Stefán Jón Hafstein

Aquaculture: the global picture and the future of blue foods

Special Envoy on Ocean Affairs for the Ministry for Foreign Affairs in Iceland, and the Chair of the Aquatic Blue Food Coalition gives a global perspective on the promise and challenge of aquatic and blue food from the Ocean. While capture fisheries have mostly peaked in volume of food, aquaculture has enormous growth potential. Not the least in developing countries and most importantly Africa. However, the context of global warming, loss of biodiversity and the need to transform food systems for a growing population will pose a challenge. In his brief Special Envoy Hafstein accounts for both promises and constraints, and sets the tone for a new way of doing business. Considering the value of nature capital, the need for ecosystems approach for regenerative aquaculture and using the method of True Cost Accounting for food from the Ocean. With concrete examples he shows that the Ocean can contribute to nature positive investment in human development.

Kevin Fitzsimmons

Keeping the ocean as a source of sustainable food: Replacing wild-catch in aquaculture feeds with more sustainable ingredients

Fishmeal (FM) and fish oil (FO) have historically been the ingredients of choice to provide key nutrients in aquaculture feeds. However, many forage fish stocks are declining and disrupting ocean ecosystems. The potential for more of these forage fish populations collapsing would be devastating for marine ecosystems and the aquaculture industry. While these FM and FO represent efficient nutritional packages, the uncertain future of forage fish stocks means that feed formulators need more options in their formulations to adapt to supply chain disruptions and ensure global food security. To address the growing concern about the availability of FMFO in the future, Future of Fish Feed (F3) was formed as a collaborative effort between NGOs, researchers, and private partnerships to accelerate the commercialization of innovative, substitute aquaculture feed ingredients to replace wild-caught forage fishes.

F3 focuses on three areas:

- F3 Challenge, a series of industry contests to develop and sell fish-free feeds and fish oil replacements within the aquaculture sector.
- F3 meetings and webinars to facilitate networking and collaboration between ingredient suppliers, feed companies, farmers, and investors.
- Feed Innovation Network (FIN) to support the innovation and widespread adoption of fish-free feed ingredients by providing experimental protocols, open formulas, and connections to testing facilities and ingredient providers.

Through these major areas of focus, the F3 team has brought together the aquafeed industry to address the challenges facing the sector and provide opportunities for alternative ingredient providers and fish farmers to connect. Industry feedback on the technical difficulty of developing fish oil substitutes and replacing FMFO in carnivorous fish diets led to the F3 Fish Oil and

Carnivore Challenges. F3 meetings brought together emerging alternative ingredient suppliers, investors, and some of the world's largest feed manufacturers to spark new ideas to facilitate FMFO replacement among members of the aquaculture industry. The Feed Innovation Network was launched in response to requests for a repository of alternative ingredient information and experimental designs to harmonize feed trials. F3 feed research trials continue to address knowledge gaps in fish-free ingredient research. Since marine fishes and shrimps claim a disproportionately high value in the seafood market and include some of the biggest users of FMFO, these species are priorities for F3 research.

F3 continues to evolve as the needs of the aquafeed sector change and new opportunities for alternative ingredients arise. New ingredients are coming online every day, but the race to replace fishmeal and fish oil will only advance through collaboration across the seafood industry. The responsiveness of industry will be a key factor in its ability to feed the growing population and protect the world's oceans.

Jose Luis Chicoma

Fish for Food: Overcoming Political and Power Challenges

Anchoveta is symbolic of a country rich in resources but failing to utilize its wealth to properly feed its population. Peru is a nation very proud of its food. Surveys from a few years ago indicated that the two biggest sources of pride for Peruvians were their cuisine and biodiversity. Despite being a country with two of the world's most important centers of origin and biodiversity—the Andes and the Amazon—as well as one of the most productive seas on the planet, we have failed to ensure that this wealth nourishes the most vulnerable. Approximately half of the population suffers from some degree of food insecurity, and one-fifth of the population cannot afford a healthy diet.

To understand these "food paradoxes" we need to identify and confront power asymmetries. These have been **considered in the blue food literature.** The Blue Food Assessment, published in 2021, along with other papers by colleagues participating in these days, includes a review of the political obstacles and governance barriers in food systems, which often result in overlooking blue foods despite their great potential in terms of nutrition, sustainability, and social inclusion.

Peru and Chile became fundamental places for global food systems since the late 1950s. Anchoveta commodities that both countries produced were crucial for enabling large-scale industrial production of poultry, hogs, and farmed fish.

This great economic power for the industry came hand in hand with political power of the industrial fishing industry and the priority that it has received from decision-makers. On the other hand, **small-scale artisanal fishing has not received the same priority**, despite producing two out of three fish that feed the country, and being a way bigger source of employment. Prioritizing the industrial sector has definitely detracted from small-scale fisheries due to the state's limited bandwidth to address all development issues.

In this presentation, taking the case of Peru, we will explain how power asymmetries have prevented the implementation of a vision for blue food transformation, that considers that the ocean is a source of food for domestic markets, than a commodity for exports. We will propose solutions to address this power imbalances with a systemic vision on the potential of blue food to improve nutrition, sustainability and social inclusion.

Maren Headley

The ocean as a source of sustainable food and its contribution to sustainable development in the Caribbean

The ocean covers 71% of the Earth's surface and is one of our most valuable natural resources. Its estimated worth is at least $24 trillion (WWF) and it absorbs 90 % of heat from global warming, sequesters 25-30 % of CO_2 released, and produces over 50 percent of the oxygen that we breathe. An estimated 50-80% of all life on earth is found in the ocean, however less than 10% of ocean space has been explored. There are 236,878 named marine species - but possibly as many as 25 million (World Register of Marine Species –Jan 2021). There are a wide variety of living marine resources that can be used, and which include mammals, fish, reptiles, crustaceans, molluscs, marine plants, algae, and plankton. There are also non-living resources including hydro-carbons, minerals including polymetallic nodules, polymetallic sulphides, and cobalt-rich ferromanganese crusts. For SIDS, the Ocean and its resources is perhaps the single most valuable natural asset that we have for food, nutrition, economic development and prosperity.

The Caribbean Regional Fisheries Mechanism (CRFM) is a specialized CARICOM Institution which was established in 2002 by CARICOM Heads of States to promote sustainable use of the living marine and other aquatic resources by the development, efficient management, and conservation of such resources. The goal of the Caribbean Community Common Fisheries Policy is to establish, within the context of the Revised Treaty of Chaguaramas, appropriate measures for: the conservation, management, sustainable utilisation and development of fisheries resources and related ecosystems; the building of capacity amongst fishers and the optimisation of the social and economic returns from their fisheries; and the promotion of competitive trade and stable market conditions. There are currently four associated protocols with the Policy: which cover: 1.) Securing Sustainable Small-Scale Fisheries for Caribbean Community Fisherfolk and Societies; 2.) Climate Change Adaptation and Disaster Risk Management in Fisheries and Aquaculture; 3.) Aquatic Food as a Strategic Resource for Food and Nutrition Security; and 4.) Sustainable Use of Marine Living Resources for Blue Economic Growth and Sustainable Development.

Our work is also guided by four Strategic Goals, which are respectively linked to environmental resilience, economic resilience, social resilience, and climate resilience. These goals are:

- **Strategic Goal 1** Sustainable use and management of fisheries and aquaculture resources in the Caribbean region

- **Strategic Goal 2** Improvement of the welfare and sustainable livelihoods of fishing communities in Member States
- **Strategic Goal 3** Contribution to the provision of sufficient, safe, and nutritious seafood that meets the dietary requirements for an active and healthy life of Member State's populations
- **Strategic Goal 4** Promote development of a regional fishery sector that is resilient to climate change, ocean acidification, natural disasters and external shocks and enhanced through comprehensive disaster risk management and recovery arrangements

Fisheries is important to SIDs in numerous ways including:

- Food Security nutrition
- High Per capita consumption
- Trade & foreign exchange earning
- Employment & Livelihood
- Culture
- Recreational fisheries
- Social stability of coastal communities

CRFM Members are characterized by extensive EEZ'z and coastlines with The Bahamas having the largest.

The marine capture fisheries production in region for 2022 was 149,000 t live weight with a value of USD 527 million ex-vessel price. Exported fisheries products from the region accounted for 55, 000 t and a value of USD 305 million. The products included finfish, shrimp, lobster and conch. The main export markets were USA, Jamaica, France, Canada and Netherlands. There are approximately 130, 000 fishers employed through the region with women accounting for 8% of this total.

Caribbean SIDs are dependent on the ocean for food security and nutrition as well as a source of livelihoods. The development of a sustainable ocean economy is key to SIDS prosperity. Sustainable use of resources by balancing development and conservation will ensure long-term availability and benefits. Protection of critical habitats and ecosystems is also essential for food security and prosperity .

Finally, healthy ecosystems such as coral reefs, mangroves, and seagrass beds also provide critical protection against storm surges, wind and sea-level ris, and contribute to a resilient future for Caribbean SIDS.

Gina Rico Mendez

Feed the Future Innovation Lab for Fish: Translating Knowledge into Impact for Sustainable Aquatic Foods

Fish and other aquatic foods are an important source of protein and are macro- and micronutrient-rich, accounting for 17% of global animal protein consumption (FAO, 2022), and are among the most traded agricultural commodities worldwide. Since 2018, the Feed the Future Innovation Lab for Fish (Fish Innovation Lab), managed by Mississippi State University's Global Center for Aquatic Health and Food Security (GCAHFS), has implemented a collaborative research-for-development program. The program aims to improve nutrition, food security, and livelihoods by supporting the development and scaling of innovations in aquaculture and fishery systems in Africa and Asia. This presentation discusses critical challenges and key opportunities within the aquatic food system and how research can foster development and scaling of innovations. Examples from the Fish Innovation Lab illustrate how collaborative research identifies, develops, and scales promising innovations to enhance local fish farming systems. These strategies aim to sustainably intensify, improve management and diversify major production systems in areas of high concentrations of poverty and vulnerability. This presentation explores how to sustainably (economically, socially and environmentally) increase production and consumption of aquatic foods.

Claire Colegrove

Mapping the Future: The Role of ProtectedSeas Navigator in Global Ocean Sustainability

In this panel, we will showcase the capabilities of the ProtectedSeas Navigator, an innovative tool that provides comprehensive regulatory information for over 22,000 managed marine and coastal areas globally, including the high seas. The discussion will highlight how this interactive map enables users to quickly understand legal protections in ocean areas and compare them on a global scale, aiding in informed decision-making for ocean conservation and management.

The presentation will examine how Navigator supports the three pillars of sustainable development by facilitating environmental sustainability through improved governance of marine areas, bolstering economic stability by aiding sustainable fisheries and enhancing tourism, and promoting social equity by ensuring community involvement and equitable resource access. We will discuss how using Navigator to guide marine spatial planning allows for optimized resource use while protecting ecosystems, supporting sustainable fisheries, and promoting fair access to ocean food resources. The panel will discuss the critical challenges that marine ecosystems face, such as pollution, overfishing, and climate-related impacts, and demonstrate how Navigator provides essential data to help stakeholders manage these challenges.

Marian Kjellevold

Harnessing Aquatic Foods for Global Nutrition: Bridging Knowledge Gaps and Policy Perspectives

In order to make aquatic food visible as a nutrient dense food to be considered in knowledge-based policies, we need reliable and up-to-date food composition data (FCD) on aquatic foods. FCD forms the foundation for calculating human nutrient intake and informing nutrition declarations on food products. These data are essential for dietary advice, research on intake and health outcomes, and the formulation of nutrition and health policies. Inadequate data can lead to incorrect assessments and food policies. Presently, there is a lack of high-quality data on aquatic foods, especially in many African and Asian countries. This may be one reason why food fortification of cereal foods and supplementation of single nutrients are more common strategies to fight malnutrition than recommending aquatic foods as a part of a balanced diet.

The EAF-Nansen Programme, in collaboration with 32 countries in Africa and the Bay of Bengal, aims to improve fisheries management using the ecosystem approach to fisheries (EAF). This FAO-executed program, funded by Norad and aligned with the UN Decade of Ocean Science for Sustainable Development, has been assessing and managing fisheries sustainably for nearaly 50 years. Nutrition and food safety, included since 2017, will play a more prominent role in the current phase. The EAF Nansen Programme has generated a comprehensive data set on nutrient composition and contaminants across over 100 distinct fish species. Our analyses include more than 500 samples, comprising whole fish, dressed (whole fish without head, tail and viscera) and fillet with skin, providing a broader scope compared to databases that focus on fillet data. The results underscore that fish as an nutrient-dense food resource and these data contribute to a knowledge base which can be used in public documents, e.g national or regional food composition databases and food based dietary guidelines (FBDG).

FBDG aim to establish foundations for public food, nutrition, health, and food policies and education programs, promoting healthy eating habits and lifestyles. These guidelines offer advice on foods, food groups, and dietary patterns to ensure nutrient adequacy, overall health, and chronic disease prevention. In Norway, new food-based dietary guidelines are being developed. The current draft highlight seafood primarily as a protein source, overlooking its role as a rich source of vitamins and minerals such as vitamin D, iodine, and omega-3 fatty acids.

Food systems encompass all actors and interactions along the food value chain. A food systems approach considers this entire network, acknowledging all elements, their interrelationships, and effects. This approach surpasses single sectors like agriculture or fisheries, though terms such as "agriculture," "fisheries," "farmer," or "fisherfolk" are often used instead of more inclusive terms like "food production" and "food producer." Notably, aquatic foods are not explicitly mentioned in Sustainable development goal 2 (Zero hunger) or goal 14 (Life below water) as food providers.

To enhance food systems and nutrition, it is crucial to continue producing high-quality food composition data on aquatic foods and integrate this information into national and regional databases. Highlighting the nutrient density and health benefits of aquatic foods in dietary guidelines ensures they are recognized as valuable food sources. Additionally, adopting inclusive terminology like "food production" over "agriculture" or "fisheries" supports a holistic view of food systems.

Hettie C Schönfeldt

Exploring the nutrient composition of different types of blue foods and their significance in delivering essential nutrients

As the earth’s population increased, so has the challenge of delivering safe, healthy, acceptable, affordable and sustainable food. Aquatic food systems have enormous potential as a lever for transformation toward a more sustainable and equitable global food system.

Various factors influence the impact of foods on health. An essential consideration is the nutrient content and quality. Frequently consumed foods with low nutritional density, such as those lacking in protein, minerals or vitamins; and high energy density, such as those high in sugar, saturated fat or sodium, can disrupt the dietary balance. However, as energy, macro-and micronutrients of foods are highly variable, the nutritional intake of individuals can only be estimated using reliable data on country-specific food composition data.

There is a need for a multidisciplinary ethos to expand food systems research to address the triple burden of disease manifested in micronutrient deficiencies, malnutrition and obesity. Ideally, this should be informed by food composition data as the starting point, combined with nutrient and dietary quality studies focusing on bioavailability and biodiversity, as well as consumer-level and supply-chain research. For optimum health and well-being, the world’s population need to consume the appropriate nutrients in adequate amounts through dietary intake and hydration.

Julio Cordano

The Ocean and Climate Dialogue under the UNFCCC: recommendations to enhance climate policies in fisheries and food security

The Ocean-Climate Dialogue created by COP25 has become the main space in the UNFCCC process to discuss the role of the ocean in the overall climate multilateral process. The presentation provides information on how the ocean is included in the Convention as well as in the Paris Agreement, as well as a general descripction of the dialogues organized in 2023 and 2024. In the case of 2023, the dialogue included, as one of its topics, "fisheries and food security". The presentation then summarizes the main outcomes and recommendations on this topic, included in the report presented at COP28.

Philipp Hess

Harmful Algal Blooms - biological and chemical diversity in a changing climate and emerging risks for food safety and security

Abstract: Microalgae are unicellular, photosynthetic micro-organisms producing 50% of the earth's oxygen and nourishing marine trophic food webs providing seafood and other ecosystem services. Of the more than 4000 species known, less than 200 cause seafood safety or security problems and are therefore referred to as Harmful Algal Blooms (HABs). Some species produce toxins leading to seafood poisoning when accumulated in fish and shellfish or causing illness through direct contact to users of the marine and coastal ecosystems. Some proliferations also provoke anoxic conditions while others are directly toxic to fish and shellfish leading to reduced food security. This presentation gives examples of different existing and emerging risks caused by such HABs and how the impacts of these are worsened by climate and global change. International regulations, research and initiatives to reduce the impact are described, with special emphasis given to the UN Ocean Decade Action HAB-Solutions, an initiative calling for break-through science-based solutions co-developed by scientists and other societal stakeholders.

Amund Maage

Building resilient aquatic food systems through seafood safety and sustainable practices

Norway has been a fish exporting country for more than a thousand years based on the rich fisheries in the North Eastern Atlantic Ocean. This talk will start by presenting the work on building a data base on seafood safety that comply with the needs of consumers world-wide and satisfies food safety authorities especially in importing countries. The needs for this came along with the increasing awareness of pollution with toxic substances increasing from the 1970-ties onwards.

The systematic work started in the 1990-ties focusing major species with large export volumes such as cod, saithe, herring and mackerel. However also species that was shown to accumulate undesirables more than other species soon came into focus, such as tusk and Greenland halibut. Further, with increasing volumes of farmed fish based on formulated feed both feed and the farmed fish also came into focus. The contaminants measured was mainly those that had already established upper limits for food trade and tolerable intake levels, and those that we anticipated such limits to be developed. This included heavy metals (Hg, Cd) and increasing number of POPs such as PCBs, dioxins, brominated and fluorinated compounds, and certain pesticides.

After the food scandal that emerged because of dioxin contaminated feed in EU, this work was stepped up with large volume surveillance studies on fish feed, and both wild and farmed fish. Also, it became important to include analysis of the essential nutrients, especially those where seafood could make a significant contribution to a healthy nutrition such as omega-3 fatty acids, iodine, selenium and several vitamins.

By this we have made a large database for evaluation of seafood safety and the role of seafood in health and nutrition security (https://sjomatdata.hi.no/#search).

The next step for this work is to add sustainability indicators for consumers and governments to be able to guide on the sustainable further development of both fisheries on wild stocks and in fish farming. However, the indicators will be quite different for these two sources of seafood.

For wild fish the sustainable management of the targeted stocks are obvious, but also avoidance of bycatch and prohibiting ecological damage. Further carbon footprint must be recorded in different fisheries. For aquaculture, feed as a major contributor to carbon footprint and ecological damage as well as fish welfare, potential spreading of disease and parasites. But indicators could also include overreaching management strategies including marine protection where goals have been set in the SDG 14.

Sebastian Mathew

Small-scale Fisheries as a Source of Sustainable Seafood: Opportunities and Challenges

Aquatic foods contribute half or more of total animal protein intake and micronutrients in many developing countries and a substantial share of these affordable, cheaper and more accessible foods, originates from small-scale fisheries (SSF). In the process, the SSF subsector supports the livelihoods of nearly half a billion people, and contributes to 90% of capture fisheries employment.

In addition, there is significant participation of women as fishers and fishworkers in SSF along the value chain, especially in post-harvest and subsistence fishing activities. It has been estimated that the SSF subsector could provide nearly a billion women, worldwide, with 50% of the recommended nutrient intake of omega 3 fatty acids and can provide growth-promoting nutrients such as bioavailable zone, iron and protein to children in remote and impoverished parts of the world.

It has been argued that low impact marine small-scale fishing methods produce lower rates of bycatch, cause minimal structural damage to marine habitats and use less fuel due to their fishing activities being undertaken closer to shore, thus making the contribution of SSF to food security rather unique. To maintain small-scale fisheries as a sustainable source of seafood there is, however, a greater need for improving overall fisheries management, addressing climate change impacts, addressing the effects of the blue economy on coastal fishing communities and moving towards collaborative governance.

Towards fully realizing the potential of SSF subsector and maintaining it as a source of nutrition and food security, the SSF contribution in this regard has to be properly mainstreamed into aquatic food systems. Secondly, fisheries management approaches need to integrate elements such as equity, traditional and ecological knowledge of Indigenous Peoples, marine and coastal fishing communities, tenure rights of fishers and fishworkers and sea safety, along with sustainability. Thirdly, greater attention is to be paid to disaster preparedness, marine spatial

planning, early warning systems, social protection and social development. Fourthly, considering the complexity of issues facing aquatic biodiversity and dependent communities for their lives and livelihoods, cross-sectoral, gender-sensitive, consultative and participatory governance is to be adopted, applying a human rights-based approach.

In this context, the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context Food Security and Poverty Eradication (the SSF Guidelines)—a negotiated instrument—provides an effective toolbox to address these challenges in a coherent manner. On its tenth anniversary, which is to be observed at the 2nd Small-Scale Fisheries Summit, FAO Headquarters, Rome, on 5 to 7 July 2024, all members of the United Nations and civil society interested in SSF, nutrition, food security and sustainable fisheries are encouraged to uphold the SSF Guidelines and to express their commitment to implement the instrument.

Callum Roberts

Rethinking fisheries sustainability for a fast-changing world

Healthy oceans are critical for nature, human wellbeing, and planetary stability. Marine fisheries remain one of the largest and most widespread direct drivers of ocean degradation. A range of seafood products are marketed as “sustainable” but demonstrably fail to achieve the concept. There is a pressing need to redefine “sustainability” so that fishers, fishing companies, management bodies and the seafood sector in general, respond and adapt to a fast changing, crowded planet, to create common understanding and more appropriate and exacting standards behind a word that carries such high expectations. Reform of marine fishing practices and management is a central mechanism to improve ocean health and amplify societal benefits derived from marine life, including supporting the delivery of the United Nations Sustainable Development Goals for poverty reduction, zero hunger, climate action, reduced inequalities and protection of “life below water”. Here we offer a vision for the future of fisheries centred on two core principles: (1) fisheries must minimise impacts on marine species and habitats, adapt to climate change and allow for the regeneration of depleted marine life and habitats; and (2) they must support and enhance the health, wellbeing and resilience of people and communities – especially, the most vulnerable among us - not simply benefit corporations that narrowly direct profits to owners and shareholders while leaving others to bear costs. We propose a series of actions to enact these core principles, balancing environmental, social, economic and institutional dimensions of sustainability.

Julio Moron Ayala,

Sustainable and Responsible fishing as source of healthy food supply to a growing population

The role of fish as fundamental source of nutrients that help the hominids to increase their brain size and progress in evolution, remarks the fundamental importance of fish for a healthy human

diet. Current fish stocks status are at compromise in certain parts of the World's Oceans, while the majority of the fish produced from the Ocean comes from sustainable sources, 82% of World landings (FAO SOFIA 2022). Effective fisheries management has been proven to successfully rebuild stocks and increase catches within ecosystem boundaries. Improving global fisheries management remains crucial to restore ecosystems to a healthy and productive state and protect the long-term supply of aquatic foods. ICFA members are fully committed to improve fisheries management as the only way to secure the role of the fishing industry as food provider to the World's growing population. Fishing sustainably means to respect fish stocks and Ocean ecosystems, respect human rights and secure decent working conditions on board the fishing fleet and secure economic sustainability of the fishing industry through a fair market, that pays the value of fish as the source of a healthy diet. Fishing is under pressure by the eNGO community that is not taken in consideration all the efforts done to manage fisheries and its role as a fundamental role of food supply. ICFA is willing to engage with stakeholders in good faith to change the narrative and get support to the hard work that our fishermen perform in order to bring food to our people.

Lindy Weilgart

The Impacts of Anthropogenic Underwater Noise on Fisheries, Fish and Invertebrates, and Ecosystem Health

Most marine animals use sound for practically all of their vital functions (e.g., reproduction, avoiding predators, sensing their environment, etc.). So far, around 100+ species of fish and invertebrates have shown documented impacts by underwater noise (almost all that have been examined). Impacts on commercial catch rates include decreased landings, large fish leaving the area, increased bycatch, and decreased abundance. Commercial fisheries catch rates can be greatly reduced by noise, with large economic losses and potential threats to food security. Ecological services, such as water filtration, sediment layer mixing, and bio-irrigation, which is key to nutrient cycling on the seabed, are also compromised by human-caused underwater noise. Seismic airgun noise can kill zooplankton, which, together with phytoplankton, form the base of the marine food web. Scallop mortality also increased five-fold with airgun noise. Noise can also affect the balance between corals and algae, increase toxic bacteria, increase vessel hull fouling and attendant invasive species, reduce replenishment of fished coral reef species, reduce water filtration, and compromise food web dynamics, community structure, and stability. Noise changed the fluid and particle transport that invertebrates provide, potentially affecting the availability of nutrients in the ocean. Seismic survey noise caused reef fish abundance to decline by 78% in the evening when fish habitat use was highest. Such reactions of an entire community of species means fish lose opportunities to aggregate, forage, or mate. Impacts on fish and invertebrates extend beyond individual species to include communities of species and how they interact, compromising ecosystem productivity, and ecological services, with commercial and food security consequences. The European Union's Marine Strategy Framework Directive (MSFD) recognizes that ecosystem health is the relevant focus and has established threshold values for underwater noise to safeguard marine ecosystems.

Maggie Broadwater

Harmful algal blooms and impacts to the environment, societies, and economies – Advancing solutions

Harmful algal blooms (HABs) impact the safety and security of sustainable ocean foods and have overarching impacts on economies, societies, and the environment. Impacts differ with different types of HABs and in different regions. The costs of a HAB are inferred from increases in expenditures related to response, assessment, mitigation, and public health impacts, and also losses related to fishery closures, decreases in tourism, and loss of subsistence, cultural, and recreational resources or access. Communities that rely on subsistence foods from the ocean may experience disproportionate impacts related to HABs. In the United States, NOAA and EPA lead other federal agencies and partners to research, prevent, monitor, and mitigate HABs. The global HAB science and management community works collaboratively through the IOC, FAO, and the GlobalHAB Science Program. The UN Decade recently endorsed the HAB Solutions program, which seeks to accelerate knowledge and understanding of the causes and effects of HABs, and develop transformational solutions to reduce the frequency and severity of HAB events and mitigate HAB impacts.

Vera Agostini

Blue Transformation: Realizing the full potential of the ocean as a source of sustainable food

The world will have an additional 2 billion people to feed in the next 25 years. Aquatic foods are already making a significant contribution to food security and nutrition; they are drivers of employment, economic growth, social development, environmental recovery while also providing essential nutrients for healthy diets, and they hold the potential to play an even bigger role in the future global food system. At the same time, the fisheries sector faces major challenges from climate change, biodiversity loss, and pollution. Overcoming these challenges will require cooperation and collaboration among member stakes and stakeholders. Multiple global fora have been established to address these challenges, including the United Nations Convention on Law of the Sea and its subsidiary agreements, the United Nations Framework Convention on Climate Change negotiations, the Kunming-Montreal Global Biodiversity Framework of the Convention on Biological Diversity, the Convention on International Trade in Endangered Species of Wild Fauna and Flora, and the United Nations Decade of Ocean Science for Sustainable Development, among others. The presentation will introduce FAO's vision for 'Blue Transformation' to enhance the contribution of aquatic food systems to sustainable development and strengthen the role of the ocean as a source of sustainable food. It will also highlight key areas of FAO's work supporting members and facilitating cooperation and collaboration among regional fisheries bodies, toward the implementation of the BBNJ agreement, and through the United Nations Decade of Ocean Science for Sustainable Development.

Masanori Kobayashi

Presentation “Securing sustainable seafood – opportunities and challenges”

Seafood is an important food source for the world's growing population. Marine fishery peaked in 1996 and has since stagnated, while marine aquaculture continues to grow, reaching 30% of the marine fish catch. Overfishing and illegal, unreported, and unregulated (IUU) fishing pose significant threats to sustainable fishery resource management. Additionally, climate change and seawater warming are reducing marine fish catch, with projections indicating a significant decrease in some sea areas.

Fishermen must adapt their fishing methods, such as using chair fishing, to catch tropical fish that were not previously present in their sea area. Seafood retailers and procurers also need to adjust to changes in fish species. The disappearance of seagrass undermines fish habitat, leading to outbreaks of predator fish and aquatic organisms.

Fishermen are collaborating with farmers and retailers to farm sea urchins during outbreaks. In light of changing climate and marine environments, fishermen must promote adaptation, social collaboration, and innovation to produce sustainable seafood. Enabling policy and institutional frameworks, blended financing, and leadership and human resource development are vital for producing sustainable seafood under these circumstances.

Mauro Gongora

The role of the ocean as a food source in the Caribbean and Central America - challenges and opportunities in international cooperation and collaboration

The Ocean and its resources are perhaps the most valuable natural asset that we have for food, nutrition, economic development and prosperity for the Small Island Developing States. The ocean also contributes to foreign exchange earnings, creates employment & support livelihoods, is part of our culture and contributes to social stability of coastal communities (CRFM, 2024).

In the Caribbean region, the ocean generates employment for over 130,000 fisherfolks (8% are women) who produce 125,000 tons (landed weight) of fish valued at US$527 million. In addition, in the aquaculture sector some 5,000 aquaculture workers (13% are women) are employed producing 8,350 tons of fish valued at US$ 48 million.

In the Central American region, the ocean generates employment for over 150,000 fisherfolks (8% are women) who produce 595,000 tons (landed weight) of fish. In addition, in the aquaculture sector some 4,000 - 5,000 aquaculture workers are employed producing 193,000 tons of fish. The three main species produced include white leg shrimp, nile tilapia and tilapia species.

The main challenges in cooperation and collaboration in the fisheries and aquaculture sectors in the Caribbean and Central American regions include: overexploitation due to high demand, inadequate regulation, monitoring & enforcement, fsheries crime including IUU fishing undermines conservation & management, climate change impacts, ocean acidification – warming waters, changes in currents, affect fish habitats, breeding, shifts in stocks & reduced productivity

and degradation of critical marine habitats such as coral reefs, mangroves, seagrass beds due to coastal development, pollution and destructive fishing practices. Other challenges include the high cost of equipment - outboard motors, boats), supplies, fishing gear and fuel, difficulty in the establishment an effective monitoring, control and surveillance system, lack of fishers organizational strengthening and entrepreneurship and lack of improvement of product quality in the value chain.

The main opportunities in cooperation and collaboration in the fisheries and aquaculture sectors in the Caribbean and Central American regions include the existence of CRFM, whose mission is "to promote and facilitate the responsible utilization of the region's fisheries and other aquatic resources for the economic and social benefits of the current and future population of the region" and OSPESCA whose objective is to coordinate the definition, execution and monitoring of policies, strategies and projects related to the regional regulatory framework that leads to the sustainable development of fishing and aquaculture activities. There is aquaculture technology (shrimp and tilapia) and trained human resource available and there is high demand for seafood products in relatively close regional and international markets; and countries are highly legally and politically organized (CRFM and OSPESCA). There is active participation of members states in the formulation of a Central American Fisheries and Aquaculture Integration Policy and there is a regional governance model for Central American fisheries and aquaculture that has led to development of a code of ethics for fisheries, regional regulations (IUU fishing, lobster management), a regional plan for development of aquaculture in SICA countries and a regional strategy for blue growth in SICA countries.

Ana Margarida Ferreira

Ocean policies and Blue Food: Cascais Sea Strategy, Local Governance in Practice

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Cascais is a small Municipality with 214 124 inhabitants, located in the Lisbon Metropolitan Area. It has 32 Km of coastline, 14.6 ha of Natural Park and an annual budget of 480 M€. Despite its actual multicultural population, it still maintains its traditions and roots deeply connected to the Sea. Today, the charm of the city and its attractiveness to national and international tourism hinges on its natural territory. Accordingly, the Municipality channels a significant amount of (human, policy and financial) resources to the management of its maritime territory, to ensure its conservation, build resilience against the impacts of climate change, as well as sustain over time

the significant economic benefits it provides to its population. In Cascais, these challenges are being addressed through our Municipal Strategy for the Sea.

One of the anchor projects of this Strategy is the creation and management of local Marine Protected Areas (MPA) like the Avencas MPA. The resilience of a well-managed MPA is of great importance for one of the most traditional blue economic activities in Cascais – professional small-scale fishing. Classified in 1998, this small 1ha area in Cascais Coastal Zone was in its original form dismissed by the local population. Lack of information, appropriate demarcation and a strong restriction of traditional activities led to a low compliance with the regulations established for that area. In 2009 the Municipality started the process that enabled a reclassification of the site as a locally managed MPA, along with several management actions (such as environmental education activities, information spots, visitation pathways, virtual visitation, and habitat recovery actions). In 2018 the formal management of this MPA was established for the Municipality of Cascais through a management commission led by the mayor with the participation of all the relevant local stakeholders.

A direct line of communication with the fishing community enables the development and implementation of different projects, either to provide better work conditions, or generate greater profitability of some of the species targeted by these fisheries like octopus and skates. Another example of sustainable blue food pursued by the Municipal Strategy is the recovery of the kelp forests once abundant in Cascais. Along with the benefits to the marine ecosystems, the economic benefits are also present. The introduction of algae in our day-to-day food habits is being developed through environmental education actions at schools and the inclusion of this new food in the menu of the local public schools and private social solidarity institutions. The Municipality buys not only algae from a local company, but also fresh fish captured locally, providing these goods for the schools' kitchens, promoting change in our students' eating habits.

In the Future, Cascais hopes to establish a greater Marine Protected Area (700 sqm) and incorporates endangered habitats like reef and sponge gardens or kelp forest. Again, this project is being conducted in close cooperation with all the local stakeholders to achieve the sustainable management of this new MPA.

Kyosti Lempa

The Seas as a Source of Sustainable Food in the Nordic-Baltic Region: Integrating Research, Practice and Policy

NordForsk is an organization under the Nordic Council of Ministers that facilitates and funds research cooperation in the Nordic region. It aims to enhance the quality and impact of Nordic research by promoting collaboration among researchers, institutions, and stakeholders in Denmark, Finland, Iceland, Norway, Sweden, and the autonomous regions of the Faroe Islands, Greenland, and Åland. NordForsk supports research initiatives that address regional and global challenges, fostering innovation and knowledge exchange. Through joint programs and funding schemes, NordForsk strengthens the Nordic research community, contributing to sustainable development and societal well-being in the region and beyond.

The NordForsk Aquaculture programme is an initiative aimed at enhancing sustainable aquaculture practices across the Nordic and Baltic regions. It supports collaborative research projects that address critical challenges in the aquaculture industry, such as environmental impact, fish health, and feed efficiency. By fostering innovation and knowledge sharing among Nordic countries, the programme seeks to improve the sustainability and competitiveness of the aquaculture sector. Key areas of focus include developing new technologies, optimizing production processes, and ensuring the responsible use of resources. Through these efforts, the NordForsk Aquaculture programme contributes to the growth of a sustainable and resilient aquaculture industry in the Nordic region.

The NordForsk initiative Sustainable Fisheries from Healthy Seas is dedicated to promoting sustainable fishing practices and preserving marine ecosystems in the Nordic and Baltic regions. The initiative supports research that addresses the ecological, economic, and social aspects of fisheries, aiming to enhance the health of marine environments and ensure the long-term viability of fish stocks. Key areas of focus include developing innovative management strategies, improving monitoring and assessment techniques, and fostering collaboration among stakeholders. By advancing scientific knowledge and best practices, the programme will produce tangible policy advice, contributing to the sustainability of fisheries, safeguarding marine biodiversity, and supporting the livelihoods of communities dependent on fishing.

Darius Campbell

The ocean as a source of sustainable seafood – the regional perspective from North-East Atlantic Fisheries.

The North-East Atlantic Fisheries Commission is a regional fisheries management organisation (RFMO). The Commission aims to provide sustainable economic, social, and environmental benefits through the long-term conservation and optimum utilisation of the fishery resources in its Convention Area. The presentation will set out how NEAFC ensures it makes a contribution to global sustainable seafood supplies. This includes on objectives, science, management, enforcement of measures and future risks. The presentation will also cover wider considerations on sustainable fisheries such as the impacts on the marine ecosystem, cooperation and interactions with other organisations in the management of human activities in the oceans, and the global marine governance framework.

Delphine Schantz

Promoting sustainable food sources through enhanced law enforcement at sea and crime prevention

Unlawful activities linked to the marine environment not only threaten the health of our ocean but also, increasingly, have a negative impact on the economies of coastal countries, threaten food security, fuel corruption and create conditions in which further crime - including serious and organized crime - can be perpetrated. At UNODC we see this as one of the major threats to the ocean as a source of sustainable food that require appropriate responses. To succeed in the

fight against these unlawful activities, integrated ocean management needs to be complemented by a criminal justice approach. In UNODC's approach, crimes in the fisheries sector cover a broad range of illegal activities that may occur at one or more stages of the fisheries value chain. These offences are different to IUU fishing, although are often related and occur at the same time. These crimes include fraud, forgery, corruption, and human trafficking. As such UNODC complements the work of the FAO in addressing IUU fishing by providing technical assistance to Member States through key initiatives for prevention and awareness raising, strengthening legal frameworks, building capacity in law enforcement, enhancing international cooperation and partnerships, and fostering innovation and technology. By addressing these key areas, international cooperation, and coordination against crimes in the fisheries sector can be significantly enhanced, leading to a more sustainable, resilient and secure fisheries sector.

Sylvain Gambert

Fostering sustainable aquatic food production into international processes

The fisheries and aquaculture sector are currently a pillar of global food security and nutrition, as a major source of nutrients, animal proteins and livelihoods for billions of people.

The availability, abundance, and sustainability of ocean food is however dependent on ongoing developments and major challenges (e.g., biodiversity loss, ocean degradation, climate change impacts, demographic growth, etc.) as they set the context for our action and must be factored into our food policies. Only effectively managed aquatic resources can contribute to address the food security and nutrition challenges ahead. In this respect, sustainability in all it dimensions is fundamental.

Sustainable aquatic food systems have a vast potential in delivering sustainable healthy diets and meeting the UN Sustainable Development Goals (SDGs), considering also that fisheries and certain types of aquaculture have a lower carbon footprint than land-based animal production, as well as a lower water footprint. Mainstreaming the SDGs, including the global nutrition targets (SDG 2) and the targets for life below water (SDG 14), in our food policies will help secure sustainable, inclusive, and resilient food systems, which, in turn, will contribute to achieving the SDGs.

The presentation will focus on the European Union's efforts in promoting sustainable and responsible fisheries and aquaculture at global level as well as on the opportunities that arise in the different international fora for enhanced cooperation among the various stakeholders.

Joel Immanuel Matonga

Capacity building for the maintenance of the ocean as a source of sustainable food: a developing and least developed countries' perspective

Oceans are a vast source of nourishment, offering an abundance of seafood that is crucial for global food security. Not only do they sustain the livelihoods of coastal communities and indigenous

populations, oceans also indirectly contribute to the livelihoods of landlock states through fish meal production for livestock and poultry, and acting as a climate regulator, among other things. Furthermore, Sustainable Development Goal (SDG) 14 on life below water embodies the need to conserve and sustainably use the ocean, seas and marine resources for sustainable development. One of the SDG 14 targets is to increase the economic benefits to small island developing states and least developed countries from the sustainable use of marine resources. However, human activities such as illegal, unreported and unregulated fishing, overfishing, invasive species introduction, and pollution of the marine environment continue to have serious harmful and irreversible consequences. As part of the process of maintaining and strengthening the role of the ocean as a source of sustainable food, through frameworks such as the United Nations Convention on the Law of the Sea and the SDGs, developing and enhancing capacity at all levels, particularly of small island developing states and least developed countries through international cooperation and coordination is imperative. This paper explores how capacity building enhances the maintenance of the ocean as a source of sustainable food, offering developing and least developed countries' perspectives.

Rado Rakotosoa

Harnessing the Ocean for ensuring food Security in Madagascar

Madagascar is a vast island located in the south east of Africa. With around 50 inhabitants per Km2, over 75% of Malagasy people are living on less than 0.9 US$ a day and 52% in extreme poverty in 2023. Furthermore, 53% of children under 5 years is suffering a growth retardation. Therefore, food security is one of the crucial economic challenges in Madagascar. According to the national social and demographic survey in 2021, the national average of the chronic malnutrition rate concerning children under 2 years was 40%. For Madagascar, the contributing factors of food insecurity are several such as : Climate change and natural disasters, environmental degradation, economic challenges, then health and nutrition.

Since 2021, the current regime decided to set up a special ministry in charge of blue economy and ocean governance. As Madagascar is a great island bigger than France Hexagon, Malagasy people living in the central highland, around 52% of the total, are taking ocean for granted. A lot of people in this area did not see the ocean. That's why, the ministry in charge of blue economy conveys the economic opportunity from the ocean across the integrated policy of ocean governance to struggling food insecurity: 1 141 000 Km² of EEZ, 5 603 Km of coastline, 256 Islets, 392 000 Ha of mangrove, 2 230 Km² of coral reef, 14400 Km² of MPA, and USD10.6 billion of Gross Marine Product. Fisheries, Marine Aquaculture, Marine tourism, other alternative activities related to ocean and sustainable use of mangrove ecosystem, can constitute the ways to food insecurity overcoming.

The last survey pointed out that the southernmost of Madagascar is the most affected by food insecurity in Madagascar, even though this south part of Madagascar has one of the biggest shelf continental in the world.

Many international cooperations already exist and operationals in terms of ocean contribution to food security. The main message is to give a regard to the ocean as our key of food security in Madagascar.

Yoshitaka Ota

Food Sovereignty and Ocean Equity

Food sovereignty asserts peoples' right to "healthy and culturally appropriate" foods and the right to define their own food systems.

Food sovereignty movement emerged as a reaction to industrialization of food production, the power of private, corporate entities over access to land and resources, and transnational governance networks. This movement is founded on the idea of dignity for both individual food producers and consumers, and provides both depth and breadth to the concept of sustainable food. Food sovereignty is of particular importance for Indigenous Peoples around the world, whose food systems have been suppressed and continue to be marginalized by the colonial and extractive global capitalism.

Rather than treating "health" and "culture' in isolation, Indigenous approaches to food integrate physical, emotional, psychological, social and spiritual aspects of "well-being". Yet, our current, unjust and inequitable ocean governance system that is defined by exploitation and marginalization—from plastic pollutions to the dominance of the Western "conservation"—continue to undermine their rights to assert their sovereignty over how food is produced and consumed, while weakening opportunities for international cooperation and achieving food sustainability in its true forms.

The Nippon Foundation Ocean Nexus, an international network of scholars dedicated to social equity in ocean governance, proposes adapting food sovereignty as a framework for recognizing the diverse values and roles that seafood plays in our global ocean policies. More specifically, we recommend:

1) including cultural considerations in ocean pollution management;

2) prioritizing food sovereignty of Indigenous and coastal communities in fisheries management;

3) critically reviewing the current models of Blue Economy and climate adaptation, with an explicit focus on the systemic inequities manifested through our histories of racism, patriarchy, and colonialism, and ensure these policies and programs are designed specifically to dismantle these inequities.

Jessica Gephart

Sustainable seafood in the context of globalization

Aquatic foods are increasingly recognized for their potential contribution to sustainable diets due to their relatively high nutrient content and high average environmental performance. However, aquatic foods include a wide range of wild caught and farmed organisms that vary in their environmental performance based on how and where they are produced. At the same time, ocean-based foods are highly traded, creating challenges for ensuring the environmental and social sustainability of traded aquatic foods. This talk will present high level findings related to the environmental performance and trade of aquatic foods, highlighting key challenges and potential opportunities for enhancing the sustainability of aquatic foods in the context of globalization.

Donald M Anderson

New technologies and approaches to early warning, mitigation, and control of harmful algal blooms (HABs)

Blooms of harmful or toxic marine algae (commonly called “red tides”) are responsible for an array of human illnesses associated with consumption of contaminated shellfish and finfish, and in some cases, respiratory exposure to aerosolized toxins. In addition to their human health effects, algal toxins and other compounds are responsible for extensive die-offs of wild and farmed fish and shellfish, and have been implicated in the episodic mortalities of marine mammals, birds, and other animals that are critical elements in the marine food web. Over the past several decades, the frequency and global distribution of harmful algal blooms (HABs) has increased in many areas of the world. This increase is of particular concern since some expansions can be attributed to human activities, such as pollution of coastal waters with sewage and agricultural fertilizers, and because the expansion threatens food security in a world with a rapidly growing population and need for food, some of which will necessarily be from coastal fisheries and aquaculture. This talk will briefly review HAB phenomena and their impacts, but the main focus will be on new approaches to monitoring and management of potentially impacted marine resources. This will include numerical modeling studies of blooms and toxin production that can be used to forecast the dynamics of outbreaks, novel instrumentation and approaches to early warning and bloom monitoring using in situ instrumentation, and an overview of the strategies being explored for bloom control and mitigation, including chemical, biological, and physical approaches. HABs are a significant threat to many marine resources and pose a challenge to the goal of maintaining and strengthening the role of the ocean as a source of sustainable food.