwide it is recognized that small-scale fisheries, encompassing all activities along the value chain, play a critical role in food security, poverty eradication, equitable development and sustainable resource utilization. These fisheries generally require limited capital investment, use traditional fishing gear and vessels, and catch for subsistence and local markets, but increasingly global markets as well. It is estimated that nearly half of the global catch of marine resources comes from small-scale fishers and yet, unlike industrial fisheries, their economic contribution remains largely invisible and they receive limited government support through dedicated research efforts, data collection, policy development or operational subsidies. As such, most small-scale fisheries are considered to be not well managed and approaches have largely failed to control fishing effort, manage a range of conflicts, account for climate change and socio-economic needs, or to incorporate meaningful co-management structures. Investment in robust and long-term data collection systems can be seen as weak, while at the same time suggested systems are often regarded as cumbersome, not customized sufficiently, with limited capacity to keep these systems running beyond a funding cycle. It is clear that a more collaborative form of governance is required for small-scale fisheries and now, more than ever, there is a need for comprehensive, affordable, scalable, customizable and interoperable Fisheries Information Systems that support decisions in a range of aspects while engaging a multitude of stakeholders, especially small-scale fishers themselves.

Information and Communication Technology for Fisheries (ICT4Fisheries) promotes the use of digital technology in the form of internet-based systems, mobile apps or satellite- and radio-based platforms to address social, ecological and economic challenges within fisheries. From maritime safety to accessing market opportunities, Information Communication Technologies (ICTs) have started to contribute to the improved well-being of fisher communities globally and have the potential to further advance the small-scale fisheries sector in particular. However, as the use of digital technology in fisheries gains traction worldwide, ensuring that ICT4Fisheries are implemented in a participatory, inclusive way that is transformative and contributes towards the implementation of the FAO Guidelines for Securing Sustainable Small-Scale Fisheries is pertinent. This becomes even more relevant in the light of emerging technologies such as artificial intelligence and distributed databases (including blockchain) or blockchain-supported financial transactions. Working in the fisheries digital space, therefore, does demand careful attention to transformative 'touch and tech' methodologies that enable the uptake of technology in small-scale fishing communities.

A deep reflection on the utilization of ICT4Fisheries, the key data elements embedded in these systems, their robustness for stock assessment work, or even supply chain traceability audits and automated digital payments, is needed to enable a timely shared learning experience and extract emerging lessons within a community of practice. A review is presented of recent initiatives in Southern Africa, and how the co-design

of an e-logbook for small-scale fishers has catalyzed a fully traceable marketplace that has, in turn, stimulated community organization, the adoption of satellite AIS trackers, and community-level fisheries benchmarking and improvement projects. Lessons and challenges related to data quality, data ownership and data use in fisheries management are presented and related to the outcome of a recent gathering in Cape Town bringing ICT4Fisheries practitioners together from 15 different countries, working in a myriad of different fisheries.

PANEL 7.2

A VISION FOR THE FUTURE – WHAT TECHNOLOGIES MUST BE SCALED AND ADOPTED, AND WHAT DO EMERGING TECHNOLOGIES NEED TO ADDRESS?

KEYNOTE: BEYOND AUGMENTED INTELLIGENCE (WHILE LEAVING NO ONE BEHIND

Donatella Castelli, CRN-ISTI, Italy.

The talk will provide a broad look on what we can expect from information systems technology based on current trends in ICT and it will speculate on future ones. Implications for human society and insights of how these will accompany and support changes in fishery sustainability will also be discussed.

At the core of the radical change of information systems in the next 5–10 years is certainly the artificial intelligence and big data systems that these systems will embed. This intelligence will be empowered by the availability of a huge amount of heterogeneous data produced in large part by sensing technologies whose variety, distribution and purpose will be growing exponentially, from satellites, buoys, terrestrial and underwater vehicles, to those in the hands of citizens and scientists.

The massive exploitation of these data will be enabled by the radical evolution of processing technologies (e-Infrastructures, edge computing, exascale computing, quantum computing) and communication networks, including mobile networks (e.g. 5G, 6G), that coupled with new software approaches and paradigms, will enable the addressing of problems of a higher order of complexity than we can envision today.

A considerable part of the generated data will be publicly available. Uniform and transparent usage of data across domains, organizations and challenges will become the norm. This process will be facilitated by the convergence by data providers towards common standards and by intelligent IT solutions that will automatically facilitate federation and harmonization when such convergence cannot be easily achieved.

Algorithms, models and, especially, new forms of reasoning based on a variety of approaches (e.g. machine learning and deep learning) resulting from the current large investments in artificial intelligence will empower systems that will be able to learn, inform, predict and decide. Augmented intelligence will span across a large variety of functionalities, from smarter retrieval and access of multimedia information to sophisticated 'what-if' predictions also in contexts where not many data, skills and resources are available, to automatic discovery of phenomena and virtual reality collaboration environments powered by intelligent recommender systems.

Trust and transparency will be mandatory properties in the resulting complex scenario of connected intelligent information systems (supporting decision-makers and taking decisions by themselves). The outcomes of

today's research on FAIR data management, blockchain, traceability and artificial intelligence will provide solutions contributing to these important questions, and the research community cannot do this in isolation.

This new scenario will need clear governance and policy decisions to address ethical questions and avoid the risk of concentrating power in the hands of a few. Aspects like the data chosen for training a deep learning algorithm, the ownership of the knowledge resources empowering the augmented intelligence and the access to data and computational model chosen are key to guarantee that everyone can participate and that no one is left behind.

SESSION 8 *– Policy opportunities for fisheries in the twenty-first century*

BEYOND THE CODE OF CONDUCT: POLICY OPPORTUNITIES FOR FISHERIES MANAGEMENT IN THE TWENTY-FIRST CENTURY

KEYNOTE: NAVIGATING NEW WATERS

Lori Ridgeway, Canada

The context for fisheries policy and management in the future will be very different than in past decades, demanding new and determined conceptual and practical leadership. It will not likely be 'business as usual', including control of the fisheries agenda. For example:

- Within fisheries, the Blue Growth framework expands the context for fisheries and aquaculture, and perhaps even the parameters on which even sustainability itself is measured
- The rising importance of the market and market rules as sustainability tools and arbiters of market access for fish products, and resulting livelihoods
- Integrative global goals (e.g. Sustainable Development Goals), arising from global processes, command attention and accountability
- Biodiversity conservation (terrestrial and marine), with its own global goal setting and assessment processes, has become the all-encompassing umbrella (efforts are underway to establish a legally binding regime for conservation of marine biodiversity of areas beyond national jurisdiction)
- A top priority for developed and less developed states is understanding and dealing with the impacts of climate change.

Contextual changes such as these and others mean the fisheries sector may be far less self-determining of its own fate and future than in the past, unless it becomes a committed and active partner with others at all levels. Many other intergovernmental organizations, panels, agencies and NGOs – and subsequently national governments – are developing plans and taking action to implement their legitimate mandates, which will potentially have impacts on options and ability for fisheries policymakers and managers to set their own agendas and pursue them to successful outcomes from their perspective. There is, for example, an increased risk of conflicting goals, incompatible instruments, data gaps and use of conflicting data and information, and a clash of risk tolerances in cases of inevitable uncertainty.

It goes without saying that this will require coordination, integration and more proactive engagement with others so that fisheries remains in control of its destiny as a viable oceans sector. Are current frameworks, approaches, attitudes and especially governance up to the task? What are key needs for navigating the path forward?

BEYOND THE CODE OF CONDUCT: POLICY OPPORTUNITIES FOR FISHERIES MANAGEMENT IN THE TWENTY-FIRST CENTURY

KEYNOTE: FISHERIES SUSTAINABILITY LEAVING NONE BEHIND: THREE KEY POLICY OPPORTUNITIES FOR THE TWENTY-FIRST CENTURY

John Kurien, Azim Premji University, India

This keynote will delve into three key policy opportunities for the twenty-first century.

Fisheries sustainability into the future cannot be ensured without giving a central role to the people involved in small-scale fisheries. They are too many and their activities are too big to ignore. However, the challenge is to highlight fresh perspectives that will give policymakers new reasons to valorise and support small-scale fisheries.

Today there is wider acceptance of an undeniable climate crisis looming large on land and at sea. However, we need to look beyond the 'scientific facts' of climate change. We must take into serious consideration the 'experiential and concrete lived reality' of fishing communities in dealing with climate events at their respective locales. At the intersection of such collaborative ventures lies a major inclusive policy opportunity for dealing with fisheries sustainability in the context of climate change.

Fish and fisheries are only a small component of the Blue Economy compared to the other realms where debates on futuristic technology, markets and profits prevail over people. However, because of far greater present and future involvement of humans in fisheries, justice and equity perspectives become central concerns. These concerns cannot be exclusively restricted to the rights of humans today. We must also give weight to the welfare of future generations in our present economic and moral decisions.

Pithy advice to policy prescribers and policy implementers, from an Indian sage of yore, provides the end note.

ANNEX C
Further reading

- **Alonso-Población, E. & Siar, S. V.** 2018. *Women's participation and leadership in fisherfolk organizations and collective action in fisheries: a review of evidence on enablers, drivers and barriers.* FAO Fisheries and Aquaculture Circular No. 1159. Rome, FAO. (also available at http://www.fao.org/3/i8480en/I8480EN.pdf).
- **Asche, F., Garlock, T.M., Anderson, J.L., Bush, S.R., Smith, M.D., Anderson, C.M., Chu, J., Garrett, K.A., Lem, A., Lorenzen, K. Oglend, A.Tveteras, S. & Vannuccini, S.**. 2018. Three pillars of sustainability in fisheries. *Proceedings of the National Academy of Sciences* 115, 11221–11225. (also available at https://doi.org/10.1073/pnas.1807677115).
- **Barange, M., Bahri, T., Beveridge, M.C.M., Cochrane, K.L., Funge-Smith, S. & Poulain, F. (eds.).** 2018. *Impacts of climate change on fisheries and aquaculture: synthesis of current knowledge, adaptation and mitigation options.* FAO Fisheries and Aquaculture Technical Paper No. 627. Rome, Italy, FAO. (also available at http://www.fao.org/policy-support/resources/resources-details/en/c/1152846/).
- **Béné, C., Devereux, S. & Roelen, K.** 2015. *Social protection and sustainable natural resource management: initial findings and good practices from small-scale fisheries.* FAO Fisheries and Aquaculture Circular No. 1106. Rome, FAO. (also available at http://www.fao.org/3/a-i4620e.pdf).
- **CFS**. 2012. *Voluntary guidelines on the responsible governance of tenure of land, fisheries and forests in the context of national food security.* Rome, FAO. (also available at http://www.fao.org/3/i2801e/i2801e.pdf).
- **CFS**. 2014. *The RAI Principles.* Rome, Italy. FAO. (also available at http://www.fao.org/3/a-au866e.pdf).
- **Cochrane, K., De Young, C., Soto, D., and Bahri, T. (eds).** 2009. *Climate change implications for fisheries and aquaculture: overview of current scientific knowledge.* FAO Fisheries and Aquaculture Technical Paper. No. 530. Rome, Italy, FAO. (also available at http://www.fao.org/fileadmin/user_upload/newsroom/docs/FTP530.pdf).
- **FAO**. 1995. *Code of Conduct for Responsible Fisheries*. Rome, Italy, FAO. (also available at http://www.fao.org/documents/card/en/c/e6cf549d-589a-5281-ac13-766603db9c03/).
- **FAO**. 1995. *Precautionary approach to fishery management and species introductions*. FAO Technical Guidelines for Responsible Fisheries. No. 2. Rome, Italy, FAO. (also available at http://www.fao.org/3/a-w3592e.pdf).
- **FAO**. 1999. *International Plan of Action for Conservation and Management of Sharks*. Rome, FAO. (also available at http://www.fao.org/ipoa-sharks/en/).
- **FAO**. 1999. *Indicators for sustainable development of marine capture fisheries*. FAO Technical Guidelines for Responsible Fisheries. No. 8. Rome, FAO. (also available at http://www.fao.org/in-action/globefish/publications/details-publication/en/c/344016/).
- **FAO**. 2005. *Voluntary guidelines to support the progressive realization of the right to adequate food in the context of national food security.* Rome, Italy, FAO. (also available at http://www.fao.org/3/a-y7937e.pdf).
- **FAO**. 2009. *International guidelines for the management of deep-sea fisheries in the high seas.* Rome, Italy, FAO. (also available at http://www.fao.org/in-action/globefish/publications/details-publication/en/c/346096/).
- **FAO**. 2010. *Ecosystem approach to aquaculture.* FAO Technical Guidelines for Responsible Fisheries. No. 5, Suppl. 4. Rome, FAO. (also available at http://www.fao.org/3/i1750e/i1750e00.htm).

ANNEX C

- **FAO**. 2010. *Marine protected areas and fisheries*. FAO Technical Guidelines for Responsible Fisheries. No. 4, Suppl. 4. Rome, FAO. (also available at http://www.fao.org/3/i2090e/i2090e.pdf).
- **FAO**. 2011. *International Guidelines on Bycatch Management and Reduction of Discards*. Rome, Italy, FAO. (also available at http://www.fao.org/3/a-ba0022t.pdf).
- **FAO**. 2015. *Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication* (SSF Guidelines). Rome, FAO. (also available at http://www.fao.org/3/a-i4356en.pdf).
- **FAO**. 2015. *Assessing climate change vulnerability in fisheries and aquaculture: Available methodologies and their relevance for the sector*, by Cecile Brugère and Cassandra De Young. FAO Fisheries and Aquaculture Technical Paper No. 597. Rome, FAO. (also available at http://www.fao.org/3/a-i5109e.pdf).
- **FAO**. 2016. *Strengthening sector policies for better food security and nutrition results*. Fisheries and aquaculture policy note. Rome, FAO. (also available at http://www.fao.org/policy-support/resources/resources-details/en/c/885757/).
- **FAO**. 2016. *Scoping study on decent work and employment in fisheries and aquaculture*. Rome, FAO. (also available at http://www.fao.org/3/a-i5980e.pdf).
- **FAO**. 2016. *Fisheries in the drylands of sub-Saharan Africa – "Fish come with the rains". Building resilience for fisheries-dependent livelihoods to enhance food security and nutrition in the drylands*, by Jeppe Kolding, Paul van Zwieten, Felix Marttin and Florence Poulain. FAO Fisheries and Aquaculture Circular No. 1118. Rome, Italy. (also available at http://www.fao.org/3/a-i5616e.pdf).
- **FAO**. 2017. *Nutrition-Sensitive Agriculture and Food Systems. Toolkit and e-learning module for policy and programme planners*. Rome, FAO. (also available at www.fao.org/nutrition/policies-programmes/toolkit/en/).
- **FAO**. 2017. Towards gender-equitable small-scale fisheries governance and development – A handbook. In support of the implementation of the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication, by Nilanjana Biswas. Rome, FAO. (also available at http://www.fao.org/3/a-i7419e.pdf).
- **FAO**. 2018. *Deep-ocean climate change impacts on habitat, fish and fisheries*, by Levin, L., Baker, M., and Thompson A. (eds). FAO Fisheries and Aquaculture Technical Paper No. 638. Rome, FAO. (also available at http://www.fao.org/3/ca2528en/ca2528en.pdf).
- **FAO**. 2018. *The State of World Fisheries and Aquaculture 2018 – Meeting the sustainable development goals.* Rome, FAO. (also available at http://www.fao.org/documents/card/en/c/I9540EN/).
- **FAO**. 2019. *The State of the World's Aquatic Genetic Resources for Food and Agriculture*. FAO Commission on Genetic Resources for Food and Agriculture assessments. Rome, FAO. (also available at http://www.fao.org/3/CA5256EN/CA5256EN.pdf)
- **FAO**. 2019. *Report of the Sixth FAO Expert Advisory Panel for the Assessment of Proposals to Amend Appendices I and II of CITES Concerning Commercially Exploited Aquatic Species, Rome, 21–25 January 2019.* FAO Fisheries and Aquaculture Report No. 1255. Rome, FAO. (also available at http://www.fao.org/3/ca3576en/CA3576EN.pdf).
- **FAO**. 2019. *Vulnerable marine ecosystems database*. iMarine MPA information system 2014, 2017. (also available at http://www.fao.org/in-action/vulnerable-marine-ecosystems/about-vme-database/en/).
- **FAO**. 2019. *Voluntary Guidelines on the Marking of Fishing Gear. Directives volontaires sur le marquage des engins de pêche. Directrices voluntarias sobre el marcado de las artes de pesca*. Rome/Roma. (also available at http://www.fao.org/3/ca3546t/ca3546t.pdf).

- **FAO**. 2019. *Securing sustainable small-scale fisheries: sharing good practices from around the world,* by Westlund, L. and Zelasney, J. (eds.) FAO Fisheries and Aquaculture Technical Paper No. 644. Rome, FAO. (also available at http://www.fao.org/3/CA3041EN/ca3041en.pdf).
- **FAO**. 2019. *GLOBEFISH Highlights; A quarterly update on world seafood markets*. (also available at http://www.fao.org/3/ca4185en/ca4185en.pdf).
- **FAO**. 2019. *FAO yearbook. Fishery and Aquaculture Statistics 2017/FAO annuaire. Statistiques des pêches et de l'aquaculture 2017/FAO anuario. Estadísticas de pesca y acuicultura 2017*. Rome/Roma. (also available at http://www.fao.org/3/ca5495t/CA5495T.pdf).
- **FAO and IFAD**. 2019. *United Nations Decade of Family Farming 2019-2028. Global Action Plan.* Rome. (also available at http://www.fao.org/3/ca4672en/ca4672en.pdf).
- **Friedman, K., Garcia, S. & Rice, J.** 2018. Mainstreaming biodiversity in fisheries. *Marine Policy.* (also available at https://doi.org/10.1016/j.marpol.2018.03.001).
- **Funge-Smith, S.** 2018. *Review of the state of world fishery resources: inland fisheries.* FAO Fisheries and Aquaculture Circular No. C942 Rev.3. Rome. (also available at http://www.fao.org/inland-fisheries/resources/detail/en/c/1145511/).
- **Garcia, S.M., Zerbi, A., Aliaume, C., Do Chi, T. & Lasserre, G.** 2003. *The ecosystem approach to fisheries. Issues, terminology, principles, institutional foundations, implementation and outlook.* FAO Fisheries Technical Paper. No. 443. Rome, Italy. FAO. (also available at http://www.fao.org/3/a-y4773e.pdf).
- **HLPE.** 2017. *Nutrition and food systems. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security.* Rome. FAO. (also available at http://www.fao.org/fileadmin/user_upload/hlpe/hlpe_documents/HLPE_Reports/HLPE-Report-12_EN.pdf).
- **Kitolelei, J., Einarsson, S., Lord, H.J. & Ogawa, T. (eds.).** (Forthcoming). *Proceedings of tenure and user rights in fisheries 2018. Achieving sustainable development goals by 2030, Yeosu, Republic of Korea, 10–14 September 2018.* FAO Fisheries and Aquaculture Proceedings No. 64. Rome, FAO.
- **Kolding, J., van Zwieten, P., Marttin, F., Funge-Smith, S., and Poulain, F.** 2019. *Freshwater small pelagic fish and fisheries in major African lakes and reservoirs in relation to food security and nutrition.* FAO Fisheries and Aquaculture Technical Paper No. 642. Rome, Italy. FAO. (also available at http://www.fao.org/3/ca0843en/ca0843en.pdf).
- **OECD/FAO**. 2019. *OECD-FAO Agricultural Outlook 2019-2028*. OECD Publishing, Paris/Food and Agriculture Organization of the United Nations, Rome, Italy. (also available at https://doi.org/10.1787/agr_outlook-2019-en).
- **Tveterås, S., Asche, F., Bellemare, M.F., Smith, M.D., Guttormsen, A.G., Lem, A., Lien, K. & Vannuccini, S.** 2012. Fish is food – The FAO's Fish Price Index. *PLoS ONE* 7(5): e36731. (also available at https://doi.org/10.1371/journal.pone.0036731).
- **UN**. 1995. *United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks.* (also available at https://www.un.org/depts/los/convention_agreements/convention_overview_fish_stocks.htm).

ANNEX D
Local Organizing Committee

THE FOLLOWING SPECIALISTS FROM FAO HAVE CONTRIBUTED TO THE EXECUTION OF THE SYMPOSIUM:

Name	Position at FAO
Vera Agostini	Chair Local Organizing Committee. Deputy Director, FAO Fisheries and Aquaculture Policy and Resources Division
Claudia Aguado Castillo	Office Assistant, FAO Fisheries and Aquaculture Policy and Resources Division
Molly Ahern	Nutrition Specialist, Products, Trade and Marketing Branch, FAO Fisheries and Aquaculture Policy and Resources Division
Manuel Barange	FAO Symposium Convenor. Director, FAO Fisheries and Aquaculture Policy and Resources Division
Pilar Bravo de Rueda	Office Associate, FAO Fisheries and Aquaculture Policy and Resources Division
Giuliano Carrara	Fishery Officer, Fishing Operations and Technology Branch, FAO Fisheries and Aquaculture Policy and Resources Division
Silvio Alejandro Catalano	Information and Communication Specialist, FISHCODE Programme, FAO Fisheries and Aquaculture Policy and Resources Division
Diana Fernandez de la Reguera	Project Management and Climate Change Specialist, FAO Fisheries and Aquaculture Policy and Resources Division
Nicole Franz	Fishery Planning Analyst, Policy Economics and Institutions Branch, FAO Fisheries and Aquaculture Policy and Resources Division
Nicolas Gutierrez	Fishery Resources Officer, Marine and Inland Fisheries Branch, FAO Fisheries and Aquaculture Policy and Resources Division
Gaelle Hermanus	Secretary, Policy, Economics and Institutions Branch, FAO Fisheries and Aquaculture Policy and Resources Division
Amber Himes-Cornell	Fishery Officer, Policy, Economics and Institutions Branch, FAO Fisheries and Aquaculture Policy and Resources Division

Name	Position at FAO
Daniela Kalikoski	Fishery Industry Officer, Rural Poverty Reduction Programme Management Team (SP3), Partnerships and South-South Cooperation Division
Blaise Kuemlangan	Chief, FAO Legal Office
Audun Lem	Deputy Director, FAO Fisheries and Aquaculture Policy and Resources Division
Luca Limongelli	Information Expert, Statistics and Information Branch, FAO Fisheries and Aquaculture Policy and Resources Division
Rebecca Metzner	Branch Head, Policy, Economics and Institutions Branch, FAO Fisheries and Aquaculture Policy and Resources Division
Roxane Misk	Gender Specialist, Statistics and Information Branch, FAO Fisheries and Aquaculture Policy and Resources Division
Omar Penarubia	Fishery Officer, Products, Trade and Marketing Branch, FAO Fisheries and Aquaculture Policy and Resources Division
John Ryder	Branch Chief, Products, Trade and Marketing Branch, FAO Fisheries and Aquaculture Policy and Resources Division
Stefania Savore	Fishery Information Officer, Statistics and Information Branch, FAO Fisheries and Aquaculture Policy and Resources Division
Ben Siegelman	Small-Scale Fisheries Consultant, Policy Economics and Institutions Branch, FAO Fisheries and Aquaculture Policy and Resources Division
Kimberly Sullivan	Communication Officer, FAO Office for Corporate Communication
Marc Taconet	Branch Head, Statistics and Information Branch, FAO Fisheries and Aquaculture Policy and Resources Division
Sandra Tardioli	Office Associate, FAO Fisheries and Aquaculture Policy and Resources Division
Rumiana Uzunova	Meetings Officer, Policy, Economics and Institutions Branch, FAO Fisheries and Aquaculture Policy and Resources Division
Jiaxi Wang	Fishery Officer, Policy, Economics and Institutions Branch, FAO Fisheries and Aquaculture Policy and Resources Division
Weiwei Wang	Fishery Officer, Products, Trade and Marketing Branch, FAO Fisheries and Aquaculture Policy and Resources Division
Yimin Ye	Branch Head, Marine and Inland Fisheries Branch, FAO Fisheries and Aquaculture Policy and Resources Division

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