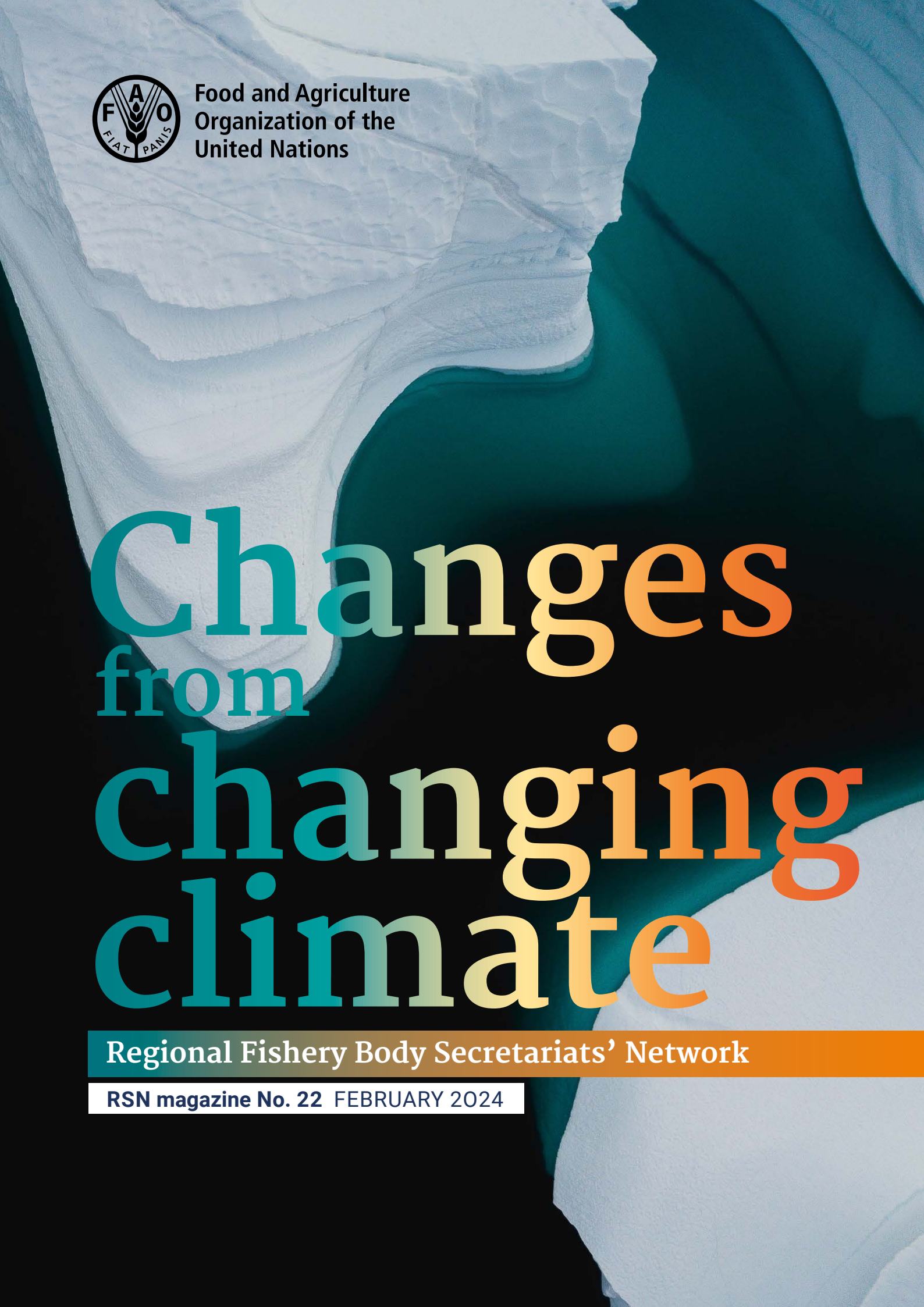

Food and Agriculture Organization of the United Nations

Changes from changing climate

Regional Fishery Body Secretariats' Network

RSN magazine No. 22 FEBRUARY 2024

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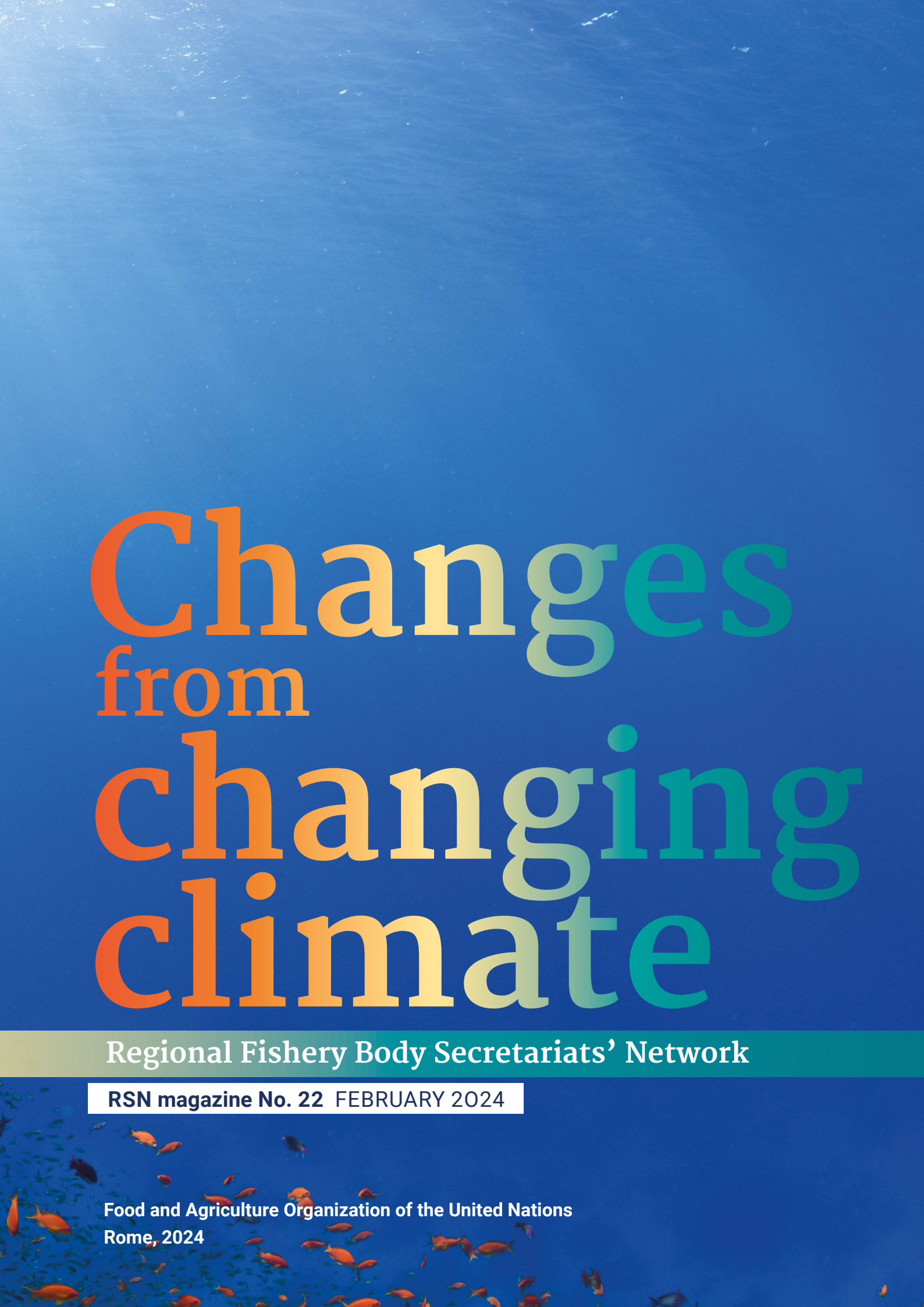

Changes from changing climate

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Food and Agriculture Organization of the United Nations
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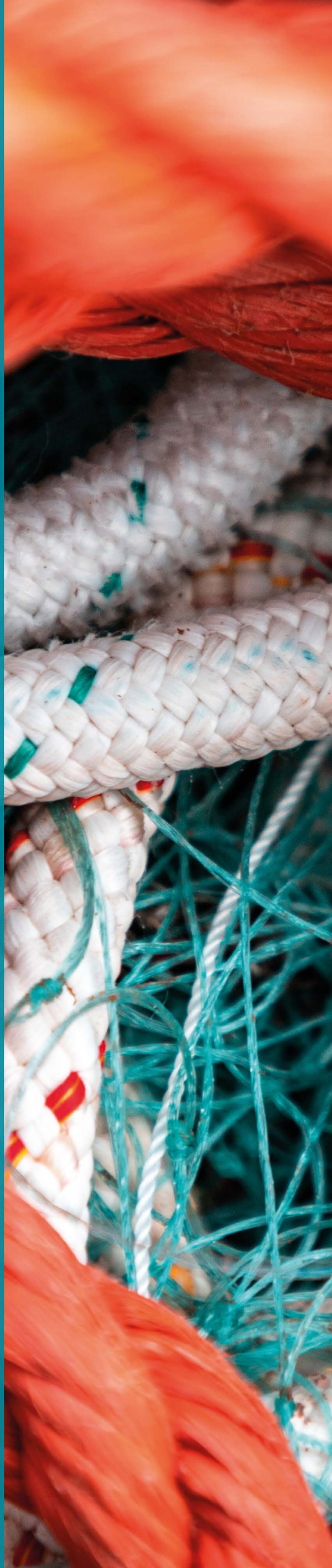

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SECTION 1

Editorial

CLIMATE CHANGE IN THE FISHING WORLD

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PIERO MANNINI
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The Intergovernmental Panel on Climate Change (IPCC) was established by the United Nations Environmental Programme (UNEP) and the World Meteorological Organization (WMO) in 1988 to provide governments at all levels with scientific information which is needed to develop climate policies. IPCC has an essential role in translating science into knowledge accessible to policymakers and in generating understanding of what many environmental activists are claiming: There is no planet B, which Stephen Hawking summarized in the following words:

"We are in danger of destroying ourselves by our greed and stupidity. We cannot remain looking inwards at ourselves on a small and increasingly polluted and overcrowded planet" (Hawking, 2016).

The first Assessment Report (AR1) of IPCC was published in 1990 underling the importance of climate change as a challenge with global consequences and requiring international cooperation (IPCC, 1992). The ocean, however, used to be described as the "Cinderella of the UN climate negotiations" (Rayfuse, 2019) and didn't play a central role in the first IPCC Assessment Reports, which had only a few sporadic mentions of the ocean. It was not until the fifth Assessment Report (AR5) that dedicated two chapters to the ocean and ocean systems, in which the IPCC called for international frameworks to address ocean-related mitigation and adaptation collectively, including "managing fisheries across national borders" (IPCC, 2014). Furthermore, in 2019, the IPCC published a Special Report on Ocean and Cryosphere (SROCC), and the sixth Assessment Report (AR6), published between 2021 and 2023, and they maintained a good coverage of the ocean.

The IPCC SROCC stated that the ocean has taken up more than 90 percent of the excess heat in the climate system (IPCC, 2019). This is causing unparalleled redistribution of resources and productivity changes, with diverse geographical impacts and further challenging governance systems. Climate change is leading to distributional shifts of fish stocks around the globe. According to recent modelling studies, by 2100, 45 percent of transboundary stocks will have shifted, and 81 percent of the world's exclusive economic zones will have experienced at least one shifting stock (Palacios-Abrantes, 2022). If business as usual continues, the SROCC also foresees the global biomass of marine animals to decrease by 9.1–20.9 percent by the end of the twenty-first century relative to 1986 to 2005 under the Representative Concentration Pathway 8.5 (RCP8.5), and in tropical regions, marine animal biomass and

production are projected to decrease by more than the global average. Moreover, about 95 percent of the deep seafloor area and cold-water coral ecosystems are projected to experience declines in benthic biomass.

There are major projected changes in maximum fisheries catch potential, namely, the maximum catch potential of fisheries is projected to decrease by 20.5–24.1 percent by 2100 under RCP8.5. This masks differences across regions and countries. Marine ecosystems in the tropical areas are projected to have a decrease of up to 40 percent in maximum catch potential, and areas in high latitudes are projected to have a 30–70 percent increase in catch potential (Cheung, 2010). The IPCC SROCC maps out an alarming prospective:

Future shifts in fish distribution and decreases in their abundance and fisheries catch potential due to climate change are projected to affect income, livelihoods, and food security of marine resource-dependent communities (medium confidence). Long-term loss and degradation of marine ecosystems compromises the ocean's role in cultural, recreational, and intrinsic values important for human identity and well-being (medium confidence) (IPCC, 2019).

This scenario will also have an impact on the freshwater fish species. In fact, it is expected that without mitigation policies, 56–70 percent of the global freshwater fish species will have over half of their present-day geographic range exposed to climatic extremes beyond current levels, in a 4.5 °C warmer world (Barbarossa, 2021).

Regional fishery bodies (RFBs) are increasingly aware of the challenges posed by climate change, and some have initiated actions ranging from public awareness-raising initiatives, policies, management plans, projects and other initiatives. However, there is a consensus that most organizations have difficulty in engaging in the topic of climate change despite the existence of good science, according to relevant discussions during the ninth Regional Fishery Body Secretariats' Network (RSN) meeting held in September 2022.

Table 1: Climate actions of RFBs 2002–2022 (non-exhaustive) (Sumby *et al.*, 2021)

APFIC
(2012): "The Commission emphasized the importance of raising awareness of climate change, particularly for policymakers in this region. It encouraged delegates to return to their agencies and engage with relevant people to make sure that fisheries and aquaculture was being incorporated into national planning for climate change mitigation and adaptation."
(2013): "The Commission recommended that fish stock assessment models should incorporate climate-change considerations."
CCAMLR
(2007): Climate change put on the permanent agenda of the Scientific Committee.
(2009): "4.45 The commission agreed that climate change is a very important issue and adopted resolution 30/XXVIII on climate change that urges increased consideration of climate-change impacts in the Southern Ocean to better inform CCAMLR management measures."

CCSBT
(2014): “PR-2014-5. In the future, the CCSBT could undertake to test the robustness of the MP [Management Plan] to climate change. It should also take every opportunity to give priority to stock rebuilding above increasing catch.”
(2014): “PR-2014-6. Every effort should be made to enhance and speed-up the rebuilding trajectory in line with the precautionary approach to fisheries... and improve resilience to fishing and climate change.”
(2015): Reiterated PR-2014-5 and PR-2014-6 with a possible implementation timeframe of 2018.
CRFM
(2018): A Protocol on Climate Change Adaptation (CCA) and Disaster Risk Management (DRM) in Fisheries and Aquaculture in the Caribbean was adopted by the Ministerial Council (2018).
GFCM
(2011): Included climate change in relevant targets and actions of the GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea (2021).
ICES & PICES
(2011): Set up ICES-PICES Strategic Initiative on Climate Change Impacts on Marine Ecosystems (SICCME).
Ad hoc WG on climate adaptive fisheries management.
IOTC
(2022): Resolution 22/01 on climate change as it relates to the Indian Ocean Tuna Commission.
IWC
(2009): Resolution 2009-1 “Requests contracting governments to incorporate climate-change considerations into existing conservation and management plans; appeals to all contracting governments to take urgent action to reduce the rate and extent of climate change.”
SWIOFC
(2007): “The possible effect of climate change on the fisheries of the South West Indian Ocean should be on the agenda of the fourth session.”
(2009): “Climate change is an item on the agenda.”
WECAFC
Developing the project on Fisheries information technology innovations for resource management and climate-change adaptation in the Caribbean (FIT4CC).

In this context, the thirty-fifth session of the Committee on Fisheries (COFI) of the Food and Agriculture Organization of the United Nations (FAO), which is the decision-making body governing issues related to fisheries and aquaculture (www.fao.org/about/meetings/cofi), requested that FAO develop guidance on climate resilient fisheries management, and as part of the solution, convene a workshop with RFBs. The work on RFBs and climate change is expected to build on and add to FAO's existing portfolio of activities to support countries and communities in adapting aquatic food systems to climate change impacts. These include a comprehensive review of the impacts of climate change on the aquatic food sector and the development of the FAO Adaptation Toolbox for fisheries and aquaculture (Barange, 2018). FAO also provides various policy frameworks with guidance on adaptation of fisheries management to climate change (Bahri, 2021); on decision-making and economics of adaptation for fisheries and aquaculture (Watkiss, 2019); and on integration of human rights standards and laws into disaster risk reduction and climate action in small-scale fisheries (Cook, 2021).

Several fundamental principles are guiding FAO's work on climate-change adaptation in the aquatic food sector: (i) Adaptation is place- and context- specific. (ii) Adaptation should be viewed as an ongoing and iterative process. (iii) Evaluations of success are necessary and often missing from adaptation studies. (iv) Transboundary issues need to be considered when developing an adaptation strategy.

The clock is ticking. The general public has heard it too much but has seen too little to tackle this issue. As Kofi Annan, the former UN Secretary-General, stated: "The world is reaching the tipping point beyond which climate change may become irreversible. If this happens, we risk denying present and future generations the right to a healthy and sustainable planet – the whole of humanity stands to lose."

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SECTION 2

The academic's corner

ON THE POTENTIAL FOR CLIMATE CHANGE TO UNDERMINE THE CLIMATE ADAPTATION RESPONSE IN REGIONAL FISHERIES BODIES

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Climate change is widely expected to have significant and negative impacts for the marine environment, marine species and marine ecosystems, creating corresponding impacts on human health and well-being. In this piece, we draw on the fisheries management literature to argue that climate change is a unique challenge because, unlike other sustainability challenges, it has the potential to undermine the ability of regional fisheries bodies to address it. We look at three ways in which climate change could potentially thwart commonly forwarded adaptation strategies: It could (i) impact policy efficiency; (ii) reduce the potential for adaptive management; and (iii) create conflict and undermine collaboration. Robust climate adaptation efforts in regional fisheries bodies will need to consider and plan for the potential that climate change could blunt their climate adaptation plans and complicate cooperation.

Introduction

Evidence documenting the seriousness of climate change for the marine environment, marine ecosystems and marine fisheries continues to mount. The Intergovernmental Panel on Climate Change's (IPCC) Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC) is the most advanced summary of the impacts of climate change impacts on the marine environment to date and distils and expansive body of research to a number of key findings. These include estimates that the ocean has absorbed more than 90 percent of excess heat in the climate system and that the ocean surface has become increasingly acidified (IPCC, 2019). Further, the 2022 IPCC report notes that marine heatwaves have become more intense, longer lasting and have doubled in frequency since the 1980s (Cooley, Schoeman *et al.*, 2022).

The implications of these oceanographic shifts for marine species and ecological communities are highly concerning. The report notes that the abundance and distribution of marine species will change, habitats will be negatively impacted and ecosystem functioning will be diminished (IPCC, 2019). Studies have found that fisheries production is also likely to be negatively impacted, though impacts

may not be uniform across species and regions (MacNeil *et al.*, 2010; Free *et al.*, 2019; Lam *et al.*, 2020; Cheung and Frölicher, 2020).

These impacts will undoubtedly impact human health and well-being. Marine fisheries make crucial contributions to economic activity, including serving as the basis for considerable employment opportunities and economic activity (UNFAO, 2022). Developing and least developed States are particularly vulnerable to climate change impacts on the marine fisheries, given the sector's contribution to food security and economic activity in these States (Barange *et al.*, 2014).

Compared to the considerable research effort exerted towards understanding climate impacts on the marine environment; marine species; ecosystems and human health and well-being, much less is known about how climate change will impact fisheries governance. Of the research which examines fisheries governance in the context of climate change, popular framings include (i) examination of how institutions can and should respond to climate-driven changes; or (ii) analysis of the institutional characteristics and political barriers that may complicate adaptation and reform (Cinner *et al.*, 2018; Pentz *et al.*, 2018; Wendebourg, 2020; Oremus *et al.*, 2020; Rayfuse, 2018; IPCC, 2019; Pentz and Klenk, 2020; Bahri *et al.*, 2021; Mason *et al.*, 2022). These framings oriented around institutional responses and barriers essentially view climate change as one more, though relatively complex, sustainability issue that regional fisheries bodies need to address.

In this piece for the academics' corner, we argue climate change is a unique challenge unlike other issues facing regional fisheries bodies because it has the potential to undermine the ability of regional fisheries bodies to address it. To make this argument, we look at three commonly cited adaptation approaches, namely, stronger policy, increased adaptability and enhanced cooperation, and we argue climate change could likely undermine their ability to contribute to climate adaptation goals.

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This piece is not meant to be a definitive and comprehensive accounting of the exact ways in which climate change could undermine climate adaptation efforts. How climate change will challenge regional fisheries bodies individually and in aggregate is uncertain and owes to the complexity of climate change as well as the scale and complexity of regional fisheries bodies. Instead, our goal is to broaden the discussion of the potential impacts facing regional fisheries bodies as a result of climate change and help shape the discussion of how adaptation efforts can be as robust, forward-looking and effective as possible.

Potential impacts on policy efficiency

One commonly identified climate change adaptation option is that stronger, more comprehensive management frameworks are needed to help regional fisheries bodies address the impacts of climate change (Weng *et al.*, 2015; Pentz *et al.*, 2018; Wendebourg, 2020). There is an implicit assumption in this argument that the policies constituting management frameworks, if well-designed, broadly accepted and implemented in an adaptive way, have a sort of inherent, static level of effectiveness. Climate change may challenge this assumption.

One potentially significant and largely explored way in which climate change could undermine climate adaptation efforts is by negatively impacting the efficiency of popular climate adaptation tools. Marine Protected Areas (MPAs) represent perhaps the clearest example of this potential. Experts have argued that MPAs, by providing refuge for species, ecosystems, and by protecting critical habitats could yield benefits for fished species and marine biodiversity (Marshall *et al.*, 2019; Brander *et al.*, 2020).

Some regional fisheries bodies, such as the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), have installed MPAs within their area of competency in an effort to capture such benefits (e.g. CCAMLR Conservation Measure 91–05). Importantly, some experts view MPAs as an important solution to address the impacts of climate change for the marine environment and marine fisheries. Both McLeod *et al.* (2009) and Roberts *et al.* (2017), for example, argue that well-managed networks of MPAs could contribute to climate adaptation imperatives.

But Bruno *et al.* (2018) find that the ability of MPAs to make oft-attributed contributions to marine biodiversity protection will be disrupted by continued "business as usual" rates of greenhouse gas emissions and that MPAs will not be able to offset the "thermal safety margins" of ecological communities within MPA footprints. In other words, the ability of MPAs to deliver conservation and fisheries' managements and to act as climate adaptation strategies will be negatively impacted by climate change.

This sort of impact, where climate change undermines the efficiency of climate adaptation strategies, is a serious and novel impact of climate change. Furthermore, it is unlikely that this sort of dynamic is restricted solely to MPAs and could likely play out in other crucial policies as well. Szuwalski *et al.* (2023) offer another important example, as they find that under escalating scenarios of climate change, the performance of Maximum Sustained Yield (MSY), which in many places has become a de facto standard for sustainable fisheries policy, declines with respect to conservation outcomes. Included in their analysis is the Bering Sea snow crab, which in 2022 experienced widespread closures because of surprisingly low numbers.

As with MPAs, the conservation potential of climate adaptive MSY approaches are already being negatively impacted by climate change.

Ability to adapt in the context of increased uncertainty and non-analogous conditions

A second way in which climate change could undermine the climate response concerns the ability of regional fisheries bodies to adapt. Adaptive management is, alongside stronger, more comprehensive policy, among the most commonly cited climate adaptation strategies (Pentz and Klenk, 2017; Sumby *et al.*, 2021), and as per the SROCC, the "responsiveness of existing fisheries management strategies reduces negative climate change impacts" (IPCC, 2019). Turning again to the SROCC, there is consensus that the marine environment is not only changing faster than at any point in the oceanographic record but will "transition to unprecedented conditions" (IPCC, 2019). Rapid change will create novel oceanographic, biological and ecological conditions that do not have analogues to contemporary or historically understood conditions. The ability to adapt will be especially important in this context. But the likely rise of non-analogous conditions creates a potentially important complication for efforts to understand and adapt to new resource statuses, as non-analogues likely introduce additional uncertainty into resource estimates.

Resource assessments can rely in part on the use of historical proxies to help understand and contextualize current conditions, including historical biomass ranges as well as the biological, ecological and oceanographic conditions underlying stock dynamics at different points in its range (see DFO, 2018 for an example of how these factors are included in Canadian stock assessment). Rapidly changing and non-analogous environmental conditions could limit the usefulness of the historical comparisons scientists use to understand and contextualize stock statuses and trends, potentially increasing uncertainty inherent in stock assessments (Pentz and Klenk, 2023).

This sort of heightened uncertainty created by climate change could have two potential impacts for climate adaptation efforts. First, increased uncertainty resulting from weakened evidence could undermine the ability of decision-makers to make accurate and informed decisions. Making informed decisions about how to adapt to climate change requires a good understanding of stock status and ecosystem trends, and climate change could undermine this prerequisite.

A second and related implication of heightened uncertainty is that it could undermine the ability of regional fisheries bodies to achieve consensus on climate-related decisions. Decision-making in regional fisheries bodies can be a complicated and protracted affair, especially since they require strong support and often consensus for such decisions. Generating consensus for reforms, which limit resource access is a difficult task even when evidence is strong and there is high confidence in scientific assessments (Pentz and Klenk, 2017). Reaching consensus when uncertainty is elevated by climate change could be even more difficult. Many stakeholders around the world have exploited the presence of uncertainty to oppose or delay actions they perceive as detrimental to their interests (e.g. the oil and gas sector and its acolytes among many others). Additional uncertainty surrounding resource status could facilitate and enable opposition to policies, which limits resource access as a climate adaptation strategy.

Cooperation during climate change

Cooperation is a third area where climate change can complicate climate adaptation. Cooperation is a central theme of the United Nations Convention on the Law of the Sea, especially with respect to high-seas fisheries management. As per Article 118 of the Convention:

> *States shall cooperate with each other in the conservation and management of living resources in the areas of the high seas. States whose nationals exploit identical living resources, or different living resources in the same area, shall enter into negotiations with a view to taking the measures necessary for the conservation of the living resources concerned. They shall, as appropriate, cooperate to establish subregional or regional fisheries organizations to this end* (Article 118).

Effective cooperation among States has also been cited as a necessary component of the climate change response. Numerous authors have called for new agreements or governance structures to improve collaboration among regional bodies and between regional bodies and coastal States calls often inspired by projected climate-driven resource range shifts and the potential for jurisdictional tensions to dramatically complicate resource access and allocation (Pinsky *et al.*, 2018; Haas *et al.*, 2020; Goodman *et al.*, 2022; Telesetsky, 2023). The SROCC also emphasizes the importance of cooperation as a climate adaptation strategy, as described in the following statements:

> *Intensifying cooperation and coordination among governing authorities across scales, jurisdictions, sectors, policy domains and planning horizons can enable effective responses to changes in the ocean, cryosphere and to sea level rise (high confidence)* (IPCC, 2019).
>
> *Coordination and complementarity between national and transboundary regional policies can support efforts to address risks to resource security and management, such as water and fisheries (medium confidence)* (IPCC, 2019).

There is, therefore, broad support in favour of enhanced cooperation as a climate adaptation strategy. Research arguing for enhanced cooperation is timely, as the once theoretical impacts of climate change are becoming realized. Having agreements, structures and governance mechanisms designed around new climate realities is increasingly important as a practical matter.

Timely progress towards enhanced cooperation is also crucial because it is possible that climate change could serve as a driver of conflict between stakeholders in fisheries governance. Mendenhall *et al.* (2020), for example, analyze the potential for climate-driven conflict to characterize fisheries governance and note that species range shifts could likely serve as a catalyst for conflict. Other studies also cite range shifts as the possible origin of conflict (Pinsky *et al.*, 2018), and Spijkers *et al.* (2021) discuss potential ways in which fisheries conflict could play out.

In addition to climate-driven impacts to stakeholder interests and relationships within fisheries management institutions, climate change could also create conflict between States in other areas of international affairs. Previous work has noted that larger geopolitical disputes not related to fisheries (i.e. tensions between the United States of America and the Russian Federation regarding the Russian Federation's 2014 annexation of Crimea) have undermined negotiations in regional fisheries bodies (Dodds and Nuttall, 2016; Brooks *et al.*, 2016). Though there is disagreement regarding the role climate change will play in future interstate conflict, there is significant potential that climate change will create a more geopolitically unstable world and create tensions between States (Mach *et al.*, 2019; Sharifi *et al.*, 2021). It is possible these climate-driven tensions originating in other venues could spill over into regional fisheries management, thus complicating governance.

The implications of climate change for cooperation, therefore, are multidimensional. Furthermore, the impacts of climate change we cite, such as oceanographic, biological, ecological, political and institutional impacts are not evolving on separate, discreet tracks. There is a distinct possibility these impacts could act synergistically, potentially creating

non-linear events and outcomes to which it is difficult, if not impossible, to predict and adapt (Ebi *et al.*, 2016). It is perhaps optimistic to assume that regional fisheries bodies will continue to function in the same manner as the pre-climate change era, therefore creating a new and uncertain adaptation and cooperation challenge.

While enhancing cooperation can serve as an important climate change adaptation approach, climate change can create the conditions for conflict to occur among stakeholders. This Catch-22 will be difficult to address, particularly if fisheries management institutions seek to adapt to biological and ecological changes as they happen rather than anticipating likely changes and organizing cooperation strategies in advance.

Conclusion

Identifying, understanding, and preparing for the ways in which climate change will challenge fisheries management institutions is a pressing objective. Our piece contributes to this effort by hypothesizing that in addition to biological, ecological and political impacts, climate change will undermine popular climate adaptation options and hamper the climate response of regional fisheries bodies.

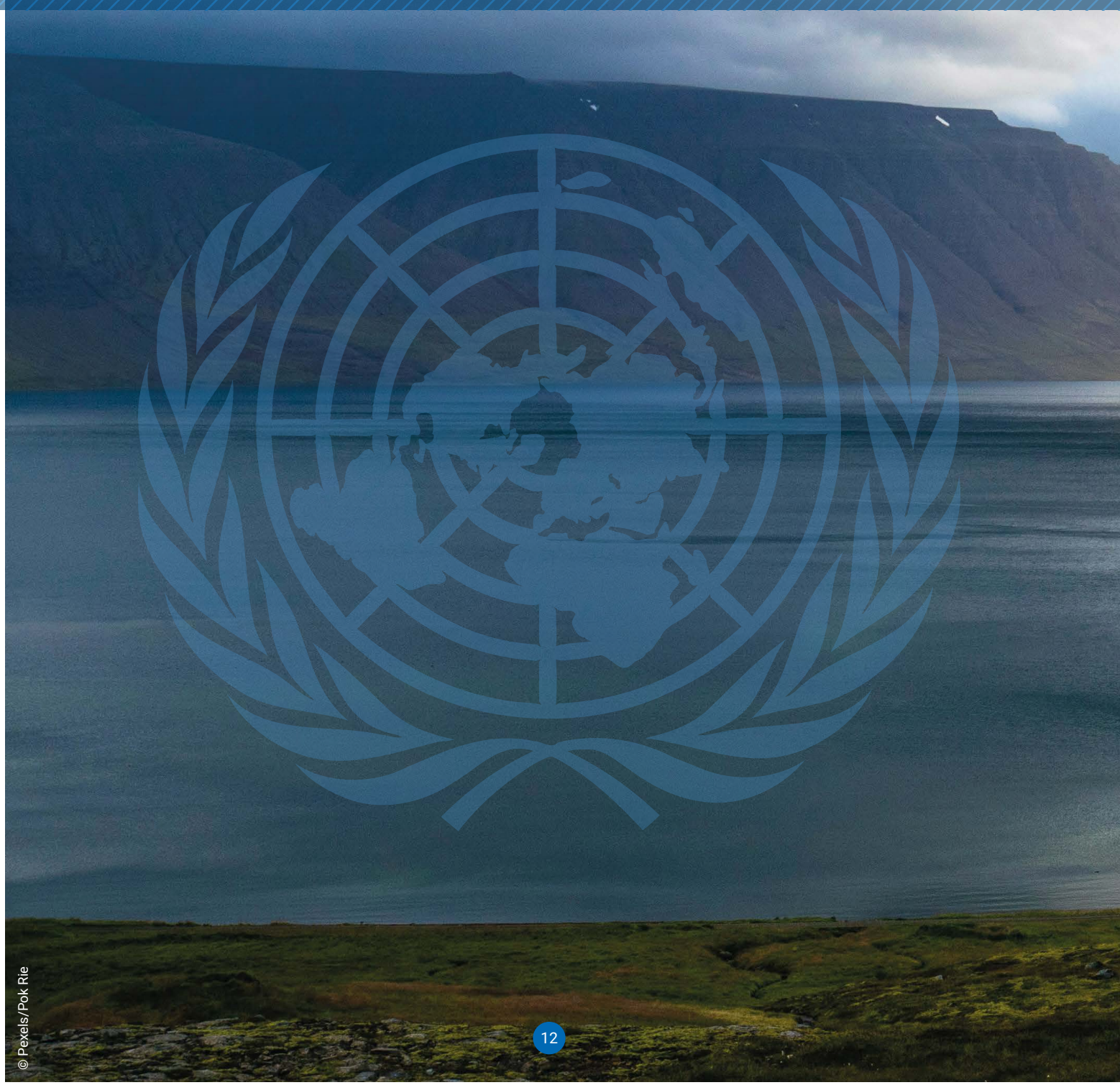
This piece is largely exploratory in nature and is not meant to be a full and definitive summary of all the possible ways in which climate change could undermine the climate response of regional bodies. Instead, the purpose is to highlight the potential self-reinforcing quality of the climate challenge and place the task of understanding this potential on the priority list for researchers and practitioners.

Regional fisheries bodies are intended to be cooperative institutions where stakeholders with common interests can work together to maximize the benefits from exploiting high-seas marine living resources. However, the potential that collaboration in its current form will be strained by climate change is significant and takes a variety of forms. Potential solutions to the cooperation challenge could focus on novel approaches where third parties or other groups work alongside regional bodies in ways which support their mandate but which do not impinge upon their jurisdiction. The ecolabelling sector, where private institutions critique and publicize exploitation decisions, could serve as a template. While regional bodies continue to rely on adaptative management, forward-looking forms of governance such as anticipatory governance where institutions anticipate and plan for a range of uncertain but possible future conditions could help regional bodies anticipate, plan for and mitigate potential areas of conflict (Quay, 2010).

Climate change is, and will remain, a fundamental issue facing regional fisheries bodies for the foreseeable future. The change underway in the ocean is dramatic, and subsequent impacts to marine species, ecosystems and human health and well-being are very likely to be substantial. Addressing these risks is a complex, high stakes and urgent challenge.

SECTION 3

The United Nations (UN) area



CONTRIBUTIONS FROM:

DOALOS:
United Nations Division for Ocean Affairs and The Law of the Sea

FAO/NFIDD:
Effects of climate change on tuna distribution and abundance by the Common Oceans Tuna Project

FAO/NFIFO:
FAO activities on the marking of fishing gear and MEPC resolution on gear marking

FAO/RSN:
Regional Fishery Body Secretariats´ Network

DOALOS: UNITED NATIONS DIVISION FOR OCEAN AFFAIRS AND THE LAW OF THE SEA

The Division for Ocean Affairs and the Law of the Sea, as Secretariat of the United Nations Convention on the Law of the Sea and the United Nations Fish Stocks Agreement, as well as General Assembly processes on oceans and the law of the sea, has undertaken a number of activities of particular interest to regional fishery bodies over the recent period. The following provides a brief synopsis of some relevant developments.

General Assembly resolution 77/118 on sustainable fisheries and review of actions of States and RFMOs to address the impacts of bottom fishing on vulnerable marine ecosystems and the long-term sustainability of deep-sea fish stocks

In December 2022, the General Assembly adopted resolution 77/118 on sustainable fisheries. This resolution, inter alia, reflects the outcome of the review of the General Assembly of the actions taken by States and RFMO/As to address the impacts of bottom fishing on vulnerable marine ecosystems and the long-term sustainability of deep-sea fish stocks, in accordance with relevant General Assembly resolutions.

Sixteenth round of Informal Consultations of States Parties to the United Nations Fish Stocks Agreement

The sixteenth round of Informal Consultations of States Parties to the Agreement (ICSP-16), was held at the United Nations headquarters on 13 March 2023. Pursuant to paragraph 69 of General Assembly resolution 77/118, ICSP-16 served as a further preparatory meeting for the resumed Review Conference on the United Nations Fish Stocks Agreement, to be held from 22 to 26 May 2023.

At ICSP-16, delegations, inter alia, undertook an initial discussion of the advance and unedited reporting material prepared by the Secretary-General for the resumed Review Conference and highlighted potential areas of priority consideration by the Review Conference.

The chairperson's report of the meeting will be made available on the website of the Division.

Review Conference on the United Nations Fish Stocks Agreement

Pursuant to General Assembly resolution 77/118, the Review Conference on the United Nations Fish Stocks Agreement will be resumed at the United Nations headquarters in New York, from 22 to 26 May 2023. The Review Conference has a mandate to assess the effectiveness of the agreement in securing the conservation and management of straddling and highly migratory fish stocks by reviewing and assessing the adequacy of its provisions and, if necessary, proposing means of strengthening the substance and methods of implementation of those provisions in order to better address any continuing problems in the conservation and management of those stocks.

In 2006, 2010 and 2016, the Review Conference adopted sets of recommendations aimed at strengthening the implementation of the agreement by States, individually and through regional fisheries management organizations and arrangements. In 2023, the Review Conference is expected to, inter alia, review implementation of the recommendations adopted in 2016.

A report of the Secretary-General, based on inputs from States and RFMO/As, as well as FAO, will inform the work of the resumed Review Conference. This report and related information, including with regards to participation in the resumed Review Conference.

Intergovernmental Conference on an international legally binding instrument under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction (General Assembly resolution 72/249)

On 5 March 2023, the resumed fifth session of the Intergovernmental Conference on an international legally binding instrument under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction agreed on the text of an international legally binding instrument under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction. The conference further decided to establish an open-ended informal working group tasked with ensuring the uniformity of terminology throughout the text of the draft agreement finalized at that session, to harmonize the versions in the six official languages of the United Nations and to resume at a later date once the open-ended informal working group has completed its work, with a view to adopting the agreement.

Climate change and the oceans

The division monitors developments in climate change and ocean acidification in the context of ocean affairs and the law of the sea, including related to sustainable fisheries at the global and regional levels. Such information is published in the annual report of the Secretary-General on Oceans and the Law of the Sea (UNGA reports). The Division also supports work in these areas taking place across the United Nations. For example, the Division has organized and serviced meetings of the United Nations open-ended Informal Consultative Process on Oceans and the Law of the Sea (ICP) on these topics, most recently on “Sea-level rise and its impacts” in 2021 and “The effects of climate change on oceans” in 2017. The 2017 Report on the work of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea at its eighteenth meeting (UNGA resolution A/72/95)

extensively addressed the impact of climate change on fish stocks and sustainable fisheries more generally, as did the report of the Secretary-General prepared by the Division in advance of that meeting General Assembly resolution (A/72/70). The Division also supports the Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects (Regular Process), which produces regular world ocean assessments (WOA) that, inter alia, addresses climate change, ocean acidification and their impacts on sustainable fisheries. The Division also supports UN-Oceans events related to ocean and climate change, in particular side events at meetings of the Conference of the Parties of the United Nations Framework Convention on Climate Change (UNFCCC). It also contributes to the annual Ocean and Climate Change dialogue under the UNFCCC. Finally, the division provides information and advice on these issues in order to ensure the uniform implementation of the United Nations Convention on the Law of the Sea (UNCLOS), including by providing statements and/or organizing events at UNFCCC meetings and drafting statements in relation to advisory opinions at the International Court of Justice and the International Tribunal for the Law of the Sea.

For more information

- Sixteenth states parties consultations to the fish stocks agreement:
  www.un.org/depts/los/convention_agreements/fish_stocks_agreement_states_parties.htm
- BBNJ:
  www.un.org/bbnj
- Bottom fishing workshop:
  www.un.org/depts/los/bottom_fishing_workshop.htm
- ICP:
  www.un.org/depts/los/consultative_process/consultative_process.htm
- Regular process:
  www.un.org/regularprocess
- Review Conference on the Fish Stocks Agreement:
  www.un.org/depts/los/convention_agreements/review_conf_fish_stocks.htm
- UNGA reports:
  www.un.org/depts/los/general_assembly/general_assembly_reports.htm
- UNOceans:
  www.unoceans.org
- WOA:
  www.un.org/regularprocess/content/woa
- DOALOS:
  www.un.org/depts/los

FAO/NFIFO: FAO ACTIVITIES ON THE MARKING OF FISHING GEAR AND MEPC RESOLUTION ON GEAR MARKING

Jon Lansley, Fishery Industry Officer (NFIFO)

Introduction

The marking of fishing gear is considered an important tool for reducing abandoned, lost or otherwise discarded fishing gear (ALDFG) and its harmful ecological and economic impacts, safety and navigational risks, and for assisting in the fight against illegal, unreported and unregulated (IUU) fishing.

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MEPC resolution on gear marking

As informed at RSN7, the seventy-eighth meeting of IMO's Marine Environment Protection Committee (MEPC78) held in June 2022 agreed to develop a "goal-based requirement" for the marking of fishing gear under Marpol Annex five. It is estimated that it will take two years to development. Assuming adoption in 2024, the obligation would come into force 16 months later, sometime in mid-2026. Gear marking will next be discussed at the tenth session of MEPC subcommittee on Pollution Prevention and Response (PPR10) being held 24–28 April.

The Voluntary Guidelines for the Marking of Fishing Gear (VGMFG) (FAO, 2019)

FAO developed the VGMFG which were endorsed at COFI33 and were published in 2019. The VGFMG address the purpose and principles, the scope of application and the implementation of a gear-marking system and its associated components, including reporting, recovery and disposal of ALDFG or unwanted fishing gear and commercial traceability of fishing gear. In support of the VGMFG, FAO published in January 2023 the following supporting guidelines:

A framework for conducting a risk assessment for a system on the marking of fishing gear: VGMFG Supplement One (He and Lansley, 2023)

The document on "A framework for conducting a risk assessment for a system on the marking of fishing gear" is a supplement to the VGFMG and provides a framework for conducting risk assessment to assist in determining the need for and requirements of a system for the marking of fishing gear.

The framework facilitates prioritization for implementation of gear-marking systems and assists stakeholders to appreciate the need for and benefits of such systems. This framework was published in February 2023.

Manual for the marking of fishing gear: VGMFG Supplement Two (Einarsson, He and Lansley, 2023)

The manual for the marking of fishing gear is a supplement to the VGFMG and provides practical instructions on marking methods for the main types of fishing gear in order to identify ownership. This manual was published in February 2023.

Operationalization of FAO voluntary guidelines for the marking of fishing gear in the Indian Ocean Tuna Commission (IOTC) area of competence (He and Lansley, 2022)

These guidelines evaluate the major fishing gears that harvest species under the management of the IOTC and propose a framework for marking these fish aggregating devices (FADs). They also provide an indicative economic assessment for implementing a system of fishing gear marking in the IOTC area.

The guidelines were presented to the IOTC Working Party on the Implementation of Conservation and Management Measures (WPICMM05) in 2022 and were deferred for further consideration. These guidelines were also published as an FAO fisheries and aquaculture circular towards the end of 2022 to provide a model and inspiration for other regional fisheries bodies to follow.

Additional FAO activities to support implementation of the VGFMG

Other FAO efforts to support the implementation of the VGMFG include the implementation of the IMO/FAO GloLitter Partnerships Project. A product of this project will be a guidance document on Legislative Options for Implementing Gear-Marking Systems. The guidance document will benefit from the experience of GloLitter countries that are working to incorporate the provisions of the VGMFG in their national fisheries regulatory framework with support from the FAO legal office. The guidance document will be completed by the end of 2023 and published in the beginning of 2024.

Next steps

The RSN will provide updates on the development of a gear-marking requirement under Marpol Annex V.

FOR MORE INFORMATION

- Responsible fishing: www.fao.org/responsible-fishing
- GloLitter Partnerships Project: www.imo.org/en/OurWork/PartnershipsProjects/Pages/GloLitter-Partnerships-Project-.aspx

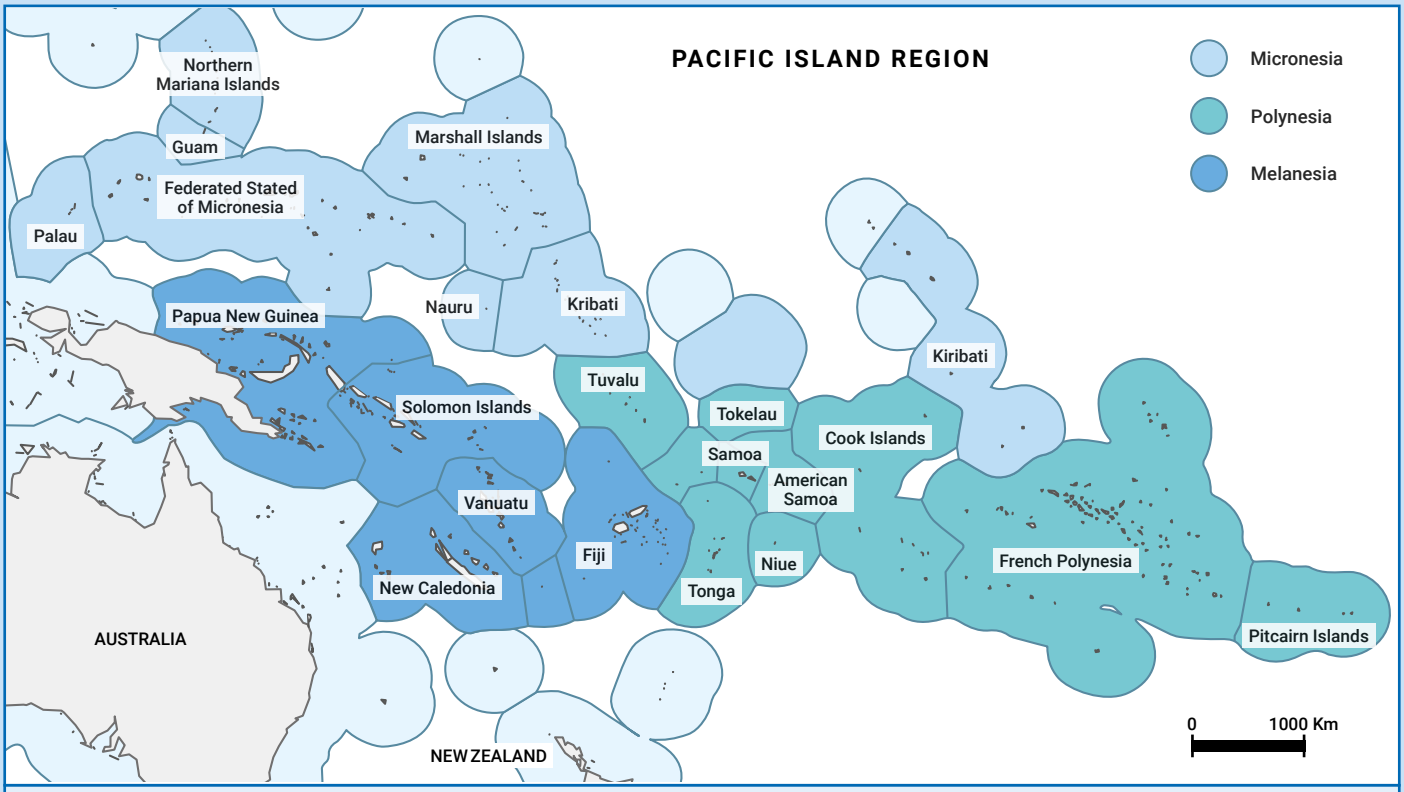
FAO/NFITD:
EFFECTS OF CLIMATE CHANGE ON TUNA DISTRIBUTION AND ABUNDANCE BY THE COMMON OCEANS TUNA PROJECT

Kim Stobberup
Project Officer/Manager, Common Oceans Tuna Project (NFITD)

A study on modelling the effects of climate change on tuna distribution in areas beyond national jurisdiction (ABNJ) in the Pacific Ocean was produced under the first phase of the Common Oceans Program (2014–2019). Projection results showed a change in abundance and redistribution of tuna species associated with climate change with an eastward shift in biomass of skipjack and yellowfin tuna. This would have significant implications for the economic development of Pacific Island Countries and Territories, as tuna catches are expected to decrease in the respective EEZs, and larger proportions of the catch are expected to increase in international waters (Figure 1, next page) (Senina *et al.* 2018).

In the new phase of the Common Oceans Tuna Project (2022–2027), Conservation International, the Pacific Community and Mercator Oceans International will extend and replicate this work to the Atlantic and Indian Oceans, as well as in the Pacific, using updated and improved physical-biogeochemical forcings data to model at finer resolution, including various climate change scenarios, based on IPCC three emission levels. The model SEAPODYM will be used to simulate spatiotemporal dynamics of tuna populations, taking into account the influence of both fishing and environment. Results will be presented to the relevant tuna Regional Fisheries Management Organizations (RFMOs) to support the development

Figure 1. Projected percentage change in the combined catch of skipjack, yellowfin and bigeye tuna in the exclusive economic zones of the ten Pacific Island countries and territories that produce 95 percent of the tuna in the Pacific Island region by 2050, together with projected changes in the contributions of licence fees to total government revenue and the value of licence revenue in present-day terms.



Federated Stated of Micronesia
Catch: -26% Revenue: -7.3% Value: -$16.3 m

Marshall Islands
Catch: -15% Revenue: -4.1% Value: -$4.5 m

Palau
Catch: -24% Revenue: -2.8% Value: -$1.6 m

Papua New Guinea
Catch: -37% Revenue: -0.9% Value: -$47.7 m

Nauru
Catch: -9% Revenue: -2.5% Value: -$3.6 m

Solomon Islands
Catch: -15% Revenue: -1.4% Value: -$6.2 m

Tuvalu
Catch: -9% Revenue: -2.2% Value: -$2.0 m

Tokelau
Catch: -8% Revenue: -0.2% Value: -$1.0 m

Kiribati
Catch: +15% Revenue:+3.5% Value: +$17.9 m

Cook Islands
Catch: +18% Revenue: +1.4% Value: +$2.3 m

Source: adapted from C. Wabnitz map

of ecosystem indicators for the implementation of the ecosystem approach to fisheries management. This will provide the basis on which decision-makers can take appropriate action including the adoption of conservation and management measures in relation to climate change.

The Common Oceans Tuna Project is part of the Common Oceans Program that has galvanized international action in support of sustainable management and biodiversity conservation of the ABNJ. Funded by the Global Environment Facility (GEF) and led by FAO, the project works in collaboration with the five regional tuna RFMOs, national agencies and intergovernmental organizations and initiatives, the private sector, civil society and academia.

FOR MORE INFORMATION

- Common ocean fact sheet: www.fao.org/documents/card/en/c/cc4043en
- www.fao.org/in-action/commonoceans

FAO/RSN:
REGIONAL FISHERY BODIES SECRETARIATS' NETWORK

FAO workshops: Mainstreaming climate change into international fisheries governance: the case of regional fisheries bodies

Climate change is leading to distributional shifts of fish stocks around the globe. According to recent modelling studies, by 2100, 45 percent of transboundary stocks will have shifted, and 81 percent of the world's exclusive economic zones will have experienced at least one shifting stock. The mobility of living resources is challenging the current fisheries management measures and adding a level of complexity to the management of straddling stocks. Transboundary fisheries management measures are traditionally based on historic catch and effort levels and usually do not align with the full distribution range of the managed stocks, nor account for the ongoing and future effects of climate change on their distribution. The discrepancy between Conservation and Management Measures (CMMs) and distributional shifts of fishery stocks is escalating the risk of inadequate management arrangements, international disputes and unsustainable fishing levels. Increased understanding of the impacts of climate change on transboundary fish stocks is an essential component of sound and climate resilient international fisheries governance that safeguards both the fisheries' resources and the livelihoods of millions of people who rely on them.

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RFBs are increasingly aware of the challenges posed by climate change, and some have initiated actions ranging from public awareness-raising initiatives, policies, management plans, projects and other initiatives. However, there is a consensus that most organizations have difficulty in engaging in the topic of climate change despite the existence of good science, according to relevant discussions during the ninth Regional Fishery Bodies Secretariats' Network meeting that was held in conjunction with the thirty-fifth session of the FAO Committee on Fisheries (COFI35) in September 2022.

In this context, COFI35 requested FAO to develop guidance on climate resilient fisheries management. As follow up to solutions, the forum proposed, FAO, through the RSN Secretariat and with financial support from the National Oceanic and Atmospheric Administration (NOAA), is organizing two regional workshops (Indo-Pacific and Atlantic) with a focus on climate change and regional fisheries governance. The workshops will be held between the last quarter of 2023 and the first quarter of 2024.

The aim of the workshop is, among others, to stocktake good practices and lessons learned from RFBs on the current management responses to climate change and develop a set of tailored solutions and roadmaps to implement risk-based management and decision framework on climate resilient management. Discussions will also focus on the needs for a capacity-building programme in this arena and will foster dialogue among RFBs to enhance regional coordination for effective fisheries management.

Examples presented by regional fishery bodies (RFBs), which include regional fisheries management organizations (RFMOs) and regional fisheries advisory bodies (RFABs) are intended to cover their relevant ongoing and planned work towards implementing risk-based management approaches that respond to changes in ecosystem States, including the impacts of climate change.

FOR MORE INFORMATION

www.fao.org/fishery/fr/rsn

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SECTION 4

Members' update

CONTRIBUTIONS FROM:

ACAP: Agreement on the Conservation of Albatrosses and Petrels

BOBP-IGO: Bay of Bengal Programme – Inter-Governmental Organisation

CTMFM: Joint Technical Commission of the Maritime Front

EIFAAC: European Inland Fisheries and Aquaculture Advisory Commission

FCWC: Fisheries Committee for the West Central Gulf of Guinea

GFCM: General Fisheries Commission for the Mediterranean

ICCAT: International Commission for the Conservation of Atlantic Tunas

ICES: International Council for the Exploration of the Sea

IPHC: International Pacific Halibut Commission

IWC: International Whaling Commission

NAFO: Northwest Atlantic Fisheries Organization

NAMMCO: North Atlantic Marine Mammal Commission

NASCO: North Atlantic Salmon Conservation Organization

NEAFC: North-East Atlantic Fisheries Commission

NPAFC: North Pacific Anadromous Fish Commission

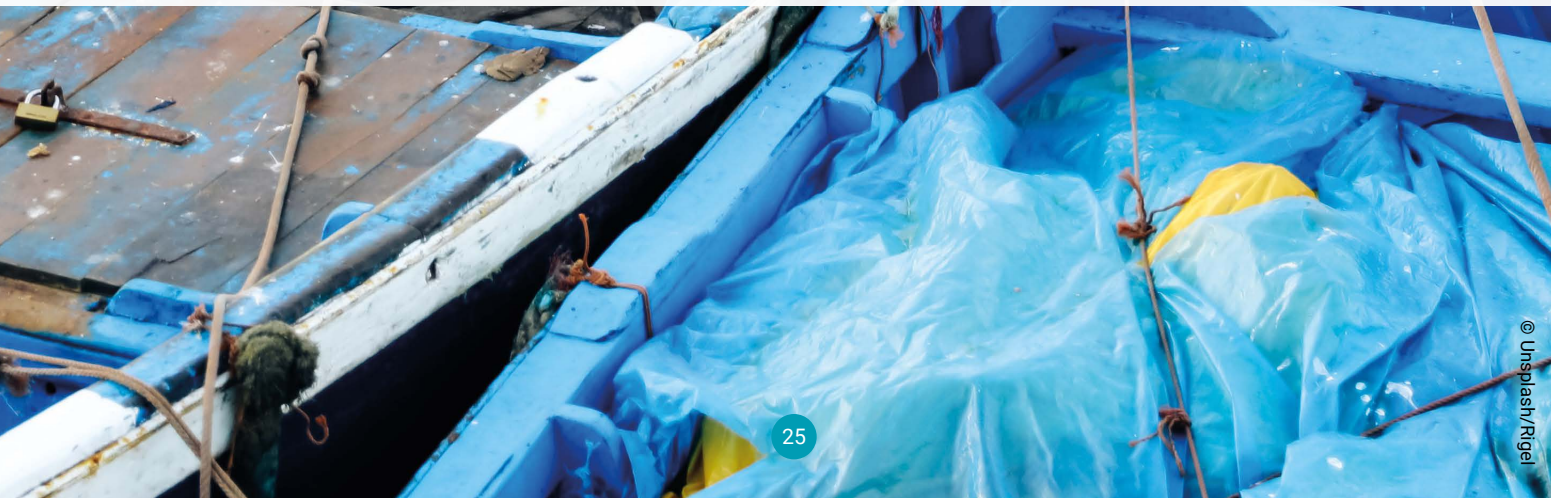
PICES: North Pacific Marine Science Organization

PSC: Pacific Salmon Commission

SEAFO: South East Atlantic Fisheries Organisation

SPC: The Pacific Community

WCPFC: Western & Central Pacific Fisheries Commission



ACAP

Agreement on the Conservation of Albatrosses and Petrels

World Albatross Day to highlight "Plastic Pollution" in 2023

ACAP has chosen to put the spotlight on "plastic pollution" this year for World Albatross Day, to be marked on 19 June 2023. Plastic pollution is a growing environmental issue that poses a threat to the world's oceans and marine life. As the theme for World Albatross Day, it aims to raise awareness about the devastating impact of plastic waste on albatross populations and their habitats. These iconic seabirds are highly susceptible to ingesting or becoming entangled in plastic debris, which can lead to injury, starvation and death.

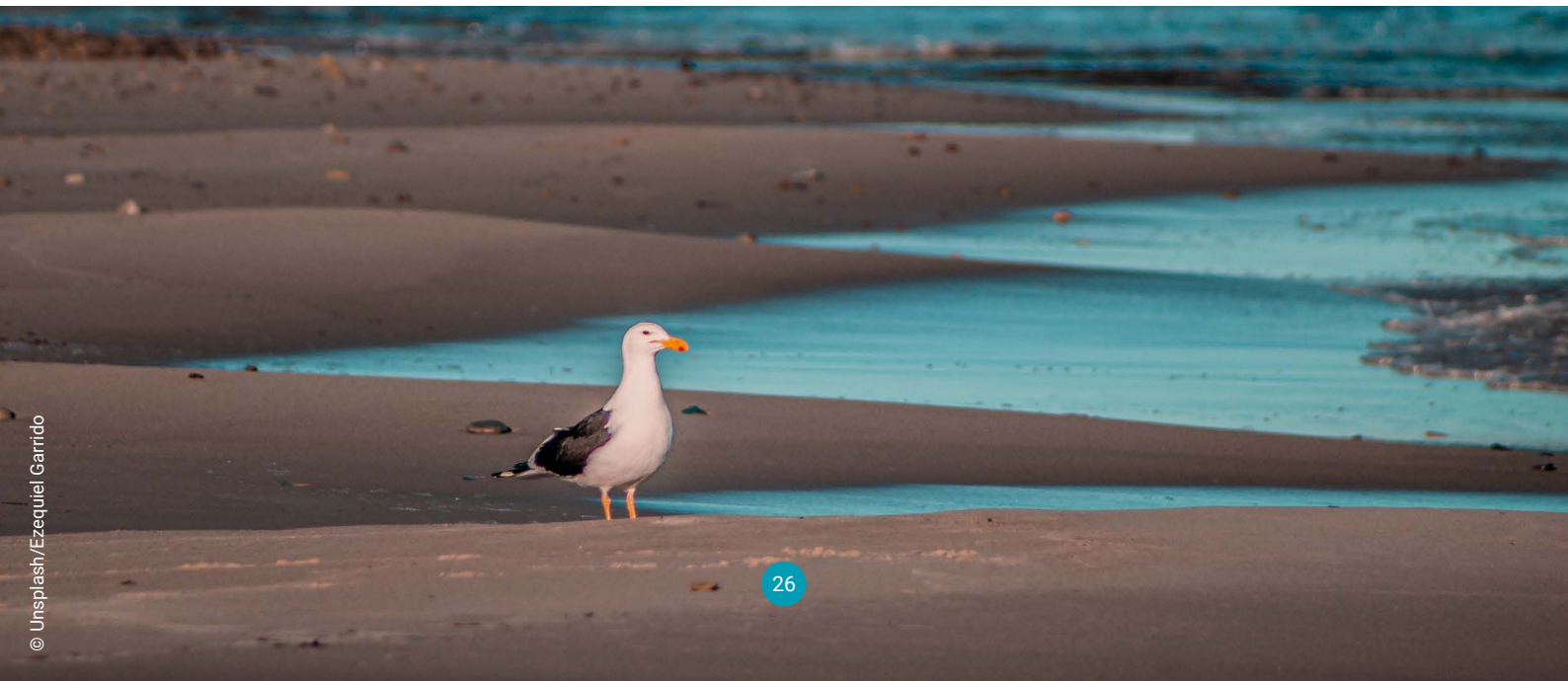
Two albatross species have been selected as the featured species for this year's World Albatross Day campaign, the globally endangered northern royal albatross, which is unique to New Zealand, and the abundant and widespread black-browed albatross. In addition, coverage is being given again to last year's species, the black-footed and Laysan albatrosses of the North Pacific, which ingest more plastic than the Southern Hemisphere species do.

A range of materials have been produced to celebrate the day, including artworks and posters, as well as educational infographics designed to help inform the general public, including school learners of the threats faced by albatrosses and what is being and can be done to combat them.

"Plastic pollution" follows the 2022 World Albatross Day theme of "Climate change", which highlighted the effects of climate change on albatrosses. The North Pacific breeding black-footed and the Laysan Albatrosses were the featured species, as both these near threatened albatrosses have most of their breeding populations on the low-lying atolls of the North-Western Hawaiian Islands of the United States. These atolls and their breeding seabirds are all at risk from sea level rise and increases in the number and severity of storms that result in flooding, both of which are considered a consequence of climate change.

FOR MORE INFORMATION

ACAP website/World Albatross Day: www.acap.aq



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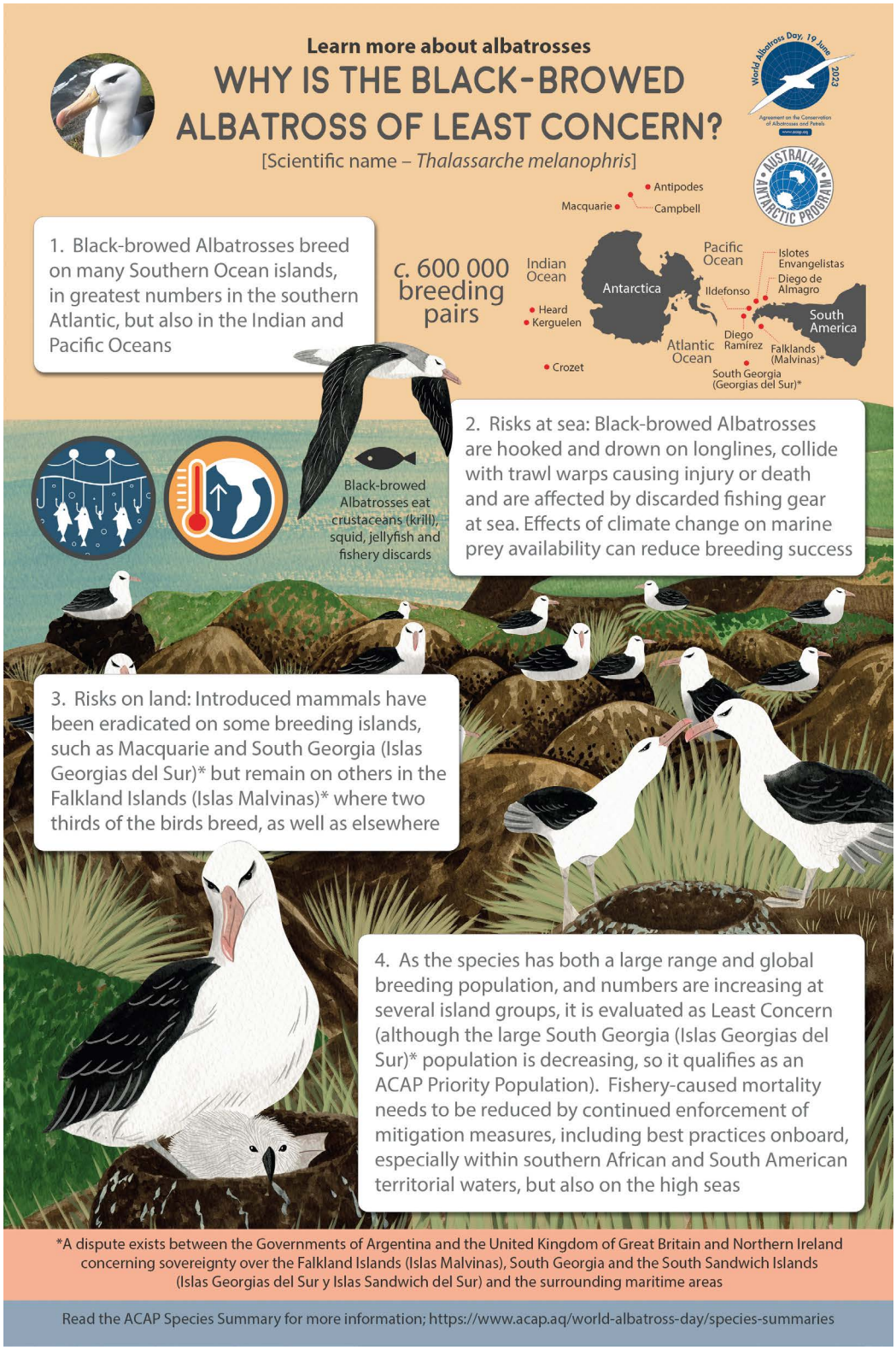

The World Albatross Day Black-browed Albatross infographic, sponsored by the Australian Antarctic Programme, provides an educational snapshot of the species and its main conservation threats.

BOBP-IGO

Bay of Bengal Programme
Inter-Governmental Organisation

News from BOBP-IGO

The Bay of Bengal region is highly vulnerable to the impacts of climate change, including increased frequency and intensity of extreme weather events, ocean acidification, sea-level rise and changes in ocean currents and temperatures. These factors have been identified as major drivers of change in the region's marine ecosystems, which are critical for the region's fisheries and aquaculture sector. In response, the BOBP-IGO has developed a comprehensive research agenda to address the impact of climate change on the sector, which is currently under implementation.

The BOBP-IGO has prioritized research areas to address climate change in the fisheries and aquaculture sector. The first thematic area, "Reimagining Regional Fisheries Management: Participatory Approaches for Near Real-time Stock Assessment" aims at enhancing the understanding of the impact of climate change on fish stocks and help develop effective strategies to address it. The Second thematic area, "Capturing the Hidden Harvest: A Framework for Small-Scale Multi-Species Fishery" aims at enhancing the resilience of artisanal and small-scale fisheries (ASSF) through technology infusion and making informed fishing communities. The third thematic area, "Insurance for Ameliorating the Climate Risks of Coastal Fishers of the Bay of Bengal Region" aims at ensuring adequate risk coverage of the loss from increasing extreme weather events in the region by introducing suitable insurance programmes such as parametric insurance.

Ongoing projects

Plan of action for enhanced safety, decent work and social protection in the fisheries sector of the BOBP-IGO region (BOBSAFE)

FAO and BOBP-IGO are working together to develop the BOBSAFE to address multiple issues concerning the fishers, including onboard working conditions and employment security, personal and vessel safety and enhancing the social security net. The Action Plan will address multiple international guidelines, including the International Labor Organization's ILO's work in Fishing Convention 2007, IMO/FAO/ILO Code of Safety for Fishermen and Fishing Vessels and the 1995 FAO Code of Conduct for Responsible Fisheries.

Economic assessment of Ecosystem-based Services (EbS) of critical habitats along the west coast of Bay of Bengal

The BOBP-IGO is implementing the project with support from the Ministry of Earth Sciences, Government of India. The broad objectives of the project include characterization of ecosystem processes and classification of services and their quantification at selected coastal ecosystems along Bay of Bengal. The study also aims at assessing the effects of climate change and anthropogenic stresses on the ecosystem services and derive appropriate adaptive strategies.

Programmes organized

International Seaweed Conference

BOBP-IGO organized an International Conference on promoting Seaweed Farming from 28 to 29 September 2022 in Chennai with support from the Government of India and the Government of Tamil Nadu. The Conference served as a catalyst that would give new impetus to the growth of the seaweed industry. Representatives from industries, researchers, experts, technocrats and policymakers from India and abroad attended.

International symposium in fishing technologies for sustainable and resilient fisheries

BOBP-IGO organized the twenty-third ICES-FAO Joint Working Group meeting on Fishing Technology and Fish Behaviour (WGFTFB) and an International Symposium on "Innovations in Fishing Technologies for Sustainable and Resilient Fisheries", hosted by the Department of Fisheries, Government of India at Kochi, India from 13 to 17 February 2023. The event brought together about 250 scientists, researchers, officials, policymakers, diplomats, industry representatives, entrepreneurs and students

from 32 countries to discuss advances in fishing technology to address challenges in the fishing sector including depleting fish stocks, habitat destruction, pollution, climate change and ghost fishing.

HD-BOBP dialogue on the development of a marine fisheries research network for the Bay of Bengal Region

The Centre for Humanitarian Dialogue (HD) and the BOBP-IGO initiated this dialogue to foster research collaboration and exchange of scientists and students among Bay of Bengal Rim countries, which lead global fisheries and aquaculture production. This dialogue was held at Kochi, India on 14 February 2023. The Kochi Declaration adopted during the meeting called for establishing a "Bay of Bengal Marine Research Network" for stronger marine scientific cooperation in the Bay of Bengal Region and invited BOBP-IGO to steer the network.

Brainstorming session on strategies for deploying artificial reefs and sea ranching in South Asia: learning from the experiences

BOBP-IGO and Central Marine Fisheries Research Institute of India coorganized this event on the sidelines of the ICES-FAO Symposium at Kochi, India on 14 February 2023 to discuss various dimensions related to past experiences, emerging challenges and enabling policies in deploying artificial reefs and also discuss different aspects which will correspond to the successful ranching programmes in future.

Panel discussion on future proofing Small-Scale Fisheries (SSF): innovations in fishing to enhance contribution of SSF to food security

BOBP-IGO organized this panel discussion on 16 February 2023 at Kochi in collaboration with International Pole and Line Foundation in Maldives (IPNLF); Sri Lanka Forum for Small Scale Fisheries (SLFSSF) and International

2022–2023

World Food Day 2022 at Chennai, India on 16 October 2022

Eighth Global Conference on Gender in Aquaculture and Fisheries at Kochi, India from 21 to 22 November 2022

International Symposium in Fishing Technologies for Sustainable and Resilient Fisheries at Kochi, India between 13 and 14 February 2023

International Women's Day on 8 March 2023

Collective in Support of Fishworkers (ICSF) to identify the challenges faced by the SSF sector in the Bay of Bengal region to share knowledge on innovations and promote strategies to ensure sustainable development of the SSF through the application of innovative technologies.

Brainstorming session on greening the fisheries sector: innovations and solutions from the industry

BOBP-IGO organized this session in collaboration with National Maritime Foundation (NMF) and ICAR-Central Institute of Fisheries Technology (CIFT) on the sidelines of the ICES-FAO symposium at Kochi to discuss strategies for decarbonizing the fisheries sector.

Waves of Art Initiative of BOBP-IGO

The Waves of Art Initiative is a step towards connecting fisheries with the larger society using art as a medium. The BOBP-IGO conducted sketching events and awareness programmes in this endeavor on topical themes, in conjuncture with international events. The sketches and publications are available at the BOBP-IGO publications webpage.

FOR MORE INFORMATION

- Publications: www.bobpigo.org/pages/publications
- BOBP-IGO: www.bobpigo.org

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CTMFM

Joint Technical Commission of the Maritime Front

CTMFM Scientific Symposium

The CTMFM Nineteenth Scientific Symposium was held from 14 to 16 November 2022, in the historical city of Colonia del Sacramento (Uruguay). The symposium was attended by more than 80 participants representing fisheries and environmental authorities of the two member countries; scientists of the fisheries laboratories; hydrographic services; academics and students and NGO representatives of Argentina and Uruguay. Professor Manuel Barange, Director of the Fisheries and Aquaculture Division at FAO, was the keynote speaker for this event.

The presentation given by Dr Nicolás Gutiérrez, Senior Fishery Officer at the Organization, and the opening lectures of the Theme Session on Climate Change and Biodiversity were particularly relevant in setting the stage for the scientific contributions presented during the symposium. Over a hundred scientific papers covered different aspects in relation to themes of fisheries sustainability, preservation of biodiversity and the impact of climate change.

FOR MORE INFORMATION

https://ctmfm.org/19-simposio-cientifico-ctmfm

Director of the Fisheries and Aquaculture Division, FAO, Manuel Barange opening the Symposium accompanied by the Presidents of the Argentine and Uruguayan Delegations: Ambassador Mariana I. Llorente and Capt. de Navío (CG) Zapicán Bonino.

Workshop on SOFIA analysis for FAO statistical area 41

Hosted by FAO the first workshop, aiming at developing a transparent assessment framework and estimates of fish stock status applicable to future SOFIA analyses of sustainability in area 41, was held in Mar del Plata from November 21 to 23 (2022) at the premises of the National Fisheries Laboratory of Argentina (INIDEP).

The workshop was conducted by Drs Nicolás Gutiérrez and Rishi Sharma, assisted by Cristiana Fusconi of the FAO Assessment and Management Team (NFIFM) of the Fisheries and Aquaculture Division. The regional organization was carried out by Dr Omar Defeo who coordinated the participation of fisheries authorities and scientists of Argentina, Brazil and Uruguay and the support of the CTMFM, responsible for the assessment of fish stocks shared by Argentina and Uruguay.
FAO's (NFIFM) is currently developing work to improve the methodology used for the calculation and reporting of the FAO Index on the State of World Fishery Resources, which is periodically performed and published as part of the work of FAO on monitoring the World Fisheries.

This methodology is based on using three categories or tiers of stocks, depending on the type and amount of data and information:

- Tier 1: Stocks with actual assessment available and/or stock status determination.
- Tier 2: Stocks without stock assessment but with available information on landings/catch time series and/or CPUE and/or biological parameters. Reliable landings and possibly some other external data, like fishing effort, allow fitting a quantitative model.
- Tier 3: Stocks without stock assessment nor consistent time-series of landings/ catch, but for which there may be other data and information, including Local Ecological Knowledge and fishing or fleet information: Indicator- or qualitative- based information requiring expert elicitation.

The sessions were attended by over fifty fishery scientists and officers who actively participated in the sustainability analysis of a number of reference stocks based on volumes landed and socioeconomic importance, with the guidance of the FAO team. A second FAO workshop to advance on this FAO initiative will be held in Brasilia, Brazil, from 25 to 28 April 2023.


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EIFAAC

European Inland Fisheries and Aquaculture Advisory Commission

EIFAAC has started a project to address the problems and challenges of climate change in inland fisheries

Raymon van Anrooy, EIFAAC Secretary

The European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC) held a joint meeting of its Management Committee (MC) and Technical and Scientific Committee (TSC) on 28 and 29 March 2023 at FAO headquarters in Rome. EIFAAC is a is an intergovernmental forum for collaboration and information exchange on inland fisheries and aquaculture among all European countries. It functions as a network, linking policymakers, managers, scientists and others working on inland fisheries and aquaculture issues. The technical and scientific work of EIFAAC is undertaken through projects and working groups composed of specialists from EIFAAC member countries. EIFAAC provides technical advice on request and links those who seek technical expertise to those who can provide it. With the recent accession of the Republic of Moldova and Serbia, its membership has grown to 35 countries and the European Union.

The meeting discussed progress with the implementation of the EIFAAC 2022–2024 work programme (FAO, 2022), its upcoming activities and plans for the thirty-second session and related international symposia. EIFAAC projects on the management and threat of Aquatic Invasive Species in Europe and on Developing Advice on Sustainable Management Actions on Cormorant Populations are showing important progress. The EIFAAC/ICES/GFCM Working Group on Eel (WGEEL) has also provided useful advice to member countries in 2022.

A project that will develop new fish stocking guidelines has recently started, as well as a project on the problems and challenges of climate change and its impact on inland aquatic resources, fisheries and aquaculture in Europe. This project aims, among others, to develop guidelines to support Member States in addressing the problems and challenges of climate change and its impact on inland aquatic resources and fisheries of Europe by using best international processes and practices.

The Government of Croatia has kindly offered to host the thirty-second session of EIFAAC in Pula in October 2024. An international symposium is being organized on “Building a sustainable future for inland fisheries and aquaculture in a time of multiple stressors”. More information on the symposium themes and dates will be made available online.


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New publication

Proceedings of the of the EIFAAC symposium on inland fisheries and aquaculture: advances in technology, stock assessment and citizen science in an era of climate change, Killarney, Ireland, 20–21 June 2022.

The international symposium on "Inland Fisheries and aquaculture: advances in technology, stock assessment and citizen science in an era of climate change" was organized in conjunction with the thirty-first session of the European Inland Fisheries and Aquaculture Advisory Commission in Killarney, Ireland on 20–21 June 2022. The symposium was organized by Inland Fisheries Ireland and the Department of the Environment, Climate and Communications.

The symposium was attended by 105 participants from 14 countries. The main documentation comprised six invited papers, 35 experience papers and 15 posters. The symposium had five major themes, which were: (i) inland fish stock assessment; (ii) developments in freshwater fish monitoring technologies with an emphasis on non-destructive methods; (iii) the problems and challenges of climate change and its impacts on inland aquatic resources and fisheries; (iv) citizen science; and (v) aquaculture - traditional freshwater systems vs recirculation systems. The symposium provided valuable networking opportunities for the participating scientists, especially that young scientists could share their research findings. Many promising studies and innovative technologies and methodologies were presented. This Occasional Paper in conjunction with a special issue of Fisheries Management and Ecology represents the proceedings of the symposium.

The thirty-first session of EIFAAC, held in Killarney from 22 to 24 June 2022, discussed and endorsed the conclusions and recommendations from the symposium.

FOR MORE INFORMATION

- EIFAAC Management Committee and Technical and Scientific Committee Meeting 2023: www.fao.org/fishery/en/meeting/41372
- EIFAAC symposium 2022: www.fisheriesireland.ie/news/events/eifaac-symposium-2022
- EIFAAC: www.fao.org/fishery/en/organization/rfb/eifaac

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FCWC

Fisheries committee for the West Central Gulf of Guinea

FCWC holds fourteenth ministerial conference to advance regional fisheries cooperation

The Fisheries Committee for the West Central Gulf of Guinea (FCWC) successfully held its fourteenth ministerial conference on 13 January 2022 at the Tang Palace Hotel in Accra, Ghana on the theme "Supporting effective fisheries management for a sustainable blue economy".

The fisheries sector ministers of Ghana, Liberia, Côte d'Ivoire and Benin were physically present at the hybrid regional ministerial meeting to adopt recommendations developed by the experts of the Advisory and Coordinating Committee (ACC) from the sessions held over the preceding two days.

Former FCWC Secretary-General (SG) Seraphin Dedi, in his opening speech reiterated that cooperation and a regional approach were necessities for safeguarding existing resources and for the development of the maritime economy and blue growth in the region. Commenting on the theme of the year, he invited States to adopt the blue economy as a pillar of economic planning, development and investment in the fisheries sector: This would ensure the alignment of national policies with the ECOWAS Comprehensive Strategic Framework for the Sustainability of Fisheries and Aquaculture Development (CSFS-FAD), as well as with the Sustainable Development Goal (SDG 14).

Ghana's Minister for Fisheries and Aquaculture Development and incoming president/ chairperson of the Conference of Ministers, Hon. Mrs Mavis Hawa Koomson, praised the foresight of the FCWC in introducing aquaculture development as a new thematic area of its activities and said Ghana was prepared to share its aquaculture programme experience.

The outgoing president of the FCWC Conference of Ministers, Minister Sidi Touré, congratulated Mr Dedi for working tirelessly as a pioneer and commended the Committee for achieving the signature of key MOUs: one with the Economic Community of West African States (ECOWAS) and another with the International Labor Organization (ILO).

High-level statements were delivered by the ambassador of the Kingdom of Norway to Ghana, H.E. Ingrid Mollestad, European Union to Ghana ambassador H.E. Irchad Razaaly, ECOWAS representative Dr Amadou Tall, FAO regional representative Yasmi Yurdi, JICA Ghana Deputy Regional Representative, Yasuaki Momita, and fishery consultant, Alhaji Jallow.


© FCWC

The conference concluded with the successful adoption of the 2023/2024 workplan and budget; the 2023 annual report included recommendations to develop and implement a third phase of the Fisheries Intelligence and MCS Support in West Africa initiative; to extend regional fisheries management measures like the closed season to all countries; to support FCWC Member States to ratify ILO's C188 to ensure decent work in the fisheries and aquaculture sector; to submit requests for support for national aquaculture projects to JICA for the Member States without one; and to begin implementation of the marine spatial planning project in partnership with the International Union for Conservation of Nature (IUCN) funded by Global Environment Fund (GEF).

The legacy of a pioneer in regional fisheries cooperation

The Fisheries Committee for the West Central Gulf of Guinea (FCWC) was established in 2007 through the Cotonou Convention to promote fisheries cooperation and to tackle illegal, unreported and unregulated (IUU) fishing in the subregion, which was estimated to account for 40–60 percent of catches. Prior to the establishment of the FCWC, cooperation between Benin, Côte d'Ivoire, Ghana, Liberia, Nigeria and Togo, its Member States was limited, and efforts to combat maritime crimes which include fisheries crimes, were usually unilateral. Seraphin Dedi Nadje, the then-Director of Fisheries of Cote d'Ivoire, was appointed as the first Secretary-General of the FCWC, and over the past 15 years, he has led the organization to many successes in three areas.

- First, Dedi led FCWC to establish partnerships with an impressive range of national, regional and international organizations in the fisheries sector. This supported the provision of financial, technical and capacity-building support in response to needs expressed by the MS. This enabled the establishment of the Regional Fisheries Management System (RFMS), the Regional Monitoring, Control and Surveillance Centre (RMCSC) and the development of sustainability plans to ensure their continued operation and ability to provide much-needed capacity building.
- Second, Dedi guided the FCWC to partner in key memorandums of understanding (MOUs) and agreements and supported MS's adoption or accession to key national and international agreements, protocols and MOUs, which advanced efforts to improve fisheries management at operational, regulatory and policy levels. Notable agreements include the strategic MOU signed with the International Labour Organization (ILO) to promote decent work in fisheries; the tripartite MOU signed between ECOWAS and the two regional fisheries bodies of FCWC and the Subregional Fisheries Commission (SRFC); the FAO Agreement on Port State Measures (PSMA); the FCWC Regional Fisheries Management Plan; and the FCWC Regional Plan of Action to Combat IUU Fishing.

- Third, Dedi oversaw the FCWC to address the subregion's preexisting challenges of low visibility, sparse communication and poor information sharing, which stifled collaboration, transparency and trust. The best example is the regional communication platform established under the West Africa Task Force, which allows near-real-time intelligence information sharing with duty bearers. By developing trust where there were confidentiality concerns and nurturing trust among stakeholders where there was anxiety, Mr Dedi skilfully navigated potential challenges of sensitive issues.

On 16 March 2023, at the handing over ceremony where he handed over to Dr Antoine Gaston Djihinto, Mr Seraphin Dedi left behind an incontestable legacy of burgeoning regional fisheries cooperation in West Africa.

FCWC welcomes new Secretary-General Dr Djihinto

The Fisheries Committee for the West Central Gulf of Guinea (FCWC) has its second Secretary-General (SG), Dr Antoine Gaston Djihinto, succeeding the first Secretary-General, Mr Seraphin Dedi, who had been serving in this position since the FCWC's establishment in 2007.

The handover ceremony on 16 March 2023 at the FCWC Regional Monitoring, Control and Surveillance (MCS) Centre in Tema, Ghana was chaired by the chief director of Ghana's Ministry of Fisheries and Aquaculture (MOFAD) Dr Kwesi Armo-Himbson, representing the FCWC chairperson and minister of MOFAD, Hon. Mrs Mavis Hawa Koomson.

In his speech, Secretary-General Djihinto thanked his predecessor for his dedication and commitment to the FCWC Mission while noting "as the new Secretary-General, I am aware of the challenges facing our community, and I am confident that by working closely with all committee members, our organization will continue to strengthen the sustainability of our fisheries resources and strengthen the transparency and accountability of our governments." He emphasized the importance of coordination with other organizations and stakeholders to achieve common objectives and thanked the Government of Benin for the trust placed in him.

Secretary-General Djihinto has played a key role with the FCWC through his position as the former director of fisheries in Benin and brings decades of fisheries and aquaculture experience. Following the announcement of the new appointment at the FCWC fourteenth Conference of Ministers, on 13 January 2023, in Accra, Ghana, he worked closely with Mr Dedi to understand the inner workings of the FCWC secretariat and the activities of the Committee.

At the handing over ceremony, Mr Dedi expressed his sincere thanks to the Government of Cote d'Ivoire and to the successive ministers in charge of fisheries and aquaculture that have formed the FCWC Conference of Ministers and supported him to have the honour of laying the foundations for the organization. He assured Secretary-General Djihinto of his availability for any advice and support needed and expressed his confidence that the new Secretary-General would successfully meet the challenge of leading the organization into a bright future.

Seraphin Dedi has been the Secretary-General since the FCWC's establishment in 2007, on secondment from the Government of Cote d'Ivoire. In accordance with the conventions for the establishment of the Committee, and a recommendation from the thirteenth session of the FCWC Conference of Ministers, the process was initiated to identify and appoint his successor. Dr Djihinto's assumption of duty concludes the process.

Dr Antoine Gaston Djihinto was born in 1959 in Hinvi-Dovo (Allada), Benin. In December 2008, he received a doctorate in technical sciences from Admiral Makarov, the State Maritime Academy in Saint Petersburg, the Russian Federation. He has worked in Benin's fisheries industry since 1985, rising through the ranks of the administration until his appointment as National Director of Fishery Production in October 2015.

FOR MORE INFORMATION

FCWC website: https://fcwc-fish.org

GFCM General Fisheries Commission for the Mediterranean

Climate change in the Mediterranean and the Black Sea

The Mediterranean and the Black Sea already show significant evidence of climate-induced changes. The region is warming 20 percent faster than the rest of the globe, and a number of additional drivers are making impacts in the region. Against this backdrop, climate change is a key consideration in the GFCM 2030 Strategy (www.fao.org/gfcm/2seas1vision/GFCM2030Strategy). Mitigating the impact of non-indigenous species More than 1 000 non-indigenous species (NIS) have been identified in the Mediterranean and the Black Sea.

NIS can harm local ecosystems in several ways: by expanding rapidly and outcompeting indigenous species in the quest for space, food or other factors; by preying upon indigenous species; or by introducing diseases to which indigenous species are not resistant. However, they also offer opportunities for fishers in a quickly changing ecosystem.

In the Mediterranean and the Black Sea, non-indigenous species mainly enter by different means through the Strait of Gibraltar and the Suez Canal, and climate change, overfishing and habitat degradation sometimes create enabling conditions for these species (e.g. tropical species) to survive and thrive.

The GFCM drives efforts to study the impacts of climate change on marine habitats and ecosystems in general and on fisheries and living marine resources in particular. It also works to mitigate negative impacts of non-indigenous species while assessing and managing potential new opportunities they bring. In both cases, the GFCM aims to devise practical adaptation mechanisms to integrate into fisheries management. The GFCM research programme on blue crab (www.fao.org/gfcm/researchprogramme-bluecrabs), for example, is setting up a coordinated science-based framework for the management of blue crab fisheries, taking into account both social, economic and environmental objectives.

In April 2023, the GFCM launched a pilot project on NIS in the eastern Mediterranean (www.fao.org/gfcm/pilotproject-nis), as a trampoline for doing similar work in other GFCM subregions. The main objective of this project will be to increase the knowledge on the structure of fish assemblages and impact in coastal areas and give insight into invasion biology by investigating the potential impact of NIS on the local ecology, food web and the livelihood of the fishers. This will be coupled with coordinated science and local knowledge-based solutions for the control and management of NIS, and in particular, the role of fisheries in this process. On this basis, the GFCM will set up an observatory on NIS that will take over the national

networks after the end of the project's activities as well as possibly bringing together information collected by other partner organizations across the Mediterranean.

First steps towards decarbonizing the fishing fleet: In March 2023, the GFCM held its first workshop on decarbonization (www.fao.org/gfcm/news/detail/en/c/1634433/), a significant new theme for the fishing sector in the Mediterranean and the Black Sea.

Decarbonization is the process of reducing and eliminating as far as possible greenhouse gas (GHG) emissions, in line with the Paris Agreement goal of limiting the average global temperature rise to 1.5 °C above preindustrial levels.

Every major industry has a part to play in these efforts, marine industries included. The GFCM has taken a proactive approach to the issue by launching a forward-looking initiative to work towards decarbonization of the regional fleet.

By the end of the first workshop within this initiative, participants agreed on a set of future steps for decarbonizing the Mediterranean and Black Sea fishing fleet. These will be compiled into a roadmap towards a low-carbon future for regional fisheries.

FOR MORE INFORMATION

- Decarbonization workshop: www.fao.org/gfcm/news/detail/en/c/1634433
- GFCM 2030 Strategy: www.fao.org/gfcm/2seas1vision/GFCM2030Strategy
- The GFCM research programme on Blue crab: www.fao.org/gfcm/researchprogramme-bluecrabs
- Pilot Project on Non-Indigenous Species in the eastern Mediterranean: www.fao.org/gfcm/pilotproject-nis
- GFCM: www.fao.org/gfcm

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ICCAT

International Commission for the Conservation of Atlantic Tunas

ICCAT adopted a resolution on climate change

ICCAT at its 2022 annual meeting adopted **Resolution 22-13 on climate change** to address climate change and its effects on ICCAT target stocks, non-target species and species belonging to the same ecosystem or associated with or dependent upon target stocks in the convention area, as well as any related socioeconomic or other impacts on the fisheries, including on contracting parties and collaborators and their fishing communities.

To initiate work on climate change in ICCAT without delay, the Commission will convene a virtual meeting of relevant experts, scheduled between 11 and 12 July 2023. Specifically, a joint expert's meeting of ICCAT's four Panels and the standing committee of Research and Statistics (in particular, its subcommittee on ecosystems and bycatch). The joint meeting will, inter alia, undertake the following:

a) review the current state of knowledge and information available, including relevant initiatives ongoing in other RFMOs, with an initial focus on the work to-date of SCRS regarding the potential impacts of climate change within ICCAT;
b) identify existing sources of climate-related data and information relevant to the commission and SCRS;
c) identify data gaps and other challenges as well as research needs and opportunities;
d) develop a workplan to guide the commission's work on relevant issues associated with climate change; and
e) recommend, if feasible and appropriate, potential actions that ICCAT could consider taking, including through cooperation with other relevant intergovernmental organizations to address identified needs and challenges, or if more appropriate, actions that CPCs could consider taking individually.

Twenty-third ICCAT special meeting

Three years after the last in-person annual meeting, the International Commission for the Conservation of Atlantic Tunas (ICCAT) met in Vale do Lobo (Algarve, Portugal) to take important decisions on the regulation of ICCAT fisheries, including a novel management procedure for bluefin tuna. This was the first adopted harvest strategy in ICCAT history for this species, and a new conservation measure for South Atlantic shortfin mako shark.

The commission convened to evaluate the results of the 2022 work plan together with the current status of application of the regulatory measures in force and to establish the conservation and management measures for the future. In 2022, full scientific stock assessments were carried out for four species: eastern Atlantic and Mediterranean bluefin tuna (*Thunnus thynnus*), eastern and western skipjack (*Katsuwonus pelamis*), Atlantic swordfish (*Xiphias gladius*) and Northeastern Atlantic porbeagle shark (*Lamna nasus*). In total, 14 new recommendations, four resolutions, and two documents of reference were adopted, covering relevant issues on Atlantic tuna and tuna-like species conservation and fisheries management.


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ICCAT has for the first time in its history adopted a management procedure for Atlantic bluefin tuna. This novel measure, which is the result of the extensive collaboration among scientists, managers and stakeholders should ensure long-term, sustainable and profitable fisheries of both the western stock and eastern Atlantic and Mediterranean stock. The total allowable catch (TAC) for the period 2023–2025 was set at 2 726 and 40 570 metric tons for western and eastern Atlantic and Mediterranean stocks, respectively.

Following the 2021 adopted measure for North Atlantic shortfin mako shark caught in association with ICCAT fisheries, this year, ICCAT agreed on a similar measure for South Atlantic shortfin mako starting in 2023 to end overfishing immediately and to gradually achieve biomass levels sufficient to support maximum sustainable yield (MSY) by 2070 with a probability ranging at least between 60 and 70 percent. The total annual fishing mortality was set to a maximum of 1 295 t until new scientific advice is provided to the Commission in 2024.

New management measures were also agreed for both North and South Atlantic swordfish stocks. For the North Atlantic swordfish, a rollover was agreed, and the TAC for 2023 was kept at the 2022 level (13 200 t), in accordance with SCRS advice. For the southern stock, a TAC of 10 000 t was agreed for the period 2023–2026.

Regarding albacore tuna, the commission adopted a plan for Mediterranean albacore, which implements a 15-year rebuilding plan until 2036 that establishes a TAC of 2,500 t. In addition, ICCAT adopted catch limits for southern Atlantic albacore for the period 2023 to 2026 that includes a TAC of 28 000 t for the period 2023 to 2026.

Albeit the extensive discussions regarding multiannual conservation and management programme for tropical tunas, no progress was achieved. Therefore, an agreement was reached for a simple rollover of the current measure, which implies a TAC for bigeye tuna of 62 000 t for 2023 and the 72-day FAD fishing closure. The annual TAC for yellowfin will remain at 110 000 t. In addition, in order to reduce the fishing mortality of juvenile bigeye and yellowfin tuna, a 72-day fishing closure and the limitation on the use of FADs in 2023 were also kept. Finally, it was decided that an intersessional meeting of Panel 1 will be held in 2023 to review existing measures and, inter alia, develop catch limits and associated catch verification mechanisms for 2024.

The Compliance Committee concentrated on some fundamental issues and adopted a Schedule of Actions for compliance issues in the future and adopted a recommendation on the use of the integrated online management system.

The ICCAT Chair, Mr Ernesto Penas, in his final address, thanked all contracting parties for agreeing on a number of management and control measures for ICCAT fisheries, as well as to protect marine biodiversity, such as the reduction of the incidental catches of marine turtles.
He also highlighted the adopted management procedure for Atlantic bluefin tuna, the new conservation measure for South Atlantic shortfin mako shark, as well as on the progress made on matters related to the fight against illegal fishing and the establishment of a joint surveillance and inspection scheme. He also mentioned that no consensus could be reached on the multiannual conservation and management programme for tropical tunas. Therefore, he urged ICCAT contracting parties to continue bilateral or multilateral consultations to overcome some of the difficulties inherent to the most relevant issues that will be addressed in the 2023 commission meetings. Finally, he thanked the Executive Secretary and his team for the work conducted throughout the year and congratulated him for the renewal of his mandate.

ICCAT expressed its gratitude to Dr Gary Melvin's many years of contribution to ICCAT's scientific work, and specifically as chair of the SCRS for the past four years. ICCAT also welcomed Dr Craig Brown as the incoming SCRS Chair.

Finally, ICCAT expressed its sincerest gratitude to all CPCs and its partners for their valuable contributions to the success of the meeting. ICCAT also thanked Egypt for the invitation to host, between 13 and 20 November 2023, the twenty-eighth regular meeting of the commission.

The meeting was attended by over 400 in-person delegates and 250 more online, from 47 contracting parties, five cooperating non-contracting parties, six intergovernmental organizations, 26 non-governmental organizations and two non-contracting parties.

FOR MORE INFORMATION

- Resolution on climate change (22-13): https://tinyurl.com/24jmem3b
- ICCAT website: www.iccat.int

ICES

The International Council for the Exploration of the Sea

How can the influence of climate change on aquaculture, fisheries and ecosystems be accounted for in ICES advice?

As managers, policymakers and other stakeholders become increasingly aware of the need to consider climate impacts on the marine environment, ICES is exploring strategies and approaches to promote resiliency in fisheries, aquaculture and ecosystems. The enormity of climate change and its wide-ranging nature has meant looking for novel ways to include various climate-driven pressures in our work. In the North Atlantic, we see changes in the distribution and productivity of fish stocks that are challenging the existing fisheries system, especially when fish move between coastal state jurisdictions and the potential fishers change. ICES provides advice on a stock basis, and many of the challenges require advice targeted at opportunities for fleets.
To begin to answer the question of how ICES can provide climate-informed advice, experts gathered in 2021 for a workshop on pathways to climate-aware advice (WKCLIMAD) chaired by Kirstin Holsman, NOAA; Michael Rust, Hubbs-Sea World Research Institute; and Mark Dickey-Collas, chair of ICES Advisory Committee.

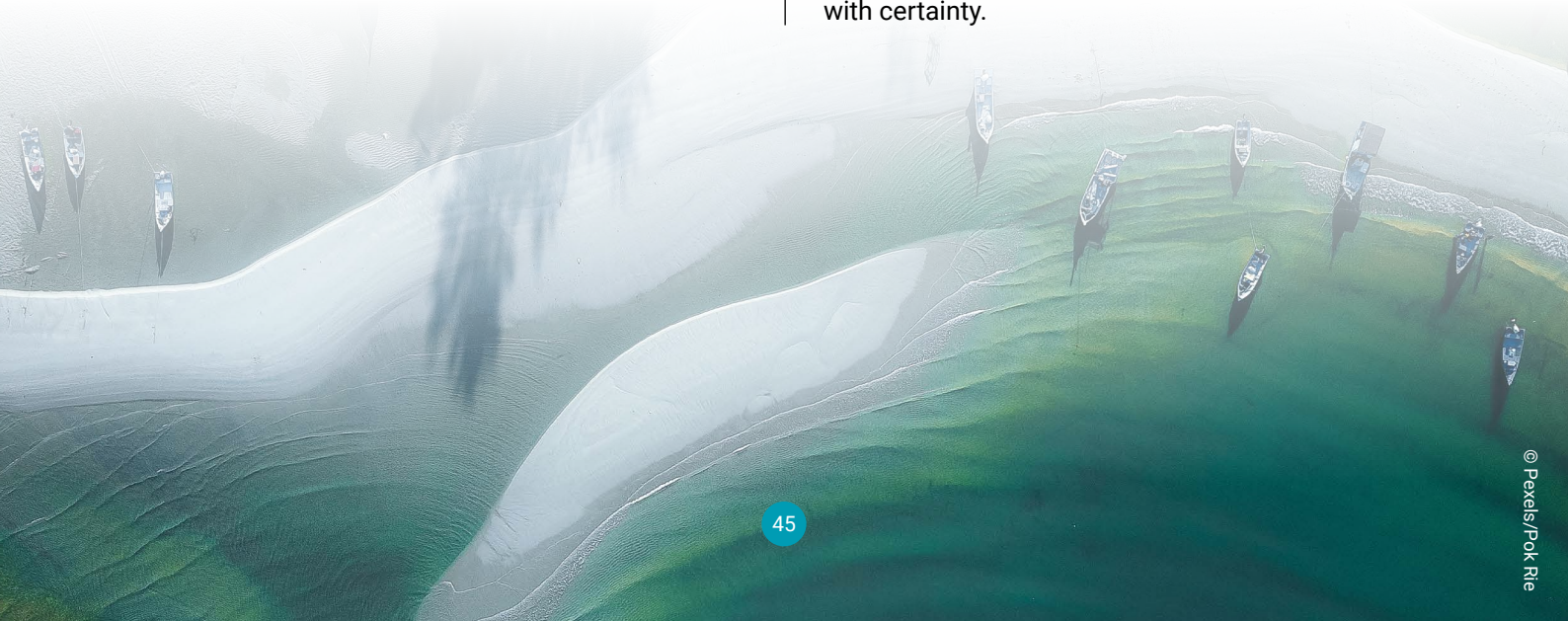
Risk-based framework

Using the work of the Intergovernmental Panel on Climate Change (IPCC) as a basis, WKCLIMAD developed a proposal for an operational climate-aware advisory framework, recommending a risk-based approach that considers the magnitude and likelihood of climate impacts, effectiveness and feasibility of measures.

"A risk-based approach is a tried-and-tested method for planning and helps catalogue impacts and evaluate responses," states Holsmann.
He adds: "The IPCC has used this approach for decades and has assembled much of the foundational information needed in terms of risk, impacts and adaptation effectiveness for fisheries management and aquaculture."

How to move forward?

Accounting for the influences of climate change in ICES advice will require an interdisciplinary approach that considers both ecological and social factors. It also requires a willingness to embrace uncertainty and be flexible in management approaches, as the impacts of climate change are complex and difficult to predict with certainty.

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There are already many data, tools and methods to incorporate climate impacts into ICES advice, but it is important to consider how these are used. “You could use a tool that turns out to be inappropriate for stakeholders, managers or governance environment,” says Holsmann. He adds: “What might seem useful could be unfeasible to implement or ineffective once implemented in advice.” The FAO Strategy and various national approaches provide insights, but ICES has a range of advisory needs on the degradation of the Baltic Sea environment; shifting distributions of fish between coastal States (mackerel); loss of sea ice in the Arctic; and changes in environmental factors that need to be considered when planning new aquaculture sites and must adapt these approaches to our specific challenges.

ICES needs to strengthen scientific evidence in a number of areas, including future scenarios of management options and ecosystem state; risk; vulnerability and resilience analysis of species; ecosystems and human communities; and trade-offs among potential actions.

To do so, we need to attract expertise from beyond our traditional areas of ecosystem and population dynamics and oceanography to help refine goals, explore trade-offs between management objectives and build a common understanding of the system and efficient pathways of action to governance.

“ICES is certainly moving the bar on this as many countries are struggling with how to use the latest climate information in government decision-making,” notes Michael Rust. He adds: “The 2023 Global Risks Report lists the failure to mitigate and the failure to adapt to climate change as its top two risks to the global economy over the next ten years. With WKCLIMAD, ICES has taken a step toward helping the fisheries, aquaculture, and marine ecosystem managers know what changes will need to happen to ease the transition.”

FOR MORE INFORMATION

ICES website: www.ices.dk

IPHC International Pacific Halibut Commission

IPHC´s programme of integrated research and monitoring

The IPHC has developed a five-year programme of integrated research and monitoring (five-year PIRM), which serves to outline the areas of study needed to achieve a holistic approach to continual appraisal of the Pacific halibut population. Specifically, this allows for changes to be detected and researched in a timely manner, which results in the most up-to-date, scientifically based harvest advice for resource managers to consider while making regulatory decisions. The four core focal areas of study at the IPHC are: stock assessment; management strategy evaluation; biology and ecology; and management supporting information, which all interact with one another as well as with fisheries monitoring activities such as the annual fishery-independent setline survey (FISS) and the monitoring and collection of biological data from commercial landings in ports located within the convention area. Knowledge building in one focal area influences and informs application in other core focal areas, also providing insight into future research priorities.

As the effects of global climate change (some of which are predictable such as increasing sea surface temperatures and others that are less predictable such as seasonal hypoxic events) interact with fisheries in various ways, the five-year PIRM allows for the detection and study of these changes in real time. For example, distribution changes within the Pacific halibut population's known range detected during the FISS are then studied within the scope of the space-time model and incorporated into the annual stock assessment. Additionally, the causes of the distribution shift can be researched through environmental and species interaction data collected during the FISS or through targeted research projects. How these changes may impact the longer-term harvest can then be modelled in the management strategy evaluation process.

The secretariat is currently addressing climate change effects on the Pacific halibut population in various ways. Environmental data collected during the annual FISS allows for a direct look at temperature, oxygen, pH, chlorophyll and salinity conditions that the fish on the gear are experiencing. As necessary, some of these parameters can be used as covariates within the space-time model. Within the stock assessment, the two long time series models included in the stock assessment ensemble allow for the Pacific Decadal Oscillation (PDO) to be a binary covariate indicating periods of higher or lower average recruitment. Although the PDO is a climate index that is not necessarily a product of global climate change, knowing how the population responds within these environmental regimes is useful. Additionally, the secretariat is undertaking a synthesis of information with the goal of identifying data that are currently available to address the effects of climate change and to highlight gaps in knowledge that is needed to inform future research plans.

FOR MORE INFORMATION

IPHC website: www.iphc.int

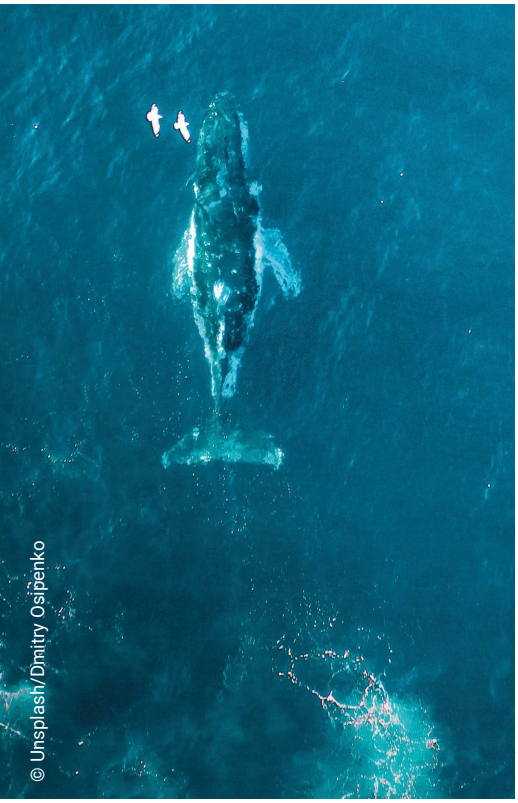
IWC International Whaling Commission

The potential impacts of climate change on whales

The IWC's Scientific Committee first considered the implications of climate change for cetaceans in the early 1990s. Thirty years ago, it was difficult to provide meaningful advice because the availability of key information and predictive power were both limited. The situation has changed dramatically in recent years, as IWC's knowledge of cetacean biology and ability to model population trends have improved.

In 1996, the first of five IWC workshops on climate change took place. Since then, the IWC has assessed the potential impacts on small cetaceans and identified those living in restricted habitats such as estuaries, rivers and shallow waters as finding it harder to adapt to changing circumstances. The Commission has also examined the impacts of increased marine activities on cetaceans in the Arctic where climate change has already significantly altered the marine ecosystem.

Research now shows strong evidence of distributional shifts in some species, which are likely to be the consequence of the changing climate. Whilst this may suggest some ability to adapt, the extent is unknown and may be forcing cetaceans into new waters containing new threats, such as moving into shipping lanes or areas of concentrated fishing activity.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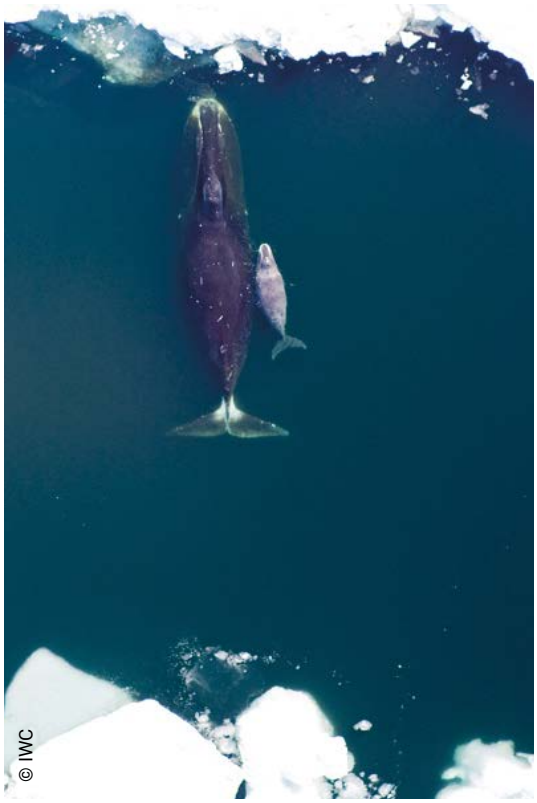
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The most recent IWC workshop reported in 2022: This reviewed the latest scientific research and assessed both observed and predicted effects of climate change on cetaceans. Recommendations included prioritization of future research on regions experiencing intense climate change impacts, which are also key cetacean habitats. The workshop also highlighted the importance of partnerships and collaboration.

In 2022, the commission established a new Intersessional Group on Climate Change under the auspices of the Conservation Committee. Working alongside the Scientific Committee, the new group's role is to provide advice on tools to mitigate the impact of climate change on cetaceans and build resilience.

In related work, the IWC is also working to explore the ecosystems services that whales provide, including how they may trap and store carbon and help in the distribution of nutrients.

In 2021, the IWC held a virtual workshop to review existing economic and social valuation techniques for the ecosystem services provided by cetaceans and to identify potential new methods for assessing their contributions. Participants included social scientists and economists as well as specialists in marine ecology and cetacean biology. The group developed a prioritized list of approaches for incorporating the contribution of cetaceans to marine ecosystem function into the decision-making processes of the IWC and other relevant organizations.

FOR MORE INFORMATION

https://iwc.int

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NAFO

Northwest Atlantic Fisheries Organization

The latest from NAFO

Over the past year, NAFO has been busy with a full meeting schedule, including the return of in-person meetings for the first time since the beginning of the global COVID-19 pandemic. Since this time, NAFO has adapted to a more hybrid style of meetings, allowing participation both in-person and online while retaining some meetings on an online only basis.

In the spring of 2022, NAFO hosted both the NAFO Standing Committee on International Control (STACTIC) Intersessional Meeting and the Meeting of the NAFO Scientific Council and its Standing Committees, in-person in Halifax, Canada. This marked a milestone for the organization as it was the first time that meeting participants met in-person in two years. Additionally, it was the first time that delegates were able to meet and visit the new NAFO headquarters location in downtown Halifax. NAFO officially switched headquarters locations in the spring of 2020, but due to pandemic restrictions, had limited guests.

Following the spring meetings, NAFO held two joint commission and scientific council meetings in Halifax, Canada. In August, the NAFO Joint Commission-Scientific Council Working Group on Ecosystem Approach Framework to Fisheries Management (WG-EAFFM) and the Joint Commission-Scientific Council Working Group on Risk-based Management Strategies (WG-RBMS) both met for a week-long meeting period. Each working group also held a workshop during this time, which was a great opportunity for fisheries managers and scientists to explore ecosystem objectives and precautionary approach measures in the collaborative environment that these working groups provide.

In September 2022, NAFO held its annual meeting in Porto, Portugal. This meeting was the first annual meeting that was fully hybrid, giving delegates the option to attend online as well as in-person to alleviate pandemic travel restrictions. During the meeting it was business as usual, and the total allowable catch and quota decisions were set. The meeting also provided decisions focusing on the ecosystem approach to fisheries management and on precautionary approaches and frameworks, respectively. Notably, it was decided to adopt a management strategy evaluation workplan for both Greenland halibut in Divisions 2J+3KLMNO and redfish in Divisions 3LN and to prohibit the landing and retention of Greenland sharks in the NAFO Regulatory Area. NAFO also selected Brynhildur Benediktsdóttir from Iceland as the new executive secretary for a four-year term beginning in January 2023, replacing the outgoing Executive Secretary, Fred Kingston, who retired after nine years at the NAFO Secretariat.

Throughout the year, NAFO hosts many working groups, both online and in-person and works with various international organizations. We look forward to seeing many of our delegates in 2023, both in-person and virtually and to continuing our collaborative relationships with the international community.

FOR MORE INFORMATION

- NAFO website: www.nafo.int
- Disturbance Workshop: https://nammco.no/scientific-workshops-symposia-reports

NAMMCO

North Atlantic Marine Mammal Commission

Effects of climate change on marine mammals and marine mammal users

Marine mammals and the peoples depending on them are faced with the severe consequences, direct and indirect, of climate change. The sea ice loss and warming of sea water represents a challenge for many species in the NAMMCO management area. Poor ice conditions are problematic for all seal species that use ice as platforms to pup, nurse, molt and haul out. Bowhead whales, narwhals and belugas cannot expand northward as waters get warmer while boreal species, such as killer whales move north due to increased predation pressure. Other dolphin and baleen whale species (increased food competition and influx of new pathogens). Such direct effects cannot be managed, but their cumulative effect must be considered when predicting population trajectories. The importance of the changes and how they generate cascading effects on the ecosystem is illustrated in a recent publication co-authored by three members of the NAMMCO Scientific Committee describing the regime shift in the Southeast Greenland marine ecosystem resulting in reduction in abundance and catches of narwhals and walruses (Heide-Jørgensen *et al.*, 2023.

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The loss of sea ice in the Arctic has resulted in new and amplified oil and gas exploration, mining activities and ship-related activities. The consequential disturbing of the habitat (e.g. increased pollution, noise and ship traffic) can potentially be detrimental to the affected species and must also be accounted for in future management. NAMMCO recently addressed cumulative effects in the Joint NAMMCO-JCNB 2022 Disturbance Workshop (https://nammco.no/scientific-workshops-symposia-reports). The workshop assessed the impact of shipping and mining activities related to the Mary River iron ore mine on marine mammals in Baffin Land in Canada and the ilmenite and titanium mine project in Wolstenholme Fjord in Northwest Greenland.

Climate change and retreating ice consequences for harp seals

Traditional breeding ice

Lack of adequate breeding ice

Consequence of bad and reduced ice - mass mortality of harp seal pups

The management recommendations included extending ship speed regulations to the south of the beluga migration route, creating buffer zones around narwhal summer aggregations and implementing traffic corridors to protect the migration routes and wintering habitats of narwhals.

Climate change not only poses a threat to marine mammals, but also to the humans using them. Increasingly, management advice must take into consideration that hunters and communities who rely on marine mammals for food and source of income will be, and in some areas are, facing food insecurity due to retreating sea ice and possible displacement of marine mammal populations. How this will be considered is yet unknown, but NAMMCO has taken action to establish a working group to involve users in the decision-making process. The focus is on how to coproduce knowledge by stakeholders (users, scientists and managers) to obtain the best ecosystem, including humans-based management of marine mammals and their use by the people that utilize them. The expectation is that the working group will be able to give invaluable information on how to balance sustainable marine mammal stocks and users' food security.

FOR MORE INFORMATION

- NAMMCO/JCNB Disturbance workshop: https://nammco.no/scientific-workshops-symposia-reports
- NAMMCO website: https://nammco.no

NASCO

North Atlantic Salmon Conservation Organization

NASCO's efforts on climate change

The best available scientific information on climate change

NASCO is an intergovernmental organization whose members are the contracting parties of the 1982 Convention for the Conservation of Salmon in the North Atlantic Ocean. Our objective is to conserve, restore, enhance and rationally manage Atlantic salmon through international cooperation while taking the best available scientific information into account.

NASCO has been engaging with the best available scientific information in relation to climate change and wild salmon for decades. As early as 1991, "Climate change and salmon stocks" was on the Agenda of the Council Annual Meeting. The CNL(91)45 report (NASCO, 1991) stated that:

Salmon may be particularly vulnerable to global warming because of its life cycle which includes a phase in cold freshwater. The Council agreed that they should keep the evidence on climate change and its impacts on salmon stocks under review (NASCO, 1991).

In 2012, the Second Performance Review of NASCO (NASCO, 2012) (https://tinyurl.com/yp58ku5s) said NASCO should consider cross-cutting issues, such as climate change, and the Secretary reported on the 2011 "Salmon Summit". The Report of the 2012 Annual Meeting (NASCO, 2012) (https://tinyurl.com/tr8xn2y2), stated:

Over the last forty years, increased mortality at sea, linked to a warming climate, has resulted in a dramatic decline in the abundance of Atlantic salmon. Since management options in the ocean are limited … the goal should be to maximize the number of healthy wild salmon that go to sea by focusing actions on impact factors in fresh, estuarine and coastal waters (NASCO, 2012).

In 2016, initiated by NASCO, the International Council for the Exploration of the Sea (ICES) held a workshop to quantify possible future impacts of climate change on salmon stock dynamics. The report provided an excellent climate change overview, and the findings were presented to the Council in June 2017 (NASCO, 2017).

In 2019, a two-day symposium entitled "Managing the Atlantic Salmon in a Rapidly Changing Environment: Management Challenges and Possible Responses" was hosted by Norway. It focused on the challenges facing Atlantic salmon and possible responses.

A theme-based Special Session (TBSS) will take place in June 2023, entitled "Informing a Strategic Approach to Address the Impacts of Climate Change on Wild Atlantic Salmon". The objective is to exchange information on the current and future impacts of climate change on salmon productivity in the North Atlantic and on management measures being implemented by NASCO parties and jurisdictions to identify best practices and inform the development of a strategic approach by NASCO. A report by the TBSS will include recommendations to the Council of NASCO. The report will be available in winter 2023.

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Actions relating to climate change

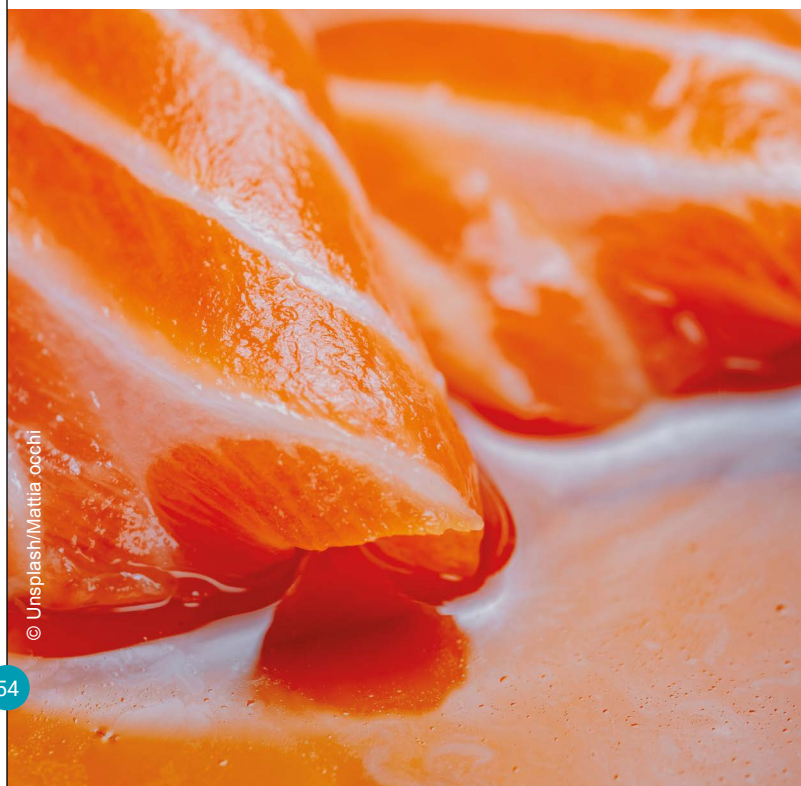
NASCO utilizes this knowledge base in its Third Reporting Cycle (https://tinyurl.com/5a6jh4mz) process to take action. Over the years, NASCO has adopted resolutions, agreements and guidelines that address key areas of concern for wild salmon. Each NASCO party and jurisdiction submits an Implementation Plan (IP) for meeting the objectives of these agreements. They report on the steps taken under their plans annually.

Many actions included in parties' and jurisdictions' plans already address adaptation in the face of climate change. However, NASCO is now considering its response to its Third Performance Review, including recommendations relating to the pressures of climate change.

Therefore, in the coming months NASCO will be considering the latest scientific advice and expert recommendations on climate change. We will be taking decisions on how to make further progress in conserving, restoring, enhancing and rationally managing Atlantic salmon in light of challenges posed by climate change.

FOR MORE INFORMATION

- First Reporting Cycle
- Third Reporting Cycle (2019–2024) https://nasco.int/conservation/third-reporting-cycle-2
- Fortieth NASCO Annual Meeting https://nasco.int/annual-meeting/fortieth-annual-meeting-2023
- NASCO website: https://nasco.int
- Report of the Third NASCO Performance Review: https://tinyurl.com/27n4b4vp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NEAFC

North-East Atlantic Fisheries Commission

News from NEAFC

NEAFC is the intergovernmental organization responsible for fisheries management in international waters in the Northeast Atlantic. Its contracting parties are Denmark (in respect of the Faroe Islands and Greenland), the European Union, Iceland, Norway, the Russian Federation and the United Kingdom of Great Britain and Northern Ireland.

NEAFC had its forty-first annual meeting in November 2022, fully face-to-face, after the difficulties of the pandemic and a hiatus in some of the subsidiary bodies meetings earlier in the year due to the international situation.

As in most years, NEAFC has adopted conservation and management measures for the year 2023 for a number of major fish stocks on the basis of the latest independent scientific advice provided by the International Council for the Exploration of the Sea (ICES). While the annual measures in place are the usual NEAFC stocks, e.g. mackerel, blue whiting, herring and Rockall haddock, there was also encouraging news on a fishery that had been suspended by NEAFC since 2009. The recovery in biomass of spurdog now meant that ICES was able to advise a total allowable catch of 17 000 tonnes to be taken each year. NEAFC welcomed the news that a management action had indeed resulted in the recovery of the fishery. However, it also noted that the fishery would need to be very carefully managed to ensure that the recovery continued. Another shark species, the porbeagle, appeared to be showing the first signs of recovery since NEAFC banned targeted fisheries in 2011, but no fishery has restarted on this species, given the precautionary nature of the advice and the low productivity of the stock.

NEAFC acknowledges that its agreements for the main stocks are not comprehensive, given that allocations of the Total Allowable Catch to each contracting party have not yet been set for 2023. Important consultations on the pelagic stocks are continuing between the Coastal States.

While the focus for the stock management measures is related to the economic, social and environmental objectives of these fisheries, NEAFC also has stock and habitat conservation measures in place, including for the protection of vulnerable marine ecosystems (VME), such as deep-sea corals and sponges. It has for many years closed bottom fisheries in all areas where VME are known to occur or likely to occur according to scientific advice. This year's scientific advice from ICES included the usual check that there was no evidence to justify a change to closed areas. In addition, following the advice, NEAFC agreed to renew all the VME closed areas for a further five years till the end of 2027. At the same time, an existing bottom fishing area in the Barents Sea was expanded by NEAF in 2023 to enhance its control of transhipment activities of fish caught in the regulatory area, wherever the subsequent transhipment occurs. It also is currently reflecting on how its regulations could be updated in light of the recently agreed FAO guidelines on transhipment.

FOR MORE INFORMATION

NEAFC website: www.neafc.org

NPAFC

North Pacific Anadromous Fish Commission

News from NPAFC

Over the last five years, the International Year of the Salmon (IYS) programme has gained a wealth of knowledge from work done throughout the North Pacific and North Atlantic which will help identify critical knowledge or method gaps and potential solutions in effective salmon management. The success of the IYS was driven by a partnership of over 30 partners from government, academia, NGOs and private industry across the North Pacific and North Atlantic Basins.

The IYS 2022 Expedition Preliminary Results Meeting took place between 2 and 3 October 2022 at the Vancouver Convention Centre. Thirty in-person participants and another thirty online from Canada, Japan, the Russian Federation and the United States of America presented and discussed preliminary results from the expedition, compared results with those from the 2019 and 2020 IYS cruises and discussed future publications. Attendees of this meeting expressed their enthusiasm to continue international collaboration over analysis and data sharing.

On the same dates, the Northern Hemisphere Pink Experts meeting featured presentations and discussions around the core questions of: (i) How has pink salmon distribution changed over the past 70 years? (ii) What are the mechanisms behind pink salmon expansion and colonization? (iii) What are the research and management priorities? and (iv) What are the next steps for managers? Featuring experts from the Western and Eastern Pacific, Arctic and Western and Eastern Atlantic, the group later presented a synthesis presentation at the 2022 IYS Synthesis Symposium based on the outcomes of this meeting.

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The secretariat prepares the summary documents of outcomes from both meetings which are set to be published in the NPAFC technical report series.

NPAFC cohosted the academic portion of the International Gathering of Indigenous Salmon Peoples on Monday, 2 October at the Musqueam (xʷməθkʷəy̓əm) Cultural Center. There was a three-day event to bring together Indigenous salmon peoples from across the Northern Hemisphere. The event included a cultural gathering and a day for sharing experiences, which preceded the academic portion. Indigenous peoples from Norway, Finland, the Russian Federation, Alaska and Atlantic and Pacific Canada presented their academic research on issues which were specific to localized Indigenous territories and salmon rivers which they have sustained, and which have been integral to their cultures and worldviews since time immemorial.

The IYS Synthesis Symposium "**Salmon in a Rapidly Changing World: Synthesis of the International Year of the Salmon and a Roadmap to 2030**" was the culmination of over 13 workshops and symposia, three historic high-seas expeditions and over 80 associated events across the North Atlantic and North Pacific basins. Salmon scientists, managers, and knowledge holders from across the Northern Hemisphere will have an opportunity to connect and engage with over 50 live academic; management-focused and Indigenous-led talks; 35 prerecorded; 13 poster presentations; and plenary discussions touching on a range of diverse topics around salmon research and management and organized under the five IYS research themes. Following the symposium, a voluntary feedback survey was distributed to all 212 attendees. The aim of the survey was to understand whether there is value in including this type of event in the roadmap to 2030 and any improvements that should come with it. The IYS Symposium proceedings will be published in the NPAFC Bulletin #7 in autumn.

The International Year of the Salmon idea architect, Dr Richard J. Beamish was honored at the symposium opening session with a glass sockeye salmon sculpture symbolizing a long way, big efforts and desired outcome of the IYS.

Famous Canadian salmon scientist Dr Richard J. Beamish accepts a glass sockeye salmon sculpture from the NPAFC Executive Director, Vladimir Radchenko.

FOR MORE INFORMATION

International Year of the Salmon: https://yearofthesalmon.org

NPAFC website: https://npafc.org

PICES

North Pacific Marine Science Organization

News from PICES

Sonia Batten, Executive Secretary

The North Pacific Marine Science Organization (PICES) is an intergovernmental science organization rather than a Regional Fisheries Management Organization, but it partners with the commissions with whom it shares an area of interest, both geographic and scientific, in order to coordinate and integrate research from the climatic, physical and biological foundations of the ocean system to the dynamics of higher trophic levels, including fisheries and human communities. These partnerships enable PICES to provide the scientific basis for policy decisions that the RFMOs and national agencies must determine and receive input on the science and information needs that are required for effective and sustainable resource management.

Climate change and its impacts on the processes and ecosystems of the North Pacific is, of course, a priority area of focus for us with many PICES events and expert groups incorporating climate change research and concerns into their activities. Examples of those that are currently focused on such work can be found below with links to where more information can be found:

- **Joint ICES/PICES working group on impacts of warming on Growth Rates and Fisheries Yields (GRAFY) WG45**: The aim of WG-GRAFY is to determine whether temporal trends in individual growth rates of marine fish are consistent with the Temperature Size Rule (the TSR proposes that fish living at warmer temperatures will have rapid early growth but lower adult size) and if so, evaluate the impacts of these responses for fisheries' yields.

© Sonia Batten

- **Working group on climate extremes and coastal impacts in the Pacific WG49**: There is a clear need to better understand the physical drivers and assess the predictability of marine heat waves and other extreme events, such as heavy rainfall, typhoons and coastal inundation and to be more prepared to resolve the socioeconomic impacts resulting from these events. Coastal communities around the Pacific Rim, which are highly reliant on coastal ecosystem services are particularly vulnerable to these extreme events and in need of a suite of potential solutions to these climate-driven changes.
- **Section: Climate change effects on marine ecosystems, a joint expert group with ICES Strategic Initiative on Climate Change Effects on Marine Ecosystems S-CCME**: This is a long-term expert group, established in 2011, to:
  - Define, coordinate and integrate the research activities needed to understand, assess and project climate change impacts on marine ecosystems.
  - Plan strategies for sustaining the delivery of ecosystem goods and services, and when possible, predictions should include quantifying estimations of uncertainty.
  - Define and quantify the vulnerability and sustainability of marine ecosystems to climate change, including the cumulative impacts and synergetic effects of climate and marine resource use.
  - Build global ocean prediction frameworks, through international collaborations and research, building on ICES and PICES monitoring programmes.

PICES is coconvening the Fifth Effects of Climate Change on the World's Ocean Symposium ECCWO5 with ICES, FAO, IOC and the local host, the Institute of Marine Research, Norway from 17 to 21 April 2023 in Bergen. At the time of writing, we are just a few days away from the opening day, so final numbers are not yet available. The conference is being held in hybrid mode, and over 700 participants from over 60 countries are registered. ECCWO5 will bring together experts from around the world

to better understand climate impacts on ocean ecosystems, the ecosystem services they provide and on the people, businesses and communities that depend on them. The symposium will highlight the latest information on how oceans are changing, what is at risk, responses that are underway and strategies for increasing climate resilience, mitigation and adaptation. It aims to identify key knowledge gaps, promote collaborations and stimulate the next generation of science and actions.

The Basin Scale Events to Coastal Impacts project

In response to the challenges posed by climate change on the people and ecosystems of the North Pacific Ocean, PICES, in partnership with other organizations, such as the North Pacific Anadromous Fisheries Commission (NPAFC) are developing the BECI (Basin-scale Events to Coastal Impacts) project. Frequent extreme events such as ocean heat waves have been observed across the North Pacific Ocean affecting iconic species like salmon, snow crab and Pacific saury. The resilience of fisheries, indigenous peoples and coastal communities will require the ability to adapt to the coming decades of highly uncertain ocean conditions.

BECI is an endorsed project of the UN Decade of Ocean Science for Sustainable Development. Over the timeline of the United Nations Decade through 2030, BECI will develop, test and implement an international ocean intelligence system of monitoring, research and analytical approaches that will provide timely knowledge, predictions and advice to decision makers about the impact of current and future climate on ocean conditions in high seas and coastal socioecological systems, in particular fisheries. Salmon will be an exemplar species, but the system will have broad applicability to species and fisheries in coastal and high-seas regions of the North Pacific Ocean.

In March 2023 we convened a development workshop, with support from many organizations and agencies to bring together around 25 subject matter experts in North Pacific climate, oceans and fisheries science together to complete the first draft of the science plan. The plan will be used to inform a detailed implementation plan and to engage funders and partner organizations. It is intended that BECI be administered as a PICES Special Project.

FOR MORE INFORMATION

- BECI: https://beci.info
- ECCWO5: https://tinyurl.com/zawu8a9t
- Working group 45: https://tinyurl.com/4n8b7h6h
- Working group 49: https://tinyurl.com/yax22pzp
- Working group S-CCME: https://tinyurl.com/3n8vkz4k
- PICES website: www.pices.int
- WG-GRAFY: https://tinyurl.com

PSC Pacific Salmon Commission

PSC´s challenges

As the North Pacific reacts to climate change, salmon productivity and ecology are changing as well. Salmon forecasting and assessment methods should incorporate this change as much as possible, but our parties (Canada and the United States of America) have had mixed success in this arena. The topic is especially timely since the parties will renegotiate a ten-year management framework under the treaty that takes effect in 2029.

The PSC has responded to this challenge through several initiatives:

1. Releasing a report introducing the concept of (and limitations to) incorporating environmental indicators in salmon assessment models. This report (Weitkamp *et al.*, 2021) summarizes discussions from a 2021 PSC workshop on the topic, including recommendations for future action.
2. Completing a comprehensive review (PSC, 2023) of the subregional and species-specific management regimes executed under our treaty to assess the extent to which environmental indicators are used in assessments and forecasts. The review identifies best practices, data gaps and commonalities across the treaty's management chapters.
3. Launching roundtable discussions in 2023 and 2024 among experts in the secretariat, PSC Technical Committees and PSC management panels to discuss the review noted above. Using facilitators, these roundtables will identify methodological changes and specific changes for consideration in treaty negotiations that begin in 2027.
4. Maintaining a series of monthly seminars on climate change, Pacific salmon and associated management challenges. To date, topics have included heat waves and ocean blobs, salmon range expansion to the Arctic, indigenous knowledge systems and management strategy evaluations. Live events are restricted to PSC delegates, but all sessions are recorded and posted on our YouTube channel.

The PSC has also initiated its first Memorandum of Understanding with the North Pacific Marine Science Organization (PICES). The two organizations have a shared interest in Pacific salmon productivity and overlapping geographic areas of focus. The collaboration would contribute to the success of both organizations by:

- → enhancing the current understanding of Pacific Salmon status and trends, climate change impacts and associated management implications;
- → promoting the collection of, and access to, data, models and other information; and
- → identifying gaps in knowledge and needs that should be addressed.

FOR MORE INFORMATION

- PSC YouTube channel: https://tinyurl.com/4v4f7uxz.
- PSC website: www.psc.org

SEAFO

South East Atlantic Fisheries Organisation

A quick update

SEAFO reconvened its physical annual meetings during November 2022 after virtual meetings in 2020 and 2021. The Commission decided to have physical meetings every second year and virtual or hybrid meetings during the years of no physical meetings. The physical meetings should coincide with every second year when stock assessments are conducted by the Scientific Committee.
Fishing activities remain low in the SEAFO Convention Area with two trips each year.
An orange roughy biomass survey conducted on the Walvis Ridge during June 2022 by the RV Dr Fridtjof Nansen did not report any significant amount of orange roughy on the surveyed grounds. Therefore, the current fishing effort is spent on Patagonian toothfish mainly with some effort spent on deep-sea red crab. Exploratory fishing has been conducted for almost ten years, and the results will be used to consider opening new fishing grounds adjacent to existing fishing grounds.

Conservation Measure CM-TAC-01 (2021): on Total Allowable Catches and related conditions for Patagonian toothfish, deep-sea red crab, alfonsino, orange roughy and pelagic armourhead for 2022 and 2023 in the SEAFO Convention Area

The Commission, taking account of the scientific advice provided by the Scientific Committee and pursuant to Article 6 of the convention, has adopted the following measures:

- **Total Allowable Catches:**
  a) Patagonian toothfish: 261 tonnes for subarea D and zero tonnes for the remainder of the SEAFOCA;
  b) Deep-sea red crab: 162 tonnes in Division B1 and 200 tonnes (status quo) in the remainder of the convention area;
  c) Alfonsino: 200 tonnes for the SEAFO CA area of which a maximum of 132 tonnes may be taken in Division B1 (status quo);
  d) Orange roughy: zero tonnes, a four tonnes bycatch allowance in Division B1, and 50 tonnes in the remainder of the SEAFO CA subject to exploratory fishing protocols (status quo);
  e) Pelagic amourhead/southern boarfish: 135 tonnes for the SEAFO CA (status quo).

- **Vessel reporting requirements**
  Each contracting party shall ensure that their vessels fishing in the SEAFO CA shall send reports as cf. Article 10, 11, 12, 13 and 18 of the System of Observation, Inspection, Compliance and Enforcement to the secretariat.

- **Bycatch of alfonsino and pelagic armourhead**
  Taking into account that a highly selective fishery for pelagic armourhead and alfonsino is practically possible by trawl fishery in the CA, the following measures should be applied for trawl fishery, targeting armourhead and alfonsino in the CA:
  a) Any vessels engaging in trawl fisheries targeting pelagic armourhead and/or alfonsino should send daily catch reports to the secretariat.
  b) Based on these daily catch reports, the cumulative catches of armourhead and alfonsino should be closely monitored by the secretariat.
  c) Fishing activities should be developed by first targeting one species (first target species).

FOR MORE INFORMATION

SEAFO website: www.seafo.org

SOUTH EAST ATLANTIC FISHERIES ORGANISATION

REPORT OF THE 19TH ANNUAL MEETING OF THE COMMISSION

30th November – 1st December 2022
Hansa Hotel, Swakopmund
NAMIBIA

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SPC The Pacific Community

From SPC FAME

The WCPFC secretariat's submission to this publication highlights the priority that the Western and Central Pacific Fisheries Commission (WCPFC) has placed on understanding the implications of climate change on both tuna and tuna-like resources and their associated fisheries within the Western and Central Pacific Ocean (WCPO).

The Pacific Community's Fisheries, Aquaculture and Marine Ecosystems Division (FAME), as both the data and scientific services provider to the WCPFC and as the technical advisor to its 27 member countries and territories, has been advising on, supporting and undertaking regional biological and data sampling programmes for over 40 years. This work has been in collaboration with its membership and regional partners, including the fishing industry. It includes the current Pacific Tuna Tagging Programme (PTTP), supported by the WCPFC membership and the Pacific Marine Specimen Bank (PMSB), which houses biological samples taken by members from across the WCPO. These scaled-up, long-term programmes now represent a comprehensive region-wide resource of information and offer a range of opportunities.

They underpin the regional modelling of the impacts of environmental variation, including climate change, on tuna and the pelagic ecosystem.

Bigeye tuna tagged with an archival tag (indicated by the red tag) about to be released

Extraction of a tuna otolith

SPC FAME pioneered the development of the SEAPODYM model, a key platform for understanding the interaction of environment and tuna. SEAPODYM integrates a variety of fisheries, biological and environmental data at a fine spatial scale, including these long-term data series, and is the basis for the evaluations of the potential impact of future climate change on tuna that are described in the WCPFC submission.

The PMSB and PTTP provide critical baseline information to understand and monitor the impacts of future climate change and allow us to develop indicators to identify which climate change pathway the Pacific is on toward identified potential climate-impacted futures and to groundtruth the outputs of the SEAPODYM model to improve our predictive capabilities. Candidate indicators of climate change have been presented to regional meetings in 2022. These will be further refined, and approaches to provide them to managers in readily accessible formats, including online dashboards for national reporting and regional report cards, are being developed.

With the support of regional partners, in particular the New Zealand Government through their climate finance commitment for 2022–2025, these programmes underpin the aim to develop an Advanced Warning System to better forecast climate impacts on tuna, and hence provide advice to support climate-smart regional management decision- making.

FOR MORE INFORMATION

- Ecosystem and climate indicators: https://meetings.wcpfc.int/node/16313
- PMSB: www.spc.int/ofp/PacificSpecimenBank
- PTTP: https://tagging.spc.int
- SEAPODYM model: www.spc.int/ofp/seapodym
- SPC website: www.spc.int

WCPFC

Western & Central Pacific Fisheries Commission

At its nineteenth Annual Session, the WCPFC agreed to prioritize discussions on how best to incorporate climate change and its impacts into the work of the commission and its subsidiary bodies, starting with making climate change a standing agenda item. The WCPFC's first clear recognition of the need to incorporate climate change into its work is reflected in its 2019 resolution on climate change as it relates to the Western and Central Pacific Fisheries Commission, which was led by the 17 members of the Pacific Islands Forum Fisheries Agency.

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Picking up on this momentum, the WCPFC's eighteenth Science Committee in 2022 recommended that "Ecosystem and Climate Indicators" be a standing agenda item for the Scientific Committee's Ecosystem and bycatch mitigation theme session. The United States of America's delegation led the push at the WCPFC's 2022 annual meeting to fully incorporate climate change into the WCPFC's annual work stream, noting that "the impact of climate change will be felt heavily in the Western and Central Pacific Ocean (WCPO), and shifting tuna stocks may result in uncertain food and economic security" (WCPFC, 2023).

The WCPFC's process-oriented decisions around climate change reflect a growing recognition by its members that climate-induced events in the marine environment must be integrated in management decision-making relating to highly migratory fish stocks. The impacts of climate change on fisheries interests of the WCPFC membership will be varied, but the Commission recognized that impacts on economies and livelihoods of its small island developing state and territory members will be especially acute.

With the strong support of WCPFC's Scientific Services Provider, the Pacific Community (SPC) members will benefit from ongoing research and evaluation into the impacts of climate change on tuna stocks and fisheries in the region. SPC's projections show a shift toward the east in skipjack and yellowfin tuna biomass over time, with a large and increasing uncertainty for the second half of the century, especially for skipjack tuna. The impact is weaker for bigeye tuna and South Pacific albacore, with prediction of a wider, warmer and more favourable range of spawning habitat. For albacore, a strong sensitivity to

subsurface oxygen conditions resulted in a very wide range of projected stock sizes and hence large uncertainty in the potential future impact of climate change.

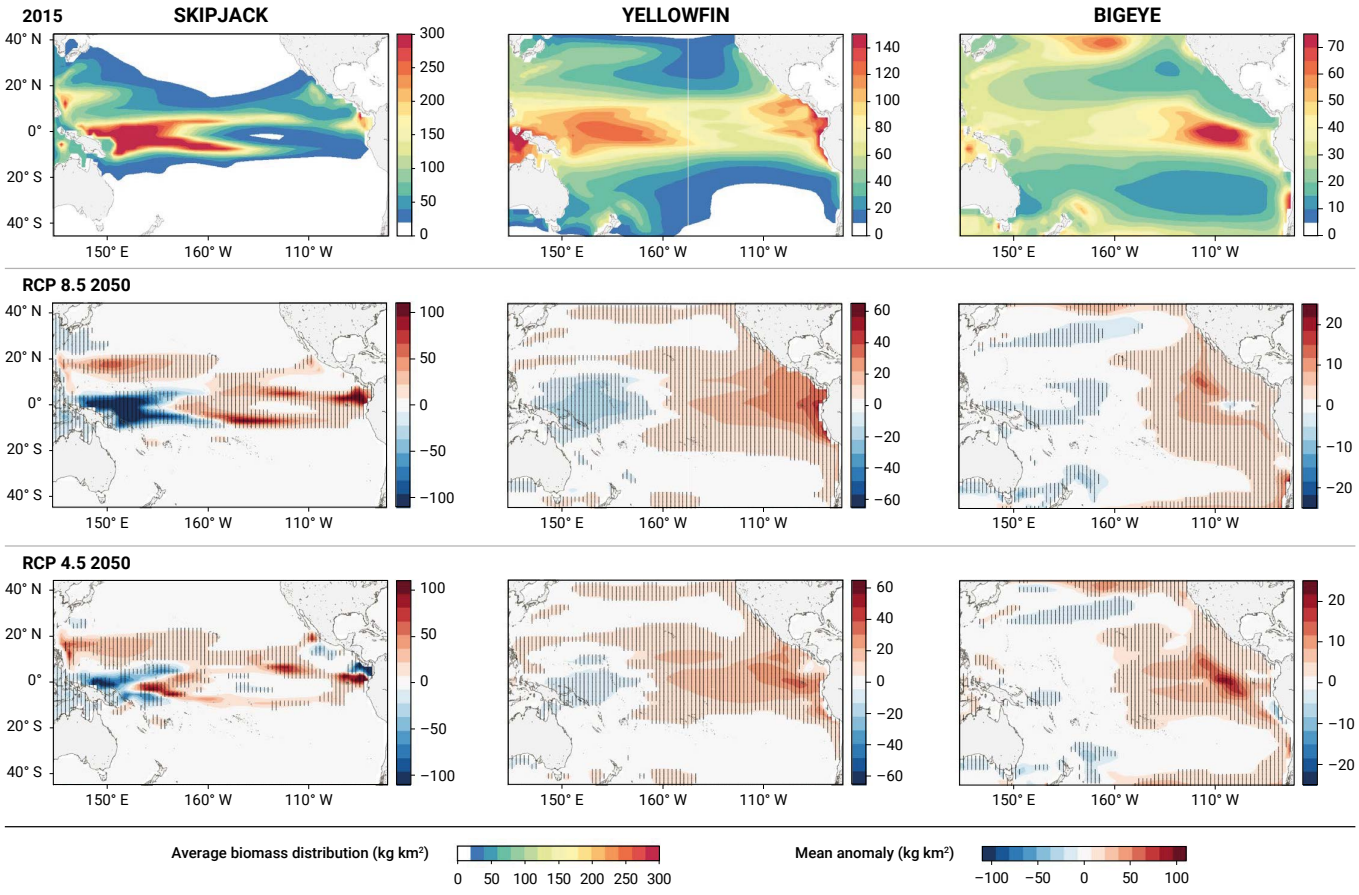
Integration of climate change impacts in fisheries management will be especially important as the WCPFC continues to develop its harvest strategy framework and as the need for an allocation framework increases each year. The WCPFC membership includes some of the most environmentally vulnerable communities in the world whose economic futures are intricately connected with the health and sustainability of the fisheries sector. The threats of climate change to those connections are potentially catastrophic.

The likelihood for significant impacts from climate change, coupled with high levels of uncertainty and variability add to the management complexities facing the WCPFC. Still, the first step of acknowledging the need to make climate change a central theme in commission business is positive news for stakeholders. As ongoing scientific modelling enhances WCPFC's knowledge and understanding of climate impacts on WCPO fisheries, expect to see more comprehensive management decisions in the future.

FOR MORE INFORMATION

WCPFC website: www.wcpfc.int

Figure 2. Projected effects of climate change on the distributions of the three tuna species caught by purse-seine fishing in the Pacific Ocean. Average biomass distributions (kg km^2) of skipjack, yellowfin and bigeye tuna in the Pacific Ocean basin for 2015 (2011–2020) (top row) and mean anomalies (kg km^2) from the average 2015 biomass distribution of each tuna species projected to occur by 2050 (2044–2053) under two emissions scenarios: RCP 8.5 (middle row) and RCP 4.5 (bottom row). Shading indicates areas where projections from all four Earth System Models agree in the sign of change, excluding near-zero changes (white zones). From Bell *et al.* (Nature sustainability 2021 https://doi.org/10.1038/s41893-021-00745-z)



WECAFC

Western Central Atlantic Fishery Commission

Strengthening capacity for climate action: success of inaugural virtual course in the Western Central Atlantic

Eric Wade (FAO)
Yvette Diei Ouadi (FAO)

As the Western Central Atlantic region continues to face the growing challenges of climate change, building capacity and knowledge sharing has become increasingly important. In this regard, the inaugural virtual capacity development course on "Addressing the climate change and poverty nexus" has made a significant contribution towards addressing these challenges. Organized by the FAO Subregional Office for the Caribbean, in collaboration with the Centre for Resource Management and Environment Studies (CERMES) and the Global Institute for Climate Smart and Resilience Development (GICSRD) of the University of the West Indies, the course aimed to equip regional and national partners with the necessary knowledge and tools to implement effective climate and poverty reduction actions in Caribbean Small Island Developing States (SIDS), with a focus on artisanal fisheries. The organization of this initiative took place within the framework and celebration of the International Year of Artisanal Fisheries and Aquaculture (IYAFA 2022) in the region. Indeed, this activity supported the regional theme, Recovery and Resilience, with youth and gender as cross-cutting, that is focused on moving the region towards sustainable development of its fisheries and aquaculture sector. Furthermore, support was provided in part through funding from the European Union Directorate General for Marine Affairs and Fisheries (EU-DG MARE) through the WECAFC secretariat.

Thirty-three participants from 12 countries in the Caribbean region completed the course, comprising 19 women and 14 men from various organizations, including government agencies, statutory bodies, non-governmental organizations and academia. Eight participants received outstanding certificates of achievement for scoring above 90 percent. The course received high marks in evaluations, reflecting its effectiveness in building the capacity of the participants.

The course combined self-paced instruction and live interactive sessions with tutors and resource persons to assist participants in understanding and addressing climate poverty interactions and resilience around Caribbean coasts. Two follow-up and in-country activities in Trinidad and Guyana were initiated to demonstrate the practical utility of the course. A postevaluation will be conducted later this year to determine the use of new knowledge gained from the course.

The success of the course demonstrates its significance in mobilizing resources to deliver practical cobenefits for achieving the Paris Agreement targets and Sustainable Development Goals in the Western Central Atlantic Region and beyond. It is an important step towards promoting sustainable development and fighting climate change in the Caribbean region.

A brief update from WECAFC

WECAFC strategic reorientation: The WECAFC has resumed the work on its strategic reorientation, with the strengthening of the drafting group tasked with developing different text options for the objective and mandate of WECAFC as a Regional Fishery Management Organization/Arrangement (RFMO/RFMA). The first meeting was held in December 2022 followed by a second one on 13 April which saw the review of a proposal for draft text options from a core group led by the chair of the ad hoc Intersessional Working Group (IWG) for the strategic reorientation of WECAFC. It is expected to make tangible progress compared to the last intersession, including a meeting of all members, to review an advanced draft before the 19th Session of the Commission slated for 6 to 8 September 2023 in Jamaica.

Working groups: Since the last RSN Magazine, several working groups met virtually to consider important scientific and management issues. These included spawning aggregations, Queen Conch and in the coming week (17–19 April), the Fisheries using Moored Fish Aggregating Devices (MFADs).

The management recommendations generated by the working groups and other scientific partners will be reviewed by the Scientific Advisory Group (SAG) at its twelfth session slated for June 2023, prior to the nineteenth plenary of the commission.

New project: The European Union DG-MARE successfully reviewed and funded a project proposal to support the secretariat's efforts in coordinating in the area of competence of the commission the work in reversing the decline in the fisheries that aggregate to spawn. The project "Improving ecosystem approach to fisheries by advancing fish spawning aggregation information gathering and increase of public engagement in the WECAFC region" started in January 2023 to be implemented over a 14-months period. Furthermore, preparations are ongoing for additional proposals to the programme on actions relating to the management and development of spiny lobster small-scale fisheries.

IYAFA 2022: The end of the EU-DG-MARE-funded project in support of the celebration of the International Year of Artisanal Fisheries and Aquaculture 2022 (IYAFA 2022) will culminate with a closing event towards a new era of support for small-scale fisheries and aquaculture in the WECAFC region, anticipated during WECAFC19.

VGT: The 2022 FAO Voluntary Guidelines for Transshipment (VGT) were endorsed by the FAO Committee on Fisheries at its thirty-fifth session in September 2022. As part of the series of regional workshops in 2023 to promote the benefits of implementing the VGT and to facilitate discussions amongst States with a view to strengthening concerted action in combatting IUU fishing, FAO with the financial support of the European Union and in collaboration with the Western Central Atlantic Fishery Commission (WECAFC), convened a regional workshop for Latin America, the Caribbean and North America, held in presence in Bridgetown, Barbados from 6 to 10 March 2023.

FOR MORE INFORMATION

WECAFC website: www.fao.org/fishery/rfb/wecafc

SECTION 5

Facts and figures

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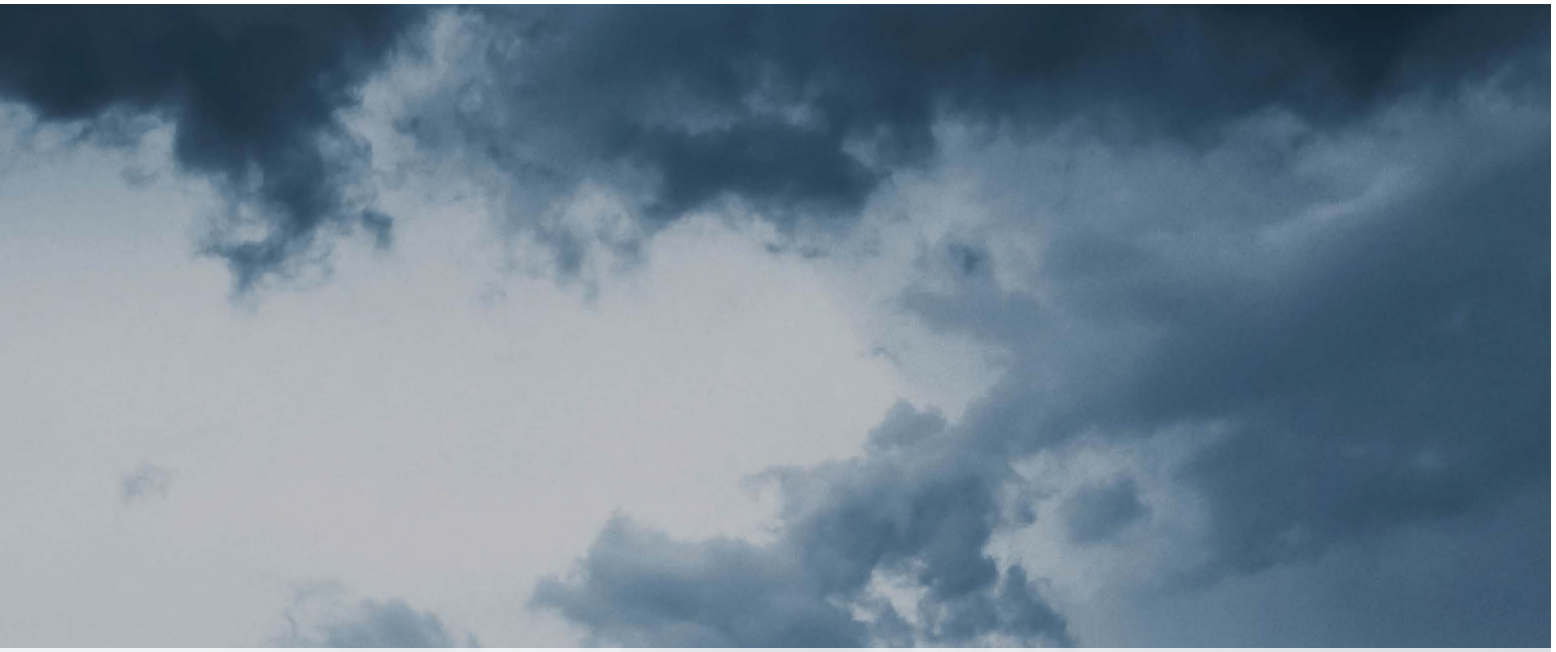

CONTRIBUTIONS FROM:

BOBP-IGO: Bay of Bengal Programme Inter-Governmental Organisation

IPHC: International Pacific Halibut Commission

IWC: International Whaling Commission

NAMMCO: North Atlantic Marine Mammals Commission

NEAFC: North East Atlantic Fisheries Commission

NPAFC: North Pacific Anadromous Fish Commission

SEAFO: South East Atlantic Fisheries Organisation

SPC: The Pacific Community

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BOBP-IGO

Bay of Bengal Programme Inter-Governmental Organisation

Developing strategies for adaptation to climate change by coastal and marine fishing communities

The BOBP-IGO recently concluded this study with the support of the Ministry of Environment, forestry and Climate Change (MoEFCC). Although there is no clinching evidence, the trend shows climate change is negatively affecting the sector. There is evidence of loss from extreme weather events, such as cyclones (e.g. loss of fishing days and destruction of fishing assets, etc.). However, currently, there is no dedicated programme to address these impacts, except providing fixed-rate ex-gratia payments. Similarly, there is an indication of drastic fluctuation in fish stocks due to different ocean-atmosphere oscillations. However, there needs to be a strategy to manage the fishing effort accordingly. Thus, it is risking the fisheries' sustainability.

Marine fisheries insurance for climate risk mitigation in South Asia

The BOBP-IGO, with funding from the World Bank, carried out a study on "Issues, Practices and Opportunities in the Application of Insurance as a Tool for Marine Fisheries Management and to Build Resilience in the Sector in South Asia". The findings show that a product-market misfit and inadequate awareness among key stakes are the leading causes of poor insurance coverage. The study highlighted the need for a proactive governmental engagement with the insurance industries and fishers to break the barrier, bringing down the cost of insurance and developing a parametric insurance programme, preferably encompassing the Bay of Bengal rim countries for covering unforeseen and broad-based climate risks, such as cyclone damages. Policy briefs for each member country of the organization were also developed.

Along with the adaptation measures, the BOBP-IGO is also working on mitigating carbon emissions from the marine fisheries sector by promoting improved vessel design, fuel management and use of alternative fuels.

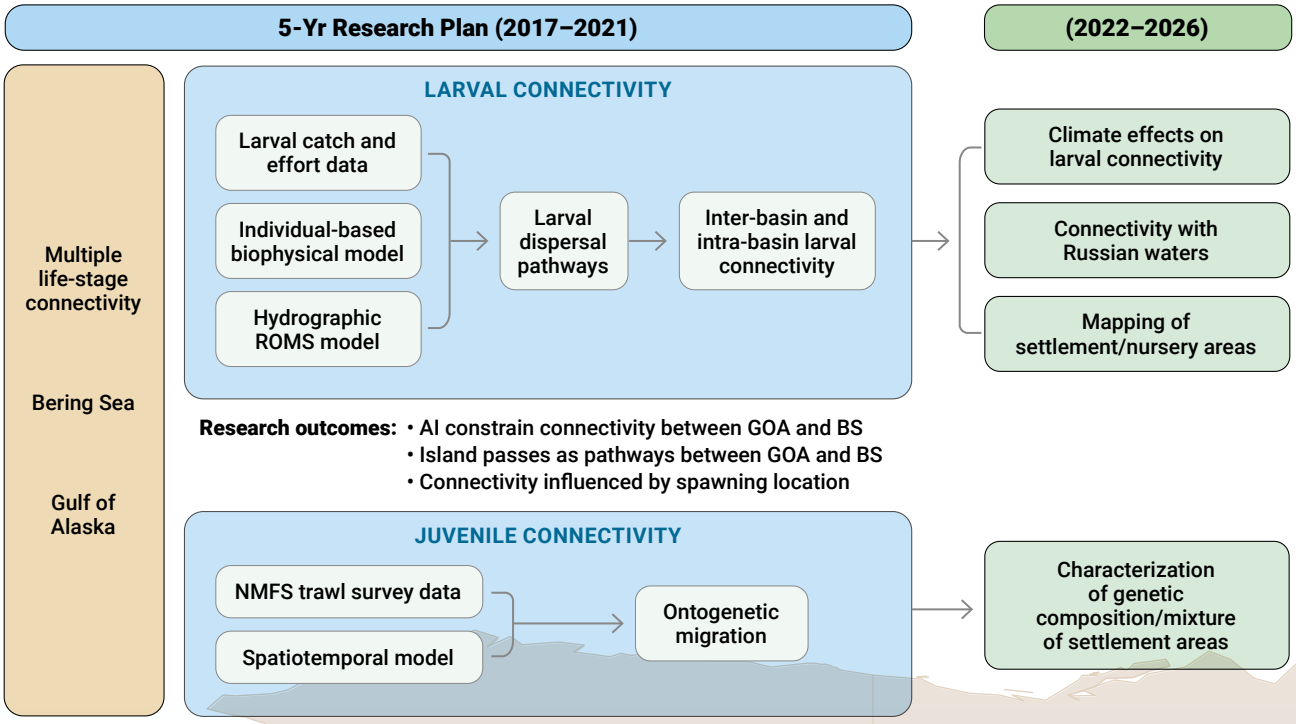
Key findings:

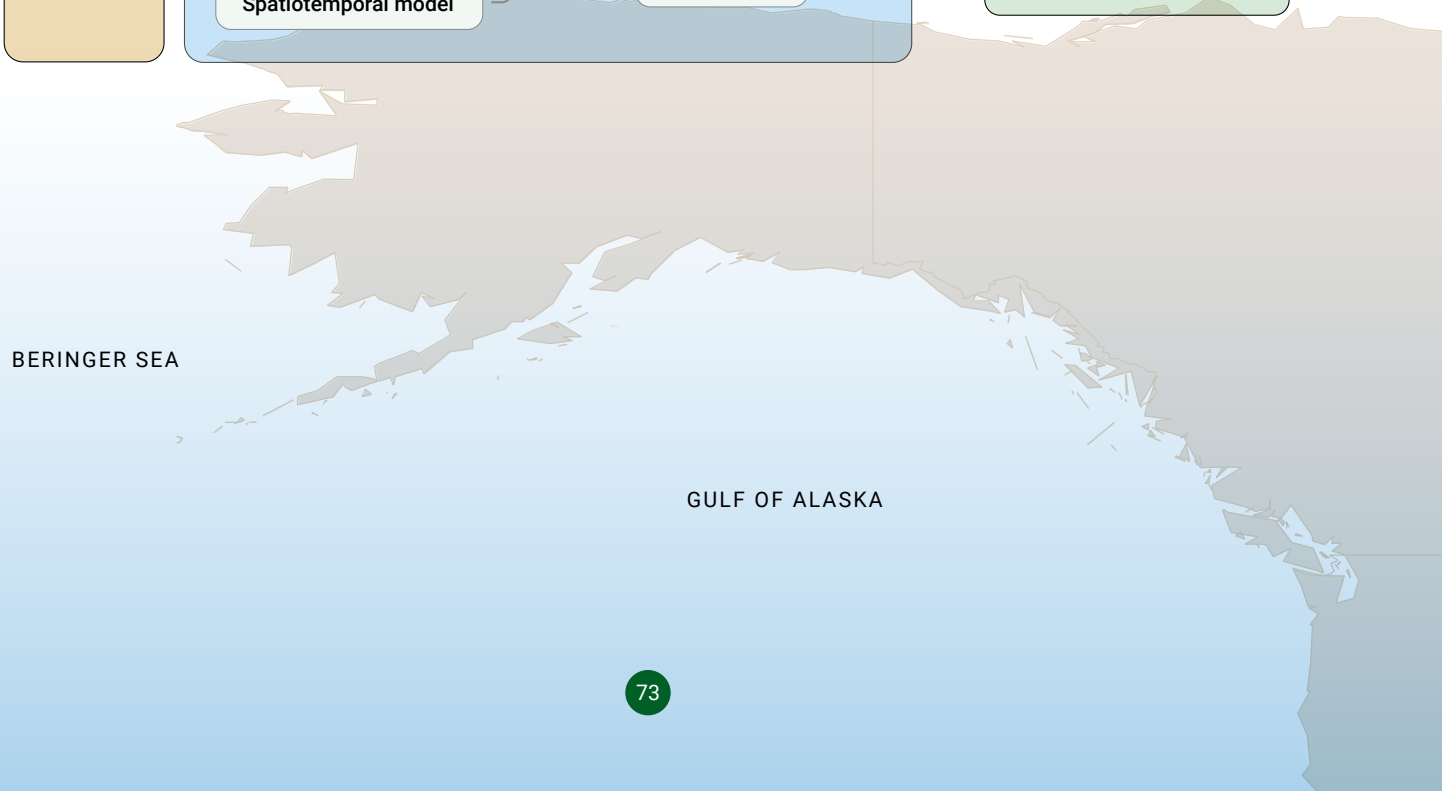
- In the EEZ of India's mainland, the catch potential is projected to decrease by 10.3 and 17.0 percent under RCP2.6 and RCP8.5, respectively, by 2050; and by 7.2 and 43.7 percent under RCP2.6 and RCP8.5, respectively, by 2095.
- In the Andaman and Nicobar Islands, the catch is projected to increase marginally by 0.25 and 1.5 percent under RCP2.6 and RCP8.5, respectively, by 2050; but to be reduced by 1.8 and 50.1 percent under RCP2.6 and RCP8.5, respectively, by 2095.
- The projected decrease in maximum catch potential may be driven by the direct effect of warming on fish physiology through a decrease in their food availability of phytoplankton and zooplankton and loss of habitat.
- India is set to lose 16 to 22 million tonnes of marine fish production over the next 30 years, which is valued at 2.6 to 3.6 lakh crores at 2019 prices, that is, 1–2 percent of the current GDP of the country.
- On average, fishers have been reporting a loss of 10 to15 fishing days in a year, due to bad weather, resulting in a financial loss of about Rs. 158 crores per year in India in aggregate.

IPHC

International Pacific Halibut Commission

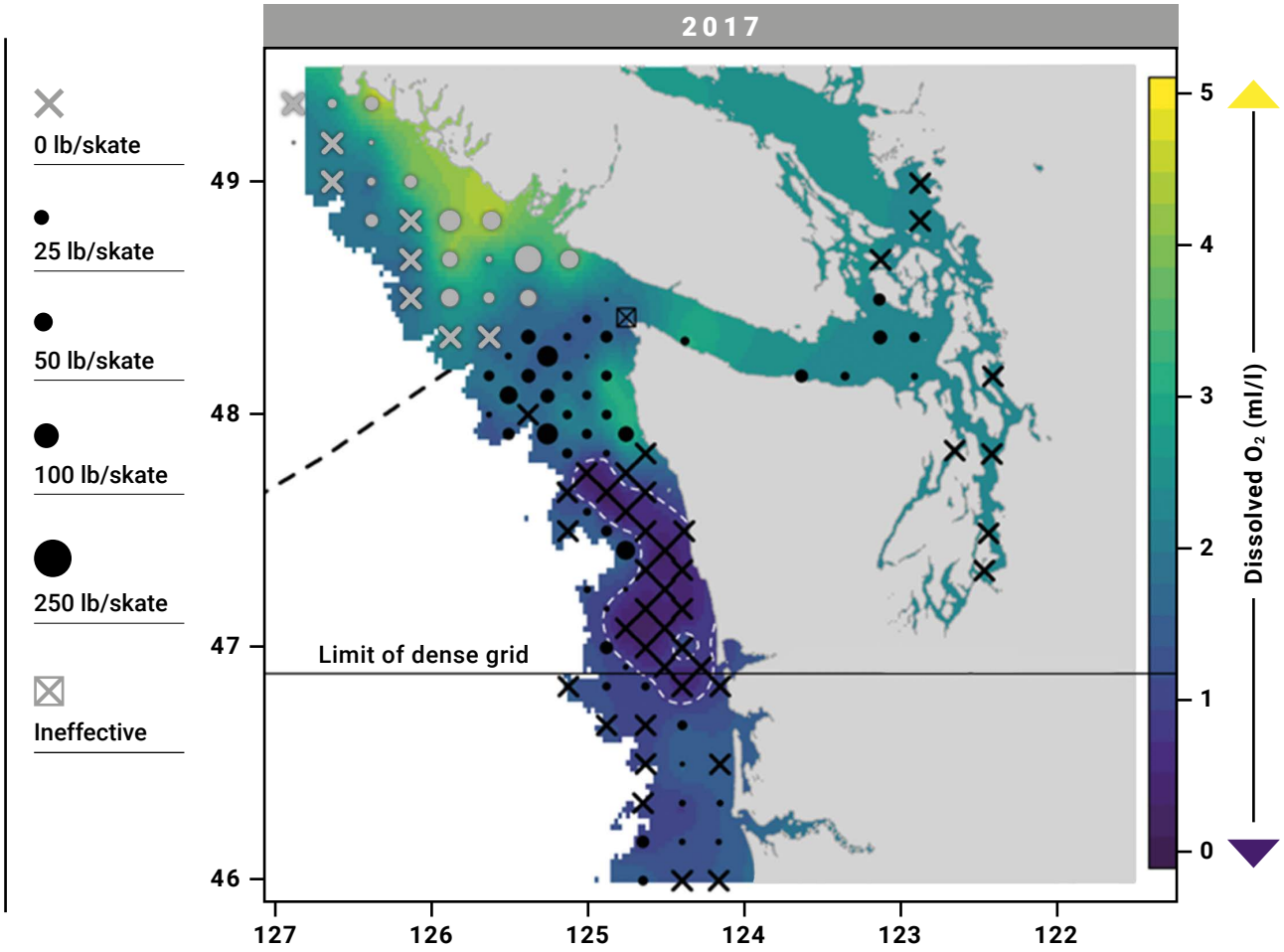
In the mid-2010s, the IPHC secretariat began investigating early life history components of Pacific halibut biology and migration. A study that involved modelling pelagic larval dispersal revealed a strong link between fish spawned in the Western and Central Gulf of Alaska and settlement of a percentage of those progenies in the Bering Sea. Over the next several years, the secretariat will be investigating climate effects on these connectivity and other early life history linkages for Pacific halibut.





A study published in 2014 found that Pacific halibut are largely not found below dissolved oxygen (DO) levels of 0.9 ml/L concentration. Since 2002, at various locations along the west coast of the United States of America, seasonal hypoxia has been detected, and these events are predicted to become more frequent and widespread as a result of climate change. As an example of hypoxia's impact on assessing Pacific halibut, in 2017, a hypoxic event coincided with the IPHC fishery-independent setline survey in that area and resulted in a large grouping of stations with no Pacific halibut catch, illustrating how IPHC environmental monitoring efforts helped to explain the cause behind reduced catch rates that did not necessarily signal reduced abundance.

Figure 3. Estimated dissolved oxygen (DO) in northern Regulatory Area 2A in 2017. Values are model predictions from a spatial model fitted to the 2017 IPHC water column profiler data. O32 WPUE values from the setline survey are overlaid with black symbols. The dashed line shows the 0.9 ml/l contour for DO. Below this threshold, Pacific halibut catch rates have historically been at or very near 0.



IWC International Whaling Commission

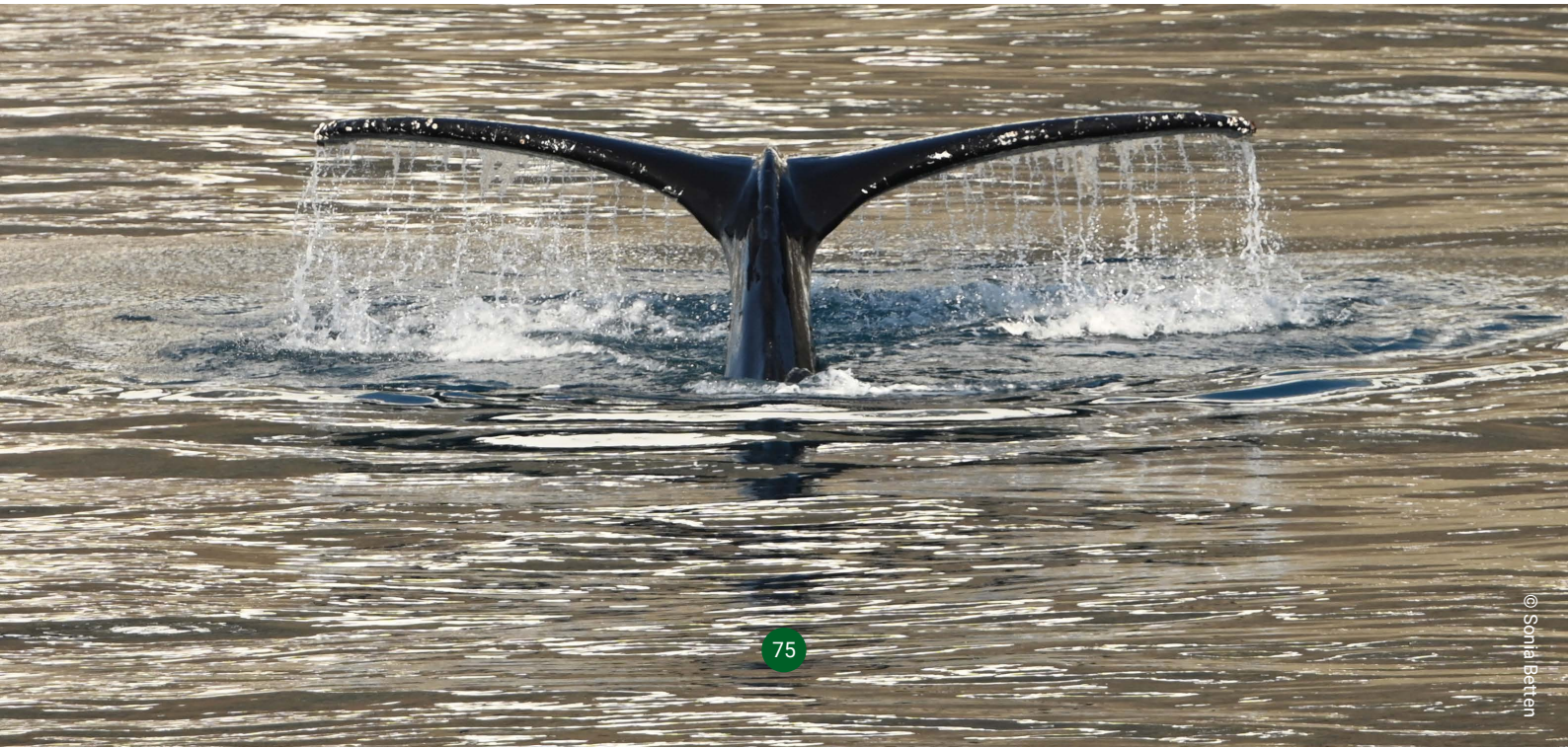
How do whales contribute to reducing carbon in the atmosphere?

First, just as trees capture carbon in the terrestrial ecosystem, whales capture carbon in the ocean ecosystem. A large whale can store a vast amount of carbon over the course of a life that may last 100+ years. When the animal dies, it sinks to the sea bed, "locking-in"this large carbon store for centuries.

Whale excrement performs a second important service to the ecosystem. It acts as a fertilizer for phytoplankton, a microscopic creature that lives at the ocean's surface and is very effective at both capturing carbon and releasing oxygen. The whale's waste contains the iron and nitrogen that phytoplankton need to grow. Whales feed in deep water and come to the surface to breathe, bringing these valuable minerals up to the phytoplankton in a process known as "the whale pump."

Further reading

- **Report of workshop on socioeconomic values of the contribution of cetaceans to the ecosystem functioning** (IWC, 2022) – PDF: https://tinyurl.com/2j996y6r
- **Report of (virtual) climate change workshop** (IWC, 2021) – PDF: https://tinyurl.com/47c6ax4x
- **Report of workshop on impacts of increased marine activities on cetaceans in the Arctic** (IWC, 2014) – PDF: https://tinyurl.com/yuhxx2xj
- **Report of workshop on small cetaceans and climate change** (IWC, 2010) – PDF: https://tinyurl.com/bp6pnjz8
- **Report of the workshop on cetaceans and climate change** (IWC, 2009)
- **Commission Resolution 2009-1, consensus resolution on climate change and other environmental changes and cetaceans** (IWC, 2009b) – PDF: https://tinyurl.com/2rrp9289



NAMMCO

North Atlantic Marine Mammals Commission

NAMMCO-JCNB Disturbance Workshop

An International Disturbance Workshop coorganized by NAMMCO and the joint Canada-Greenland Commission on Narwhal and Beluga (JCNB) was held in Copenhagen in December 2022 to assess the impact of two mining projects in Canada (Mary River Mine and Nunavut) and Greenland (Dundas Mine and Qaanaaq) on the dynamics of local marine mammal populations.

This workshop showed that the shipping of bulk cargo across Baffin Bay had increased due to the Mary River mining operations, and that shipping was projected to further increase in the future due to climate change decreasing ice cover. This increase in disturbance is expected to affect wintering habitats of narwhals (Monodon monoceros), bowhead whales (*Balaena mysticetus*), beluga whales (*Delphinapterus leucas*), walrus (*Odobenus rosmarus*) and bearded seals (*Erignathus barbatus*) and may have negative impacts on their energy budget and populations. Of these, the workshop concluded that narwhals were the most sensitive to ship noise disturbance, based on research results showing physiological stress, loss of feeding opportunities and population displacement of narwhals due to increasing ship traffic: These are negative impacts that will become more common as the Arctic warms.

The increase in shipping across the Arctic facilitated by climate change also raised concerns on the risk of oil spills and releases of other toxic materials in the area, as well as the potential introduction of invasive species and/or parasites.

"A regime shift in the Southeast Greenland marine ecosystem"

(Heide-Jørgensen *et al.*, 2023)

Two major oceanographic changes have recently propagated through several trophic levels in coastal areas of Southeast Greenland (SEG).

First, the amount of drift ice transported with the East Greenland Current (EGC) has decreased significantly over the past two decades, and summer sea ice has virtually disappeared since 2003, leading to a regime shift in oceanographic and ecological conditions in the region. The following 20-year period with low or no coastal sea ice is unique in the 200-year history of ice observations in the region, and the temperature of the EGC south of 73.5 N has increased significantly (>2 °C) since 1980.

Second, the warm Irminger Current, which advects warm, saline Atlantic Water into the region, has become warmer since 1990. The lack of pack ice in summer, together with a warming ocean, generated cascading effects on the ecosystem in SEG that are manifested in a changed fish fauna with an influx of boreal and subarctic species.

At higher trophic levels there has been an increase in the abundance of humpback, fin, killer and pilot whales and dolphins that are either new to this area or occur in historically large numbers. It is estimated that the new cetacean species in SEG consume 700 000 tonnes of fish, annually, with >1 500 000 tonnes of krill also consumed, mainly by fin whales.

Simultaneously, there has been a reduction in the number of narwhals and walruses in SEG, and it is suggested that these species have been impacted by the habitat changes.

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NEAFC

North East Atlantic Fisheries Commission

Climate change is a big challenge for fisheries management and governance in the North East Atlantic

Like all sectors that rely on ecosystem function, climate change is likely to present many challenges to fisheries in the North East Atlantic.

Like all RFMOs, NEAFC relies on good science on which to base its management measures. NEAFC exclusively receives scientific advice from the International Council for Exploration of the Seas (ICES). ICES has recently produced a report on its workshop on pathways to climate-aware advice (ICES, 2023). The report highlights the changes likely to happen both in species and in the social-ecological system. Climate change has impacted metabolism, growth and life histories of marine species and the fisheries and communities that rely on them. The report set out that fishery managers would have to balance needs with other goals in sustainable exploitation of species.

ICES is reporting that while a number of changes were happening, these are gradual in the North East Atlantic. If anything, this makes operational advice for management more difficult in the short term as 10 to 20 trends are not clear enough to affect specific annual catch advice. Even the normal length of long-term management plans are shorter than the clearer and more predictable long-term trends which span 50 years or more. NEAFC will also need to engage with climate-informed advice, which will be within a risk-based framework that considers magnitude and likelihood of impacts, as well as the effectiveness and feasibility of measures.

Fisheries governance reform to address the impacts of changing climate is another message that has resonance for NEAFC. A number of papers have been published that report that the North Atlantic was not doing well in adapting to change. The key example is on the issue of allocations related to large and valuable pelagic stocks, such as mackerel. Whereas mackerel had been seen to move to new areas, such as Icelandic waters in certain years, the Coastal States and NEAFC have been unable to find a way to adapt to such changes in terms of allocation among the parties. The evidence on the changes in mackerel distribution being driven by climate change or some other parameter is equivocal. Nevertheless, clearly, distribution of stocks is likely to change in the future, and NEAFC has so far not demonstrated its ability to deal with this politically.

Given this background, NEAFC's Permanent Committee on Management and Science is, indeed, currently reflecting on this issue. It is, for instance, considering what further information it needs to help it with decision making in terms of advice. In parallel, it is also looking at further developing its implementation of an ecosystem approach to fisheries management, of which climate change will no doubt be an essential element. On the issue of allocations, the Coastal States have currently intensified their negotiations with an aim to resolve the issue as rapidly as possible.

There are, of course, other social and economic aspects to fisheries and climate change impacts for instance, related to mitigation and carbon impacts of different fishing techniques and energy efficiency in vessel fleets etc. However, like most RFMOs, these decisions are carried out at the national level rather than regionwide objectives or measures.

NPAFC

North Pacific Anadromous Fish Commission

Pink salmon in the North Pacific and Arctic regions

Pink salmon are the most widely distributed species of Pacific salmon along the Pacific Rim. On the North American side, significant spawning populations of pink salmon extend from Puget Sound and the Fraser River northward to northwest Alaska. Along the Asian coasts, pink salmon spawn in rivers from northern Honshu Island in Japan and the northern part of the Republic of Korea to the Lena River mouth in Siberia. Feeding areas in the open ocean extend from about 39° N in the Pacific Ocean to the southern Chukchi Sea.

In the 2000s, pink salmon extended their natural distribution range in the marine environment into the Russian Federation and Canadian Arctic. High abundances of juvenile pink salmon were reported from the Chukchi Sea in 2007, suggesting that the Arctic marine ecosystem may provide a viable habitat in some years. Warming temperatures facilitate increased pink salmon production at the northern extent of natural range. In the western Canadian Arctic, pink salmon occurrences increased from the sporadic catch of individual fish prior to 2003 to more catches being reported in both even- and odd- numbered recent years, and across a wider geographic area. Pink salmon have also been reported, although rarely, from the eastern Canadian Arctic (the Cambridge Bay and Nunavut) in recent years. In the Asian Arctic, pink salmon westward penetration was also noted since 2011.

Southern parts of pink salmon distribution range are characterized by a significant decrease in salmon-run magnitudes and catches in recent years when compared to northern ones. Along the mainland North American coast, abnormally warm conditions in the ocean and on land over three years in 2015–2017 and in 2019 were determined by the transfer of overheated waters by the North Pacific Current and by the strongest El Niño in recent years. There are negative consequences of climate warming, such as drought, frequent forest fires or a drop in water level in spawning rivers. These factors led to a decrease of pink salmon-run magnitude and commercial catches in more than 50 percent in statistical areas located at 55° N and southwards. Along with pink salmon expansion into the North Atlantic, this salmon distribution and abundance dynamics are under thorough attention of experts.

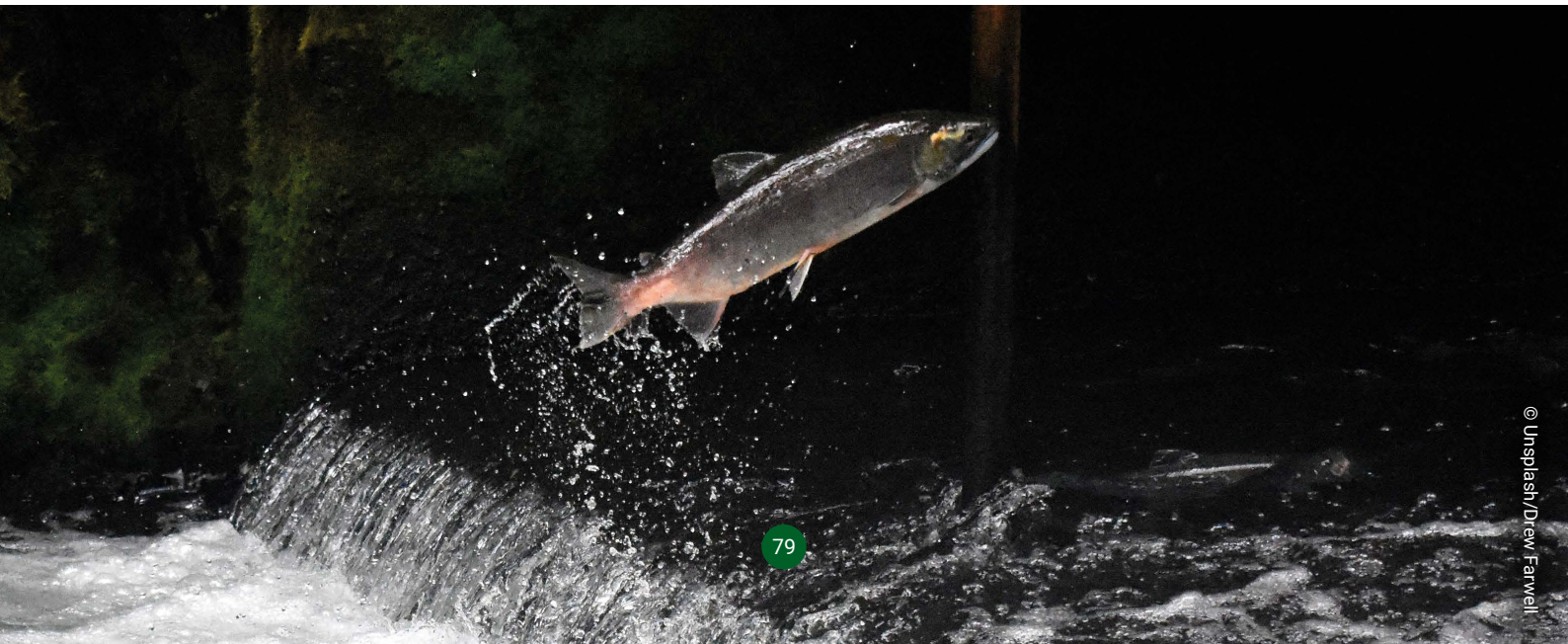
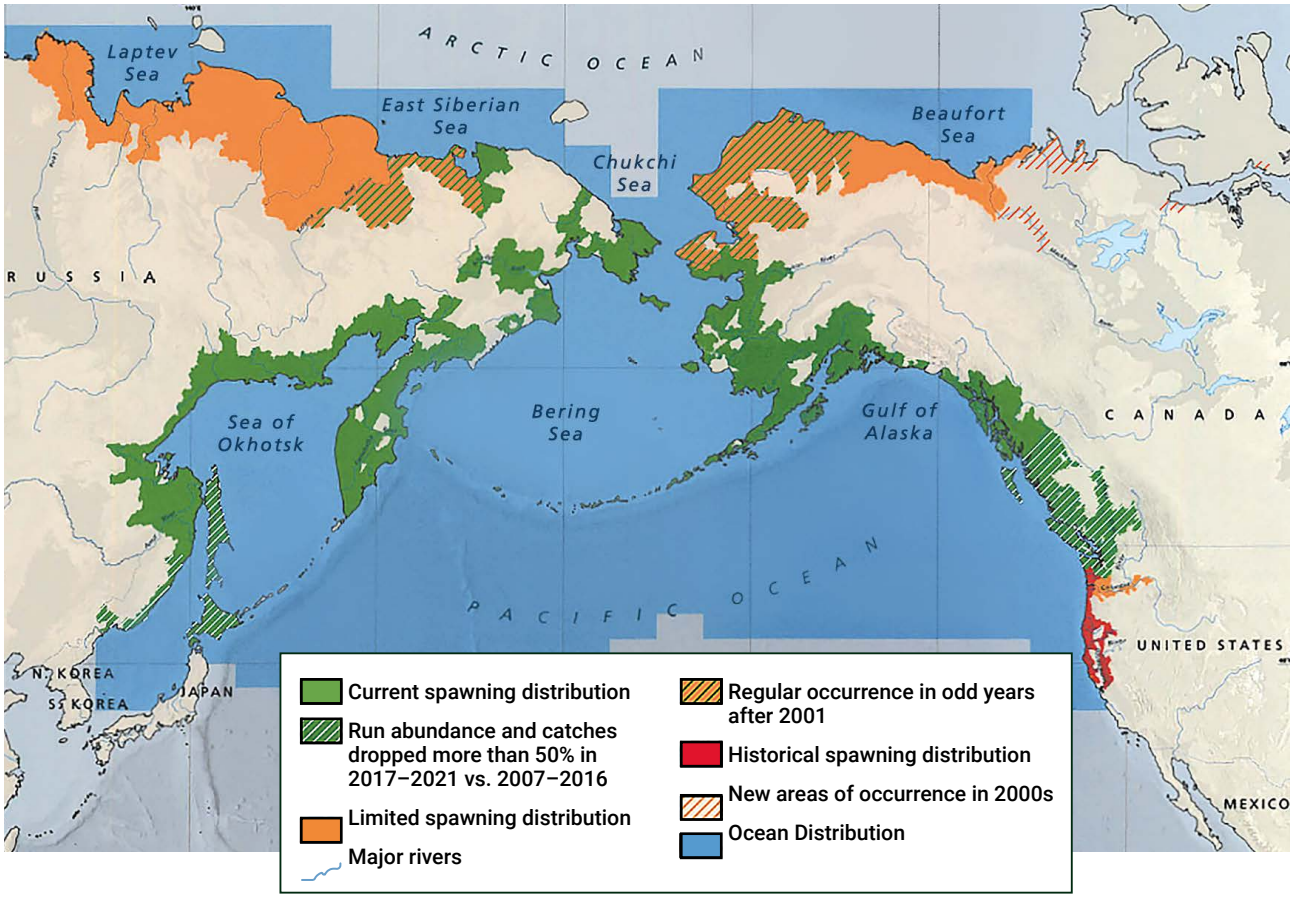
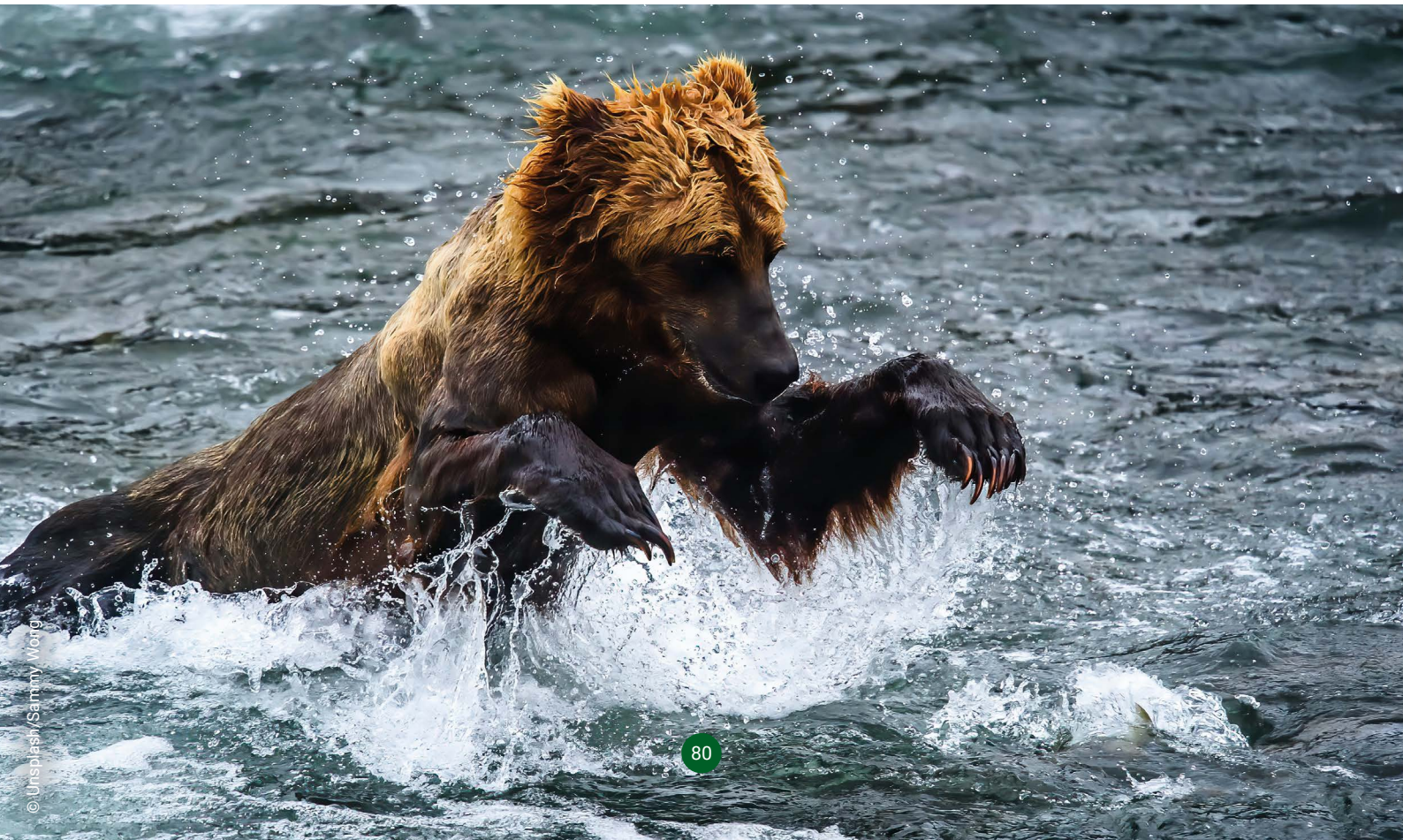


Figure 4. Pink salmon distribution (Augerot, 2005) updated based on the recent reports on its penetration to the Arctic.





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SEAFO

South East Atlantic Fisheries Organisation

In recent years, SEAFO has increasingly recognized the need to address climate change and its impacts on fish populations and ecosystems. Here are some actions that are taken towards climate change:

- Developing climate-change strategies, such as adjusting fishing quotas, protecting essential fish habitats and promoting sustainable fishing practices;
- Incorporating climate change into stock assessments is a challenge for SEAFO due to low fishing effort and a data scare situation for all stocks. This makes the incorporation of climate-change scenarios into stock assessments to better understand the potential impacts of climate change on fish populations and to develop more robust management strategies extremely difficult. SEAFO however applies precautionary approaches to secure future fish stocks;
- SEAFO, through the EAF Nansen programme obtains valuable research information to better understand the impacts of climate change on fish populations and ecosystems. This research can help inform management decisions and identify potential adaptation strategies;
- Implementing ecosystem-based management, which can help fisheries adapt to changing conditions and promote long-term sustainability, is a challenge in the data poor situation.
- SEAFO is working with other RFMO's and organizations, such as the FAO to share information and develop coordinated approaches to address the impacts of climate change on fisheries.

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SPC The Pacific Community

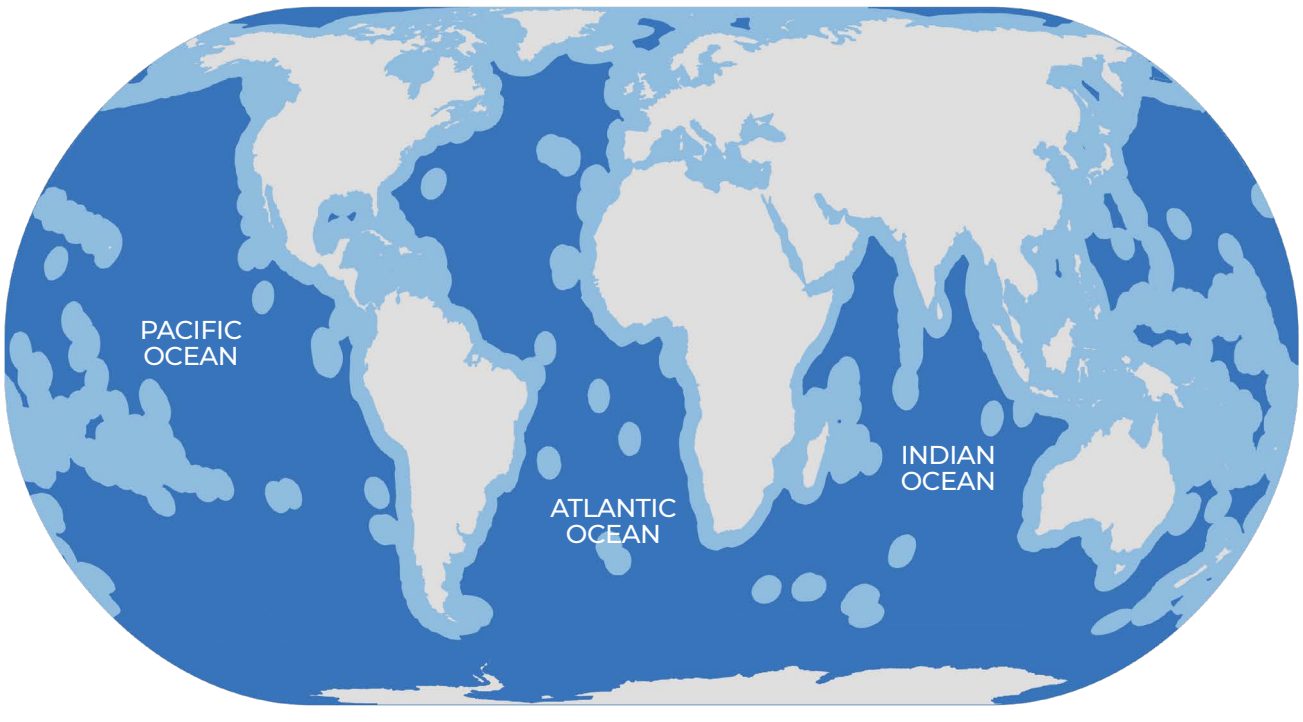
WCPFC climate and ecosystem indicators

As noted in the WCPFC and SPC articles within this magazine, climate and ecosystem indicators are being developed to regularly update WCPFC members on important trends and changes and to support this Commission's implementation of the WCPFC climate resolution. The resulting indicator report card will be developed into a dashboard-style tool to allow varying spatial and temporal resolutions to be communicated. The full document of 35 different indicators is available here, and some specific example indicators are provided below. Greater detail on how these indicators are calculated is provided in Annex two of the full document.

The indicators demonstrate that climate change is already affecting Western and Central Pacific Ocean fisheries in the shorter term through, for example, the impacts of ENSO conditions on the location of fishing (see "Centre of annual tropical purse seine effort" graphic below) and through a hypothesised positive relationship between warm pool size and skipjack recruitment levels (see "mean size of the warm pool" graphic below).

However, projected longer term negative impacts have been forecast on both overall biomass and the abundance of tropical tunas in western Pacific Island Country and Territory EEZs (see the WCPFC article within this magazine). Given the forecast implications for regional fisheries and the national economies that depend upon it, ongoing refinement and monitoring these indicators in combination with supporting research are a priority.

Areas beyond national jurisdiction (ABNJ)



Source: Elaborated by FAO/Fisheries and Aquaculture Division. Map conforms to UN. 2020. Map of the World. www.un.org/geospatial/content/map-world

SECTION 6

Publications and papers

CONTRIBUTIONS FROM:

BOBP-IGO: Bay of Bengal Programme – Inter-Governmental Organisation

EIFAAC: European Inland Fisheries and Aquaculture Advisory Commission

ICCAT: International Commission for the Conservation of Atlantic Tunas

ICES: International Council for the Exploration of the Sea

IPHC: International Pacific Halibut Commission

IWC: International Whaling Commission

NAFO: Northwest Atlantic Fisheries Organization

NAMMCO: North Atlantic Marine Mammal Commission

NASCO: North Atlantic Salmon Conservation Organization

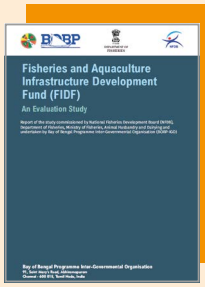
NPAFC: North Pacific Anadromous Fish Commission

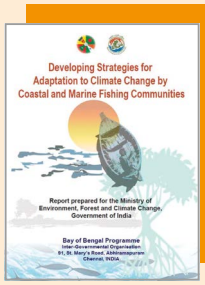
PICES: North Pacific Marine Science Organization

PSC: Pacific Salmon Commission

SEAFO: South East Atlantic Fisheries Organisation

Publications and papers





BOBP-IGO

Bay of Bengal Programme Inter-Governmental Organisation

Policy briefs

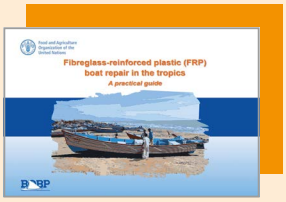
- **BOBP-IGO**. 2022. *Marine fisheries insurance: issues and strategies for India–a policy brief*. Chennai, Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO), pp. 22.

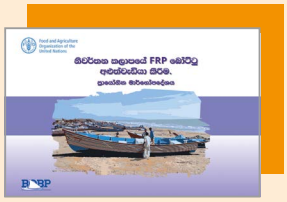
Reports and bulletins

- **BOBP-IGO**. 2022. *Issues, practices and opportunities in application of insurance as a tool for marine fisheries management and to build resilience in the sector in South Asia*. Chennai, Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO), pp. 96.
- **BOBP-IGO**. 2023. *Fisheries and aquaculture infrastructure development fund (FIDF): an evaluation study*. Chennai, Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO), pp. 136.
- **BOBP-IGO**. 2023. *Developing strategies for adaptation to climate change by coastal and marine fishing communities*. Chennai, Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO), pp. 62.

Books and guides

- **FAO (Food and Agriculture Organization of the United Nations)/ BOBP-IGO**. 2023. *Fibreglass-reinforced plastic (FRP) boat repair in the tropics: a practical guide*. Rome, FAO.
- **BOBP-IGO**. 2022. Waves of Art 1. Women in fisheries–through the eyes of artists. Chennai, Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO).
- **BOBP-IGO**. 2023. Waves of Art 1. Women in aquaculture and fisheries–through the eyes of artists. Chennai, Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO).





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- **Kantharajan, G., Govindakrishnan, P.M., Chandran, R., Singh, R.K., Kumar, K., Anand, A., Krishnan, P., Mohindra, V., Shukla, S.P. & Lal, K.K.** 2023. Anthropogenic risk assessment of riverine habitat using geospatial modelling tools for conservation and restoration planning: a case study from a tropical river Pranhita, India. *Environmental Science and Pollution Research*, 30(13): 37579–37597.
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- **SriHari, M., Pavan-Kumar, A., Krishnan, P., Ramteke, K., Ayyathurai, K., Sreekanth, G. & Kumar Jaiswar, A.** 2022. Meta-analysis of fish stock identification in India: current status and future perspectives. *Marine and Freshwater Research*, 74(2): 99–110.

EIFAAC

European Inland Fisheries and Aquaculture Advisory Commission

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International Commission for the Conservation of Atlantic Tunas

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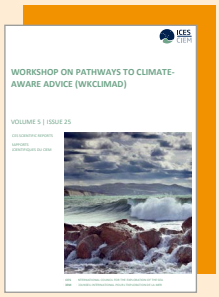

ICES

International Council for the Exploration of the Sea

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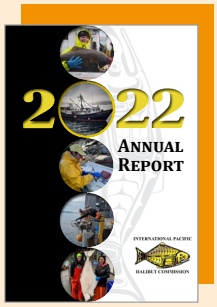

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- **Jasonowicz, A. J., Simeon, A., Zahm, M., Cabau, C., Klopp, C., Roques, C., Iampietro, C., Lluch, J., Donnadieu, C., Parrinello, H., Drinan, D.P., Hauser, L., Guiguen, Y. & Planas, J.V.** 2022. Generation of a chromosome-level genome assembly for Pacific halibut (*Hippoglossus stenolepis*) and characterization of its sex-determining genomic region. *Mol. Ecol. Resour.*, (00):116. https://doi.org/10.1111/1755-0998.13641

IWC

International Whaling Commission

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Northwest Atlantic Fisheries Organization

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NAMMCO

North Atlantic Marine Mammal Commission

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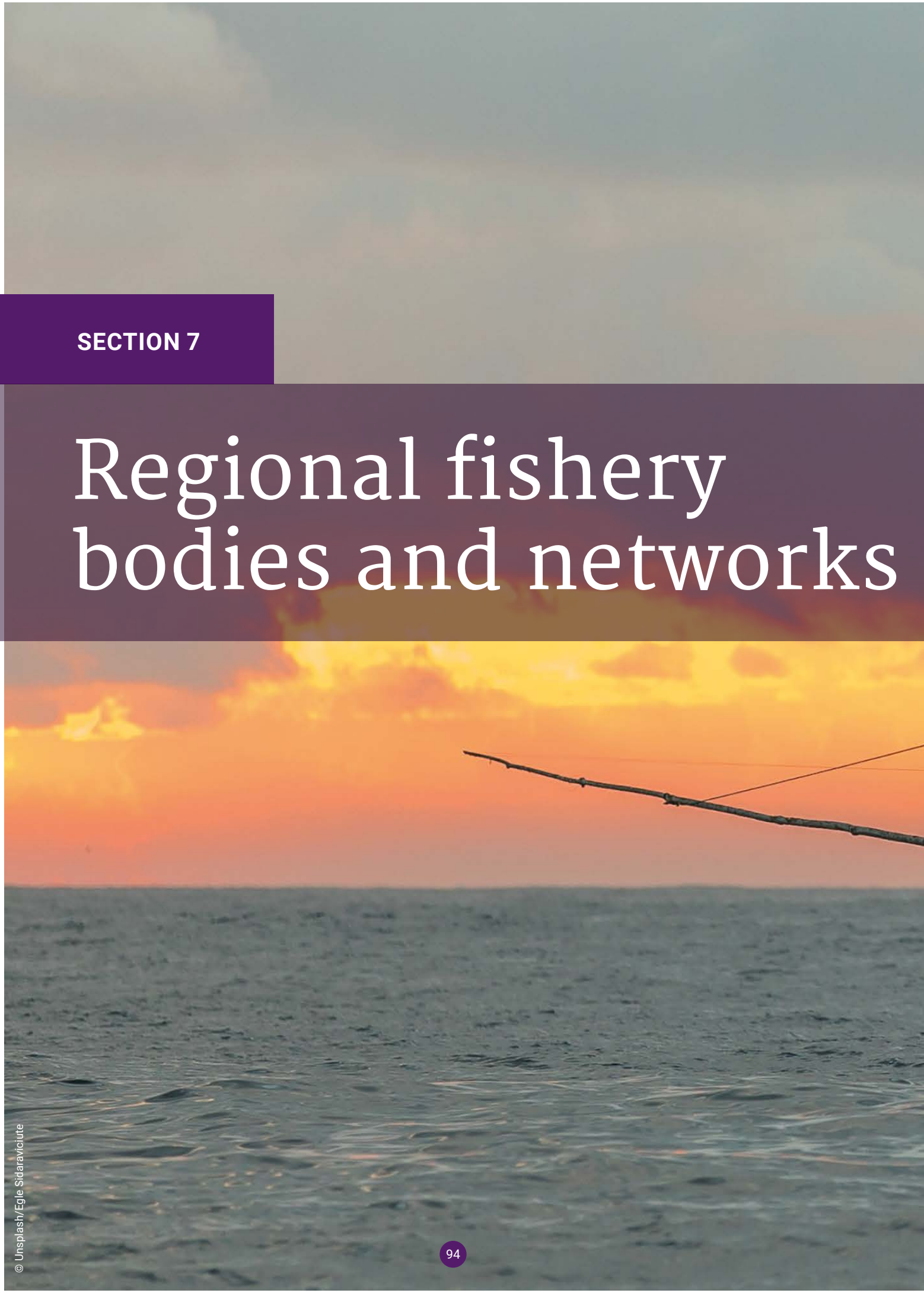
SECTION 7

Regional fishery bodies and networks



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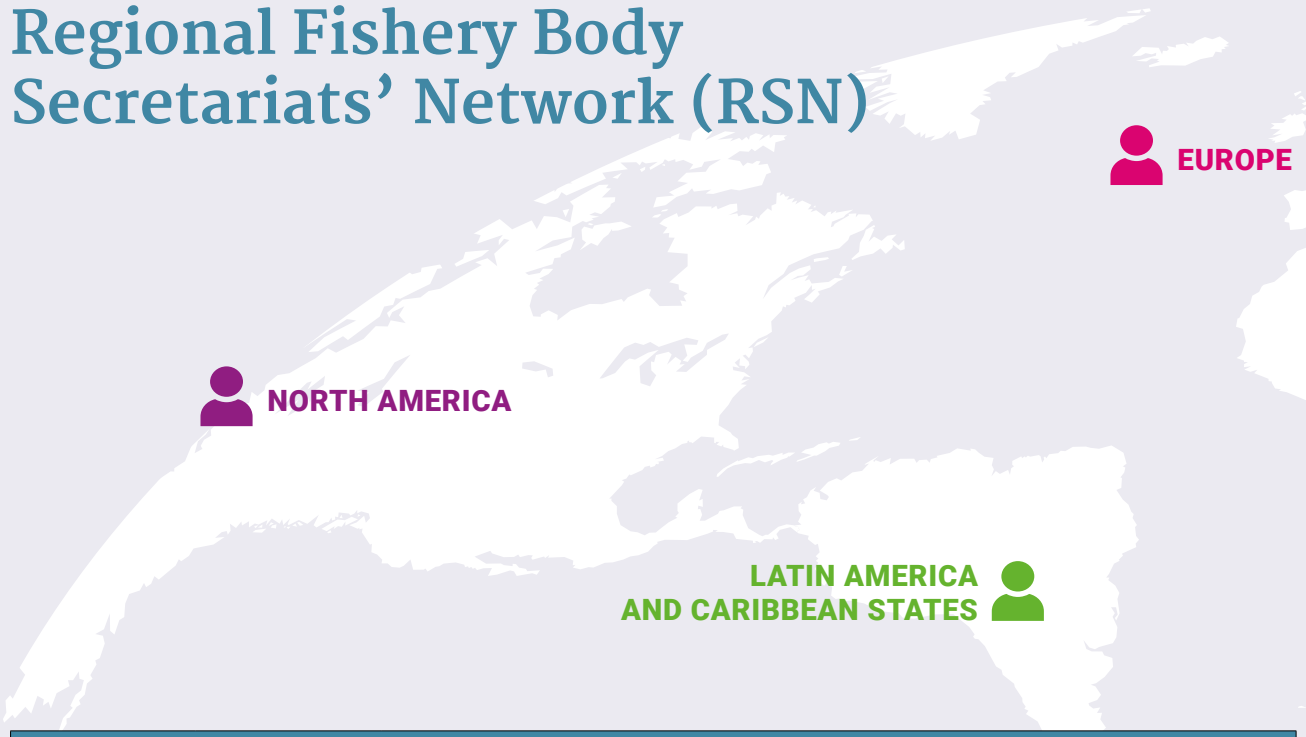
Regional Fishery Body Secretariats' Network (RSN)



Members		
	APFIC	Asia-Pacific Fishery Commission
	ATLAFCO	Ministerial Conference on Fisheries Cooperation among African States bordering the Atlantic Ocean
	BCC	Benguela Current Convention
	BOBP-IGO	Bay of Bengal Programme Inter-Governmental Organisation
	CACFish	Central Asian and Caucasus Regional Fisheries and Aquaculture Commission
	CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
	CCBSP	Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea
	CCSBT	Commission for the Conservation of Southern Bluefin Tuna
	CECAF	Fishery Committee for the Eastern Central Atlantic
	CIFAA	Committee for Inland Fisheries and Aquaculture of Africa
	COPPESAALC	Commission for Small-Scale Artisanal Fisheries and aquaculture of Latin America and the Caribbean
	COREP	Regional Fisheries Commission for the Gulf of Guinea
	CRFM	Caribbean Regional Fisheries Mechanism
	CTMFM	Joint Technical Commission of the Maritime Front
	EIFAAC	European Inland Fisheries and Aquaculture Advisory Commission
	FCWC	Fisheries Committee for the West Central Gulf of Guinea
	FFA	Forum Fisheries Agency
	GFCM	General Fisheries Commission for the Mediterranean
	GLFC	Great Lakes Fishery Commission
	IATTC	Inter-American Tropical Tuna Commission
	ICCAT	International Commission for the Conservation of Atlantic Tunas
	IOTC	Indian Ocean Tuna Commission
	IPHC	International Pacific Halibut Commission
	IWC	International Whaling Commission
	LCBC	Lake Chad Basin Commission
	LTA	Lake Tanganyika Authority
	LVFO	Lake Victoria Fisheries Organization
	MRC	Mekong River Commission
	NAFO	Northwest Atlantic Fisheries Organization

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	NAMMCO	North Atlantic Marine Mammal Commission
	NASCO	North Atlantic Salmon Conservation Organisation
	NEAFC	North-East Atlantic Fisheries Commission
	NPAFC	North Pacific Anadromous Fish Commission
	NPFC	North Pacific Fisheries Commission
	OSPESCA	Organization of the Fisheries and Aquaculture Sector of the Central American Isthmus
	PSC	Pacific Salmon Commission
	RECOFI	Regional Commission for Fisheries
	SEAFDEC	Southeast Asian Fisheries Development Center
	SEAFO	South East Atlantic Fisheries Organisation
	SIOFA	Southern Indian Ocean Fisheries Agreement
	SPC	The Pacific Community
	SPRFMO	South Pacific Regional Fisheries Management Organisation
	SRFC	Sub-Regional Fisheries Commission
	SWIOFC	Southwest Indian Ocean Fisheries Commission
	WCPFC	Western and Central Pacific Fisheries Commission
	WECAFC	Western Central Atlantic Fishery Commission
Permanent observers		
	ACAP	Agreement on the Conservation of Albatrosses and Petrels
	CPPS	Permanent Commission for the South Pacific
	CWP	Coordinating Working Party on Fishery Statistics
	FIRMS	Fisheries and Resources Monitoring System
	GESAMP	Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection
	ICES	International Council for the Exploration of the Sea
	NACA	Network of Aquaculture Centers in Asia-Pacific
	PICES	North Pacific Marine Science Organization
	RAA	Aquaculture Network for the Americas
	UN	United Nations, specialized agencies of the United Nations and related organizations

SECTION 8

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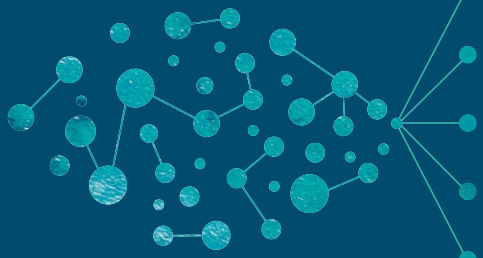
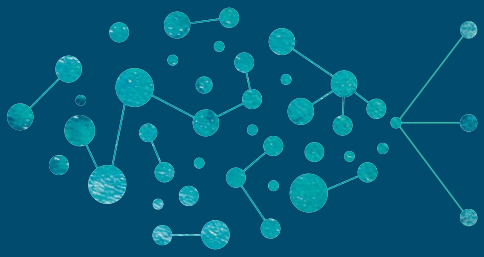
Regional Fishery Body Secretariats' Network

A unique coordination mechanism bringing together key regional fishery and aquaculture actors from across the globe



- A Network of 47 Members and 11 Permanent Observers
- Promoting sustainability of fisheries and aquaculture
- Learning and sharing best practices on critical issues of common concern
- Unlocking the potential of regional cooperation for regional and global fisheries governance
- Focusing on communication and visibility of regional fisheries bodies' work

RSN members and partners achieving the 2030 Agenda!



- Delivering effective, inclusive and sustainable fisheries and aquaculture development
- Working with Member States and multi-stakeholder partnerships to establish efficient accountability frameworks
- Tackling challenges and developing capacity of members

Regional action, global impact.

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This magazine is based on contributions from secretariats of regional fisheries management organizations, regional fisheries advisory bodies, permanent observers and related networks and partners, as well as colleagues from FAO and other agencies and organizations working on matters relevant to these bodies. The publication of this issue of the RSN Magazine was made possible thanks to the funding provided by the Government of Japan.

The Fisheries and Aquaculture Division of FAO hosts and provides the RSN Secretariat services, the venue for biennial meetings, and works with the network day-to-day on technical and operational issues. In this context, the Secretariat will continue working with its members, partners and colleagues, to ensure, as much as possible, that voices and experiences from different regions are being considered.

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IN THE PREVIOUS ISSUE - No. 21
Ecosystem approach to fisheries (EAF)

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