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Organización de las Naciones Unidas para la Agricultura y la Alimentación

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Annex

Submission by the Food and Agriculture Organization of the United Nations (FAO) to the 17th round of Informal Consultations of States Parties (ICSP-17) of the United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks

As a UN specialized agency leading international efforts to defeat hunger including through the sustainable production of food from the ocean, rivers and lakes, FAO is pleased to submit this written statement to the ICSP-17 on the topic of "Sustainable fisheries management in the face of climate change". FAO's relevant experience is structured around the sub-topics indicated in the invitation: a) assessing the impacts of climate change on fisheries; b) addressing the impacts of climate change on fisheries; c) accounting for cumulative impacts; d) application of an ecosystem approach and precautionary approach in the face of climate change; and e) incorporating economic, social and cultural aspects into sustainable fisheries management in the face of climate change.

a) assessing the impacts of climate change on fisheries

The impact of climate change on aquatic ecosystems and the services they provide, as well as the livelihoods that depend on them, is today profound and pervasive and is expected to exacerbate in the future.[1] Climate-driven shifts in the geographical distribution and changes in the productivity of fish stocks challenge fisheries worldwide.[2] Failing to adapt current fisheries management frameworks will lead to social risks and vulnerabilities in terms of loss of livelihood and food and nutrition insecurity,[3] thus threatening the achievement of Sustainable Development Goals (SDGs) that address poverty, hunger, and life below water, among others.

Studies have shown that since the 1950s, the rate of range shifts for near-surface organisms in the ocean is estimated to be 51.5 km per decade, and 29.0 km per decade for near-bottom organisms.[4] Projections indicate that by 2100, 45 percent of transboundary stocks will have shifted, and 81 percent of exclusive economic zones (EEZs) worldwide will have experienced at least one shifting stock.[5] Ocean warming has also led to a 4.1 percent decline in

[1] IPCC. 2019. IPCC Special Report on the Ocean and Cryosphere in a Changing Climate. https://www.ipcc.ch/site/assets/uploads/sites/3/2022/03/SROCC_FullReport_FINAL.pdf; Wassénius, E., Jonell, M., Koehn, J.Z., Short, R., Tigchelaar, M., Daw, T.M., Golden, C.D., Gephart, J.A., Allison, E.H., Bush, S.R., et al. 2023. Four ways blue foods can help achieve food system ambitions across nations. Nature, 616(7955), pp.104-112. https://doi.org/10.1038/s41586-023-05737-xhttps://doi.org/10.1038/s41586-023-05737-x

[2] Holsman, K.K., Hazen, E.L., Haynie, A., Gourguet, S., Hollowed, A., Bograd, S.J., Samhouri, J.F. and Aydin, K., 2019. Towards climate resiliency in fisheries management. ICES Journal of Marine Science, 76(5), pp.1368-1378. https://doi.org/10.1093/icesjms/fsz031

[3] Golden, C.D., Koehn, J.Z., Shepon, A., Passarelli, S., Free, C.M., Viana, D.F., Matthey, H., Eurich, J.G., Gephart, J.A., Fluet-Chouinard, E. and Nyboer, E.A., 2021. Aquatic foods to nourish nations. Nature, 598(7880), pp.315-320. https://doi.org/10.1038/s41586-021-03917-1

[4] IPCC. 2019. IPCC Special Report on the Ocean and Cryosphere in a Changing Climate. https://www.ipcc.ch/site/assets/uploads/sites/3/2022/03/SROCC_FullReport_FINAL.pdf

[5] Palacios-Abrantes, J., Frölicher, T.L., Reygondeau, G., Sumaila, U.R., Tagliabue, A., Wabnitz, C.C. and Cheung, W.W. 2022. Timing and magnitude of climate - driven range shifts in transboundary fish stocks challenge their management. Global change biology, 28(7). https://doi.org/10.1111/gcb.16058

the maximum sustainable yield over the past 80 years,[6] and it is expected that the maximum catch potential in EEZs will decrease by up to 12.1 percent by 2050, with tropical regions experiencing greater declines than the global average.[7] In many freshwater ecosystems, climate change also has a pronounced effect.[8] It has been estimated that 65 percent of inland waters are moderately or highly threatened by anthropogenic stressors,[9] limiting their ability to support human populations and fisheries-related livelihoods.[10] Furthermore, climate change poses a threat to approximately 50 percent of global freshwater fish species[11] and interacts with land-use modifications, resulting in increasing dominance of species that prefer warm and slow-water habitats.[12] In the absence of mitigation policies, up to 70 percent of global freshwater fish species are projected to have over half of their current range exposed to extreme climatic conditions beyond current levels.[13] Changes in the distribution and productivity of marine and freshwater resources will carry far-reaching consequences throughout the fisheries value chain, from net to plate (i.e., harvesting, processing, distribution, marketing, and consumption). Substantial variations are expected across different geographic regions with significant challenges to global, regional, national, and local fisheries management systems. Small-scale fisheries are particularly vulnerable to the impacts of climate change, as documented in the exponentially increasing number of scientific articles relating to climate change and small-scale fisheries.[14]

b) addressing the impacts of climate change on fisheries

To address climate change in agrifood systems, including aquatic food systems, an FAO Strategy on Climate Change 2022-2031 was endorsed by the FAO Council at its 170th Session in June 2022.[15] In support of the implementation of the FAO Strategy on Climate Change and its Action Plan,[16] the 35th session of the FAO Committee on Fisheries (COFI35) recommended the development of a set of FAO actions focused on climate resilient fisheries and aquaculture.[17] Furthermore, the COFI35 highlighted the need for guidance on climate resilient fisheries management, including by convening a workshop with Regional Fisheries Management Organizations (RFMOs) and

[6] Free, C.M., Thorson, J.T., Pinsky, M.L., Oken, K.L., Wiedenmann, J. and Jensen, O.P. 2019. Impacts of historical warming on marine fisheries production. Science, 363(6430), pp.979-983. https://doi.org/10.1126/science.aau1758
[7] Barange, M., Bahri, T., Beveridge, M.C.M., Cochrane, K.L., Funge-Smith, S. & Poulain, F. eds. 2018. Impacts of climate change on fisheries and aquaculture: synthesis of current knowledge, adaptation and mitigation options. FAO Fisheries and Aquaculture Technical Paper No. 627. Rome, FAO. 628 pp. https://www.fao.org/3/i9705en/i9705en.pdf
[8] Harrod, C., Ramírez, A., Valbo-Jørgensen, J. & FungeSmith, S. 2018. Chapter 18 – How climate change impacts inland fisheries. In: *ibid*; Harrod, C., Ramírez, A., Valbo-Jørgensen, J. & FungeSmith, S. 2018b. Chapter 19 – Current anthropogenic stress and projected effect of climate change on global inland fisheries. In: *ibid*.
[9] Vörösmarty, C.J., McIntyre, P.B., Gessner, M.O., Dudgeon, D., Prusevich, A., Green, P., Glidden, S., Bunn, S.E., Sullivan, C.A., Liermann, C.R. & Davies, P.M., 2010. Global threats to human water security and river biodiversity. nature, 467(7315), pp.555-561. https://doi.org/10.1038/nature09440
[10] FAO, Duke University & WorldFish. 2023. Illuminating Hidden Harvests – The contributions of small-scale fisheries to sustainable development. Rome. https://doi.org/10.4060/cc4576en
[11] Reid, A.J., Carlson, A.K., Creed, I.F., Eliason, E.J., Gell, P.A., Johnson, P.T., Kidd, K.A., MacCormack, T.J., Olden, J.D., Ormerod, S.J. and Smol, J.P., 2019. Emerging threats and persistent conservation challenges for freshwater biodiversity. Biological Reviews, 94(3), pp.849-873. https://doi.org/10.1111/brv.12480
[12] Comte, L., Olden, J.D., Tedesco, P.A., Ruhi, A. and Giam, X., 2021. Climate and land-use changes interact to drive long-term reorganization of riverine fish communities globally. Proceedings of the National Academy of Sciences, 118(27). https://doi.org/10.1073/pnas.2011639118
[13] Barbarossa, V., Bosmans, J., Wanders, N., King, H., Bierkens, M.F., Huijbregts, M.A. and Schipper, A.M. 2021. Threats of global warming to the world's freshwater fishes. Nature Communications, 12(1). https://doi.org/10.1038/s41467-021-21655-w
[14] FAO, Duke University & WorldFish. 2023. Illuminating Hidden Harvests – The contributions of small-scale fisheries to sustainable development. Rome. https://doi.org/10.4060/cc4576en
[15] FAO. 2022. FAO Strategy on Climate Change 2022–2031. Rome. https://www.fao.org/3/cc2274en/cc2274en.pdf
[16] FAO. 2023. FAO Action Plan 2022–2025 for the implementation of the FAO Strategy on Climate Change. Rome. https://doi.org/10.4060/cc7014en
[17] FAO. 2023. Report of the Thirty-fifth Session of the Committee on Fisheries, Rome, 5–9 September 2022. FAO Fisheries and Aquaculture Report, No. 1391. Rome. Paragraph 16(d). https://doi.org/10.4060/cc3652en

Regional Fisheries Advisory Bodies (RFABs).[18] FAO has initiated a range of activities in response to COFI35 requests; they are summarized into broad categories of adaptation, mitigation, finance, and regional and global processes in support of implementation.

i. adaptation

Adaptation policy frameworks for resilient fisheries exist,[19] including the FAO Adaptation Toolbox for fisheries and aquaculture,[20] as well as guidance on good practice criteria and a compilation of good practices to climate proof the fisheries management cycle.[21] However, examples of successful implementation are limited[22] due to several factors, including: (1) lack of effective fisheries management resulting in weak adaptive capacity to climate change and other external stressors; (2) limited awareness about the impacts of climate change and the adaptation options for increasing resilience; (3) lack of context-specific information to perform climate risks and vulnerabilities assessments and inform adaptation strategies; (4) difficulties in modeling the combined ecological and socio-economic implications of climate change for ecosystems and societies; and (5) mismatch of spatial and temporal scales between climate research and management policies.[23]

An effective fisheries management system is often the best adaptation and the first foundation of climate-resilient fisheries.[24] FAO has been actively promoting the adoption of participatory, adaptive, and precautionary fisheries management systems across the world through dedicated capacity development programs.[25] Despite the progress made in some jurisdictions, many areas of the world still face problems caused by ineffective management systems, including the overfishing of stocks and illegal fishing.[26] Achieving climate resilient fisheries requires the

[18] Ibid, paragraph 16(h).

[19] Mason, J.G., Eurich, J.G., Lau, J.D., Battista, W., Free, C.M., Mills, K.E., Tokunaga, K., Zhao, L.Z., Dickey-Collas, M., Valle, M. and Pecl, G.T., 2022. Attributes of climate resilience in fisheries: From theory to practice. Fish and Fisheries, 23(3), pp.522-544. https://doi.org/10.1111/faf.12630

[20] Poulain, F., Himes-Cornell, A., and Shelton, C. 2018. Chapter 25 – Methods and tools for climate change adaptation in fisheries and aquaculture. In: Barange, M., Bahri, T., Beveridge, M.C.M., Cochrane, K.L., Funge-Smith, S. & Poulain, F. eds. 2018. Impacts of climate change on fisheries and aquaculture: synthesis of current knowledge, adaptation and mitigation options. FAO Fisheries and Aquaculture Technical Paper No. 627. Rome, FAO. 628 pp. https://www.fao.org/3/i9705en/i9705en.pdf

[21] Bahri, T., Vasconcellos, M., Welch, D.J., Johnson, J., Perry, R.I., Ma, X. & Sharma, R., eds. 2021. Adaptive management of fisheries in response to climate change. FAO Fisheries and Aquaculture Technical Paper No. 667. Rome, FAO. https://doi.org/10.4060/cb3095en

[22] Bryndum-Buchholz, A., Tittensor, D.P. and Lotze, H.K., 2021. The status of climate change adaptation in fisheries management: Policy, legislation and implementation. Fish and Fisheries, 22(6), pp.1248-1273. https://doi.org/10.1111/faf.12586

[23] Holsman, K.K., Hazen, E.L., Haynie, A., Gourguet, S., Hollowed, A., Bograd, S.J., Samhouri, J.F. and Aydin, K., 2019. Towards climate resiliency in fisheries management. ICES Journal of Marine Science, 76(5), pp.1368-1378. https://doi.org/10.1093/icesjms/fsz031

[24] Bahri, T., Vasconcellos, M., Welch, D.J., Johnson, J., Perry, R.I., Ma, X. & Sharma, R., eds. 2021. Adaptive management of fisheries in response to climate change. FAO Fisheries and Aquaculture Technical Paper No. 667. Rome, FAO. https://doi.org/10.4060/cb3095en

[25] Examples include the EAF-Nansen programme (https://www.fao.org/in-action/eaf-nansen/en/), the CLME+ project, relevant Mediterranean projects, and activities in the Philippines under the Norad project. For more information on these projects, see: https://www.fao.org/fi/static-media/MeetingDocuments/WECAFC/NBSLME2018/prospectus.pdf; https://www.fao.org/3/cb6509en/cb6509en.pdf; Labaria, E.C., Fernandez de la Reguera, D., Poulain, F., Siar, S. and Vasconcellos, M. 2021. The risks and vulnerability of the sardine fisheries sector in the Republic of the Philippines to climate and other non-climate processes. Rome. https://doi.org/10.4060/cb7506en

[26] FAO. 2022. The State of World Fisheries and Aquaculture 2022. Towards Blue Transformation. Rome, FAO. https://doi.org/10.4060/cc0461en; Welch, H., Clavelle, T., White, T.D., Cimino, M.A., Van Osdel, J., Hochberg, T., Kroodsma, D. and Hazen, E.L., 2022. Hot spots of unseen fishing vessels. Science Advances, 8(44), p.eabq2109. https://doi.org/10.1126/sciadv.abq2109

reciprocal mainstreaming between climate change adaptation and fisheries management. One critical aspect is the integration of climate change adaptation into national and local fisheries management and the use of climate data and information, including results from climate risk assessments and monitoring,[27] in decision-making.

Another crucial aspect is the integration of fisheries into local and national climate change adaptation planning and implementation, which can be accomplished through mechanisms such as the Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs). A clear example of this integration is found in Albania's NDC, where the development of sectoral adaptation plans for water, energy, and agriculture/ forestry/ fisheries is recognized as a high-priority adaptation measure.[28] Overall, of the 85 new or updated NDCs submitted (between 1 January 2020 and 31 July 2021) by countries as part of their commitment to the Paris Agreement, 62 of the 77 (81 percent) with adaptation components referred to adaptation in fisheries and aquaculture, including ocean and coastal zone management.[29] Moreover, countries such as Chile, [30] Saint Lucia,[31] and Senegal[32] have developed fish-related NAPs, demonstrating the importance of addressing climate change impacts in the fishery sector within national planning frameworks. In the Philippines, the Philippine Development Plan (PDP) 2023-2028 devotes to aquaculture and fisheries a huge role to "accelerate climate action and strengthen disaster resilience".[33] To support these efforts, FAO has conducted a sectoral review of NDCs and NAPs, with a specific focus on identifying the adaptation funding gap in the aquatic food sector. This analysis helps pinpoint areas where additional support and resources are required to enhance the climate resilience of fisheries and dependent communities.

Furthermore, enhancing the adaptive capacity and resilience of fishers and fisheries can be achieved through the development of climate-proofed fisheries infrastructure, such as ports, jetties, slipways, fish buying stations and fish markets. Various international development banks and FAO are supporting their members with the design and construction of climate-proofed fisheries infrastructure and to build-back-better after natural disasters. Besides, the integration of early warning systems directly adapted for fishers, for example, in the form of local weather monitoring with information delivered to fishers through smartphones and radio, or during community meetings, can provide lifesaving information about upcoming strong weather events. Moreover, considering the escalating climate change and disaster risks, it becomes imperative to provide fishers with safety training and develop and promote fishing vessel safety standards. Developing practical guidelines, such as global standards and checklists for seaworthiness and safety inspections of small-scale fishing vessels, can contribute to safety of small-scale fishing vessels. In addition, linking early warning systems with shock-responsive social protection programs not only increases the access of fishers to assistance, insurance, and financial services but also plays a key role in ensuring a climate resilient development.[34] To disseminate fishing safety innovations in support of sectoral adaptation to

[27] Boyce, D.G., Tittensor, D.P., Garilao, C., Henson, S., Kaschner, K., Kesner-Reyes, K., Pigot, A., Reyes Jr, R.B., Reygondeau, G., Schleit, K.E. and Shackell, N.L., 2022. A climate risk index for marine life. Nature Climate Change, 12(9), pp.854-862. https://doi.org/10.1038/s41558-022-01437-y

[28] Albania. 2021. Revised NDC. https://unfccc.int/sites/default/files/2022-08/Albania%20Revised%20NDC.pdf

[29] Crumpler, K., Abi Khalil, R., Tanganelli, E., Rai, N., Roffredi, L., Meybeck, A., Umulisa, V., Wolf, J. and Bernoux, M. 2021. 2021 (Interim) Global update report – Agriculture, Forestry and Fisheries in the Nationally Determined Contributions. Environment and Natural Resources Management Working Paper No. 91. Rome, FAO. https://doi.org/10.4060/cb7442en

[30] Chile. 2015.Plan de adaptación al cambio climático para la pesca y la acuicultura. https://www4.unfccc.int/sites/NAPC/Documents/Parties/Plan-Pesca-y-Acuicultura-CMS.pdf

[31] Saint Lucia. 2018. Sectoral Adaptation Strategy and Action Plan for the Fisheries Sector (Fisheries SASAP) 2018-2028. https://www4.unfccc.int/sites/NAPC/Documents/Parties/SLU-Fisheries-SASAP-May-2018.pdf

[32] Senegal. 2016. Plan d'adaptation de la Pêche et de l'Aquaculture. Plan national d'adaptation du secteur de la pêche face aux changements climatiques horizon 2035. https://chm.cbd.int/api/v2013/documents/A0E18B74-831F-6EEB-3AAA-1A7C07F3F3AC/attachments/207058/Plan%20National%20Adaptation%20Principal_2016.pdf

[33] https://pdp.neda.gov.ph/

[34] IPCC, 2022: Summary for Policymakers [H.-O. Pörtner, D.C. Roberts, E.S. Poloczanska, K. Mintenbeck, M. Tignor, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem (eds.)]. In: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on

climate change, FAO, together with partners, organized the 6th International Fishing Industry Safety and Health Conference (IFISH 6) on 8-12 January 2024 in Rome, Italy.[35]

ii. mitigation

Despite being a minor contributor to global carbon emissions, fisheries can adopt decarbonization measures along the value chain to contribute to the 1.5 degrees climate goal. These include the use of renewable energy, enhancing vessels energy efficiency through practices such as reducing trawling speed, fishing gear modifications (lighter ground gear and trawl doors, different mesh sizes, lighter netting materials and other trawl components), hull modifications, timely cleaning of the hull bottom from fouling and timely servicing the engine. However, fuel savings practices resulting from gear modifications and changes in trawling practices may result in reduced catch rates. FAO, in close collaboration with the Bay of Bengal Programme – Intergovernmental Organization (BOBP-IGO), has been promoting in 2022-2023 simple fuel-saving measures in Sri Lanka and India using a technical manual.[36] Electrification of the industrial fishing fleet is going slow. It consists in equipping vessels with lithium-ion batteries; hydrogen fuel cells, and/or solar-power. Tests are ongoing in a few places with governmental support to overcome hesitations of early adaptors and innovators among the vessel owners to invest in electrification. Several hybrid solutions are also being tested, such as vessels equipped with battery packs and a diesel engine that power the vessel together for a full day of operation.[37]

Furthermore, post-harvest activities can optimize their operations by using renewable energy and climate-smart technologies, like solar dryers or biodigesters. These practices are supported by field projects targeting women and fostering access to more efficient ovens for fish smoking.[38] A recent FAO publication has identified opportunities for renewable energy interventions along the small-scale fish value chains and discussed challenges associated with cost and financing, policy environment and local capacity, awareness.[39]

There are also opportunities for fisheries to contribute to carbon sequestration and blue carbon ecosystems through holistic fisheries management with measures such as mangrove preservation and restoration. Estuaries and nearshore canyons serve as valuable habitats for multiple species and actively sequester carbon. With support from the Norwegian Agency for Development Cooperation (NORAD), FAO supported the development of a climate smart Small Pelagic Fisheries Management Plan in the Philippines, which includes coastal and marine ecosystems restoration. The project is expected to improve fisheries governance, restore coastal habitats, and protect critical ecosystems, hence alleviating climate change impacts on ecosystems.

iii. finance

Climate finance is indispensable for the implementation of adaptation and mitigation solutions. FAO has conducted a sectoral review of NDCs and NAPs, with a specific focus on identifying the adaptation funding gap in the aquatic food sector. A total of 85 countries have submitted costed NDC adaptation priorities or NAPs, and of these 32 have identified costs for the fisheries and aquaculture sector. An analysis of these finds that fisheries and aquaculture costs average 5 percent of total adaptation costs (though the percent values are much higher for island states). An

Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 3–33, doi:10.1017/9781009325844.001.

[35] https://ifishconference.ca/

[36] FAO, 2023. Fuel savings for small fishing vessels: a manual. Available in 6 languages here: https://www.fao.org/documents/card/en?details=98995c6b-bd40-56c7-bcf5-768c1d8eccc1

[37] Thermes, S., Van Anrooy, R., Gudmundsson, A., and Davy, D. 2023. Classification and definition of fishing vessel types – 2023 edition. FAO Fisheries and Aquaculture Technical Paper No. 670. Rome (https://doi.org/10.4060/cc7468en)

[38] https://www.fao.org/voluntary-guidelines-small-scale-fisheries/resources/detail/en/c/1607567/

[39] Puri, M., Kojakovic, A., Rincon, L., Gallego, J., Vaskalis, I. & Maltsoglou, I. 2023. The small-scale fisheries and energy nexus – Opportunities for renewable energy interventions. Rome, FAO. https://doi.org/10.4060/cc4903en

extrapolation of these costs to all developing countries has been made, based on the size of each country's fishery sector. This indicates that the costs of adaptation for fisheries and aquaculture for all developing countries could be USD 4 billion per year by 2030. These costs are estimated to rise strongly towards 2050.[40] An analysis has also been made of the public international adaptation finance flows to the fisheries and aquaculture sector, based on analysis of the OECD Development Assistance Committee (DAC) database and bilateral and multilateral flows. This finds that finance flows have averaged only USD 0.2 billion per year (2017 - 2021) for fisheries. This identifies a significant adaptation finance gap, between estimated costs and actual flows.[41]

With financial support from the Green Climate Fund (GCF), Global Environment Facility (GEF) and bilateral funds, FAO is currently implementing a field programme on adaptation that puts climate solutions for aquatic food into practice in Africa, Latin America, the Caribbean, Southeast Asia, and Pacific Small Island Developing States (SIDS). An increasing number of FAO-led GCF projects are aiming at supporting the increased resilience of ocean and riparian livelihoods and ecosystems, both through readiness and preparatory support (4 ongoing projects in Belize, Cabo Verde, Saint Lucia, and Sri Lanka) and larger support (one ongoing project in The Gambia, and projects in Cabo Verde, Saint Lucia, and Sri Lanka currently being designed). GEF-funded projects are underway in Bangladesh, Cambodia, Kiribati, Malawi, Myanmar, and Timor-Leste. Work is also ongoing with projects implemented by FAO with bilateral funds from Canada, Norway, and the European Union, supporting countries to build the resilience of aquatic food systems to climate change and natural disasters so as to attain sustainability.

During the UNFCCC Ocean Dialogue 2023, ensuring access to climate finance for small-scale aquatic food producers emerged as a significant concern. Addressing this concern necessitates equipping small-scale producers with the know-how to effectively access funds. It is also essential to enhance the awareness and capacity of funding institutions like GEF and GCF to facilitate easier access to climate finance for vulnerable communities. In line with this objective, FAO is developing relevant climate finance training materials to provide guidance, frameworks, and tools for accessing climate finance for fisheries and aquaculture projects. FAO is also seeking to identify opportunities to engage with the private sector to drive aquatic food climate solutions at larger scale, leveraging the FAO Strategy for Private Sector Engagement 2021-2025.[42]

iv. regional and global processes in support of implementation

At the regional level, climate change is leading to distributional shifts of fish stocks, thereby challenging current management systems for shared fishery resources. RFMOs and RFABs - collectively referred to as regional fisheries bodies (RFBs) - are increasingly aware of the challenges posed by climate change, and some have initiated actions such as public awareness-raising initiatives, policies, management plans, events,[43] and projects.[44] However, most organizations have been slow in engaging in the topic of climate change despite the existence of good science, according to relevant discussions during the 9th meeting of the Regional Fishery Body Secretariats' Network (RSN)

[40] Sectoral approach using data from FAO (Barange et al., 2018). This includes costs for marine protected areas, and also safety at sea. Costs of ocean acidification are not included

[41] This analysis was funded by FAO under the NORAD-funded Project on Assisting partner countries and key stakeholders to adapt to climate change effectively (GCP/GLO/352/Nor, component 2).

[42] FAO. 2021. FAO Strategy for Private Sector Engagement 2021-2025. https://www.fao.org/3/cb3352en/cb3352en.pdf

[43] For example, on 2 May 2023, the Bay of Bengal Programme Inter-Governmental Organization (BOBP-IGO) organized an event titled " Tuna Fisheries in the BOB Region: Emerging Challenges Under Changing Climate and BBNJ Regime", with a focus on the impact of changing climate and the emerging Biodiversity Beyond National Jurisdiction (BBNJ) regime on managing transboundary tuna resources. See the meeting report: https://www.bobpigo.org/webroot/publications/Report%20of%20World%20Tuna%20Day%2020%20May%202023.pdf

[44] Sumby, J., Haward, M., Fulton, E.A. and Pecl, G.T., 2021. Hot fish: The response to climate change by regional fisheries bodies. Marine Policy, Vol. 123. https://doi.org/10.1016/j.marpol.2020.104284

held in conjunction with COFI35.[45] In response to COFI35 request, FAO is responsible for convening workshop(s) on climate change in collaboration with RFBs Secretariats. The first workshop focused on RFBs from the Indo-Pacific region (Chennai, India on 17-19 October 2023) and the second workshop, scheduled for mid-2024, will concentrate on RFBs from the Atlantic region, ensuring a balanced number of RFBs for each workshop and to maintaining ecosystem continuity and connectivity. The outcomes are expected to include a compilation of good practices and lessons learnt, as well as the identification of key entry points and opportunities for RFBs to integrate climate change into multilateral fisheries management.

The workshops are intended to build on ongoing climate discussions undertaken by RFBs. For instance, the International Commission for the Conservation of Atlantic Tunas (ICCAT) held a virtual expert meeting on climate change (11-12 July 2023).[46] The General Fisheries Commission for the Mediterranean (GFCM) has also initiated activities to address climate change, in line with its 2030 Strategy for sustainable fisheries and aquaculture. These include organization of a hybrid meeting on the decarbonization of the fishing industry (14-15 March 2023, Rome, Italy), a climate change vulnerability assessment for fisheries in all Mediterranean subregions to identify management measures, a pilot study on non-indigenous species (NIS) in the eastern Mediterranean and a research programme on blue crabs in the Mediterranean, along with a dedicated NIS observatory, as well as including climate change as a dedicated theme in the upcoming GFCM Forum on fisheries science (FishForum). Additionally, the RSN Secretariat circulated a call for inputs to RFBs to gather information regarding their climate work and received feedback from 20 RFBs, the results of which are presented in the RSN Magazine No. 22.[47]

At the global level, the nexus between climate change, aquatic ecosystems, and aquatic food production is receiving increasing attention. The 26th session of the Conference of Parties (COP26) of the United Nations Framework Convention on Climate Change (UNFCCC) mandated annual Ocean Dialogues, officially including the ocean under the UNFCCC multilateral process.[48] The aquatic food sector has been instrumental in generating this momentum, and the Ocean Dialogue, held on 13-14 June 2023 in Bonn, Germany, selected "fisheries and food security" as one of the two topics for deep-dive discussions,[49] thus recognizing the potential of the aquatic food sector in providing climate solutions while ensuring food security.[50] Emphasized throughout the Ocean Dialogue was the vital need to develop a roadmap for the aquatic food sector to be integrated into relevant work programmes and constituted bodies under the UNFCCC, as well as other relevant UN bodies and processes.[51]

FAO is also implementing activities that look at more technical aspects, such as information gathering and use. These include co-sponsoring the Marine Stewardship Council (MSC)'s project on assessing risks of climate change to seafood sustainability to identify challenges and opportunities (e.g. MSC ecolabeling) and collaborating on a technical report that summarizes marine ecosystem and fishery modelling progresses. FAO co-sponsored, through the Common Oceans Tuna Project, an expert workshop (December 2022, Rome, Italy) to inform the risk assessment methodology for improving data use and modelling approaches. This effort is complemented by the FAO's collaboration with the Fisheries and Marine Ecosystem Model Intercomparison Project (FishMIP) team (a global network of marine ecosystem modelers and scientists) to summarize modelling progresses that are relevant

[45] FAO. 2023. Report of the Ninth Meeting of the Regional Fishery Body Secretariats' Network – Rome, 2, 3 and 9 September 2022. FAO Fisheries and Aquaculture Report No. 1398. Rome. https://doi.org/10.4060/cc4686en
[46] https://secretariat.iccat.int/index.php/s/W53aaRtQrP6PjEF
[47] FAO. 2024. Changes from changing climate – Regional Fishery Body Secretariats' Network Magazine, No. 22. Rome. https://www.fao.org/3/cc9471en/cc9471en.pdf
[48] https://unfccc.int/topics/ocean#The-ocean-at-COP-26-
[49] https://unfccc.int/topics/ocean/ocean-and-climate-change-dialogue
[50] Wassénius, E., Jonell, M., Koehn, J.Z., Short, R., Tigchelaar, M., Daw, T.M., Golden, C.D., Gephart, J.A., Allison, E.H., Bush, S.R., et al. 2023. Four ways blue foods can help achieve food system ambitions across nations. Nature, 616(7955), pp.104-112. https://doi.org/10.1038/s41586-023-05737-x
[51] UNFCCC. Ocean and climate change dialogue 2023. Informal summary report by the co-facilitators of the Ocean and Climate Change Dialogue 2023–2024. https://unfccc.int/sites/default/files/resource/Ocean%20dialogue_informal%20summary%20report_SB58_2023%20UNFCCC%20webpage%20publication%20%282%29.pdf

for decision-making. An FAO fisheries and aquaculture technical paper, linked to the "Past and Future of Marine Ecosystems" Special Issue in the journal Earth's Future, is under preparation to summarize the latest findings on future changes in ocean biomass at global and regional scales, as a basis to answer policy questions on biodiversity, water, food, and health to support the blue transformation. Another FAO-led initiative of global relevance is the GEF-funded Common Oceans Program that has ecosystem-based management accounting for environmental variability and climate change, as a central theme in all of its five projects. A specific output of the Common Oceans Tuna Project is to model the effects of climate change on the distribution and abundance of tuna resources in the Pacific, Atlantic and Indian Oceans, support the development of indicators for the implementation of the ecosystem approach, and provide this information to the relevant tuna Regional Fisheries Management Organizations (RFMOs) for decision-makers to take appropriate action. In addition, FAO is working on locating global information that can be used and scaled down to regional and national levels to inform policymaking. Relevant activities include a planned review of the implications of the IPCC-AR6 findings for the aquatic food sector, and the co-convening of the session "Managing fisheries in a world of shifting stocks, integrating biological, policy, behavioral, social, and economic aspects" at the 9th World Fisheries Congress (3-9 March 2024, Seattle, the USA).

c) accounting for cumulative impacts

Climate change is exacerbating disaster risks to fisheries. The approach of reciprocal mainstreaming mentioned above is also essential in Disaster Risk Reduction (DRR). This requires: the incorporation of DRR into fisheries legislation; the alignment of the national legislation, policies and practices with global frameworks for DRR and sustainable development; and the development of appropriate institutional arrangements. The institutional structure should strengthen the horizontal and vertical integration of DRR between different levels of government, between various line agencies, and between other stakeholders (fishing communities, private sector, academia, etc.). This may require building the capacities of the local government units to develop, implement and monitor DRR, as done by FAO in the Philippines. DRR also includes developing risk assessment, developing Preparedness, Response and Recovery Plans, carrying out trainings (e.g. simulation exercises) and awareness activities. Mainstreaming DRR could bring about several positive results: improved safety of fishers and fishing communities, reduced impacts on critical fisheries infrastructure, more efficient and capable institutions with strengthened capacity to manage disasters and more efficient response and rehabilitation of the fisheries and aquaculture sector after a disaster.

Climate change is also adding complexity to the prediction and responses to harmful algal blooms (HABs) that adversely affect food safety and security by contaminating food and causing mass aquatic organism mortality. Surveillance systems, though present in many countries, may lack sufficient lead time or data for effective food safety management or other purposes, such as transferring aquaculture products to other areas. Implementing forecast and early warning systems can mitigate the impacts of HABs and reduce their occurrence. In this regard, FAO, together with the United Nations Educational, Scientific and Cultural Organization (UNESCO)'s Intergovernmental Oceanographic Commission (IOC) and the International Atomic Energy Agency (IAEA), led the development of a Joint Technical Guidance for the Implementation of Early Warning Systems for HABs.[52] This guidance specifically addresses areas where HABs have a direct impact on food safety and security. Over the past years, FAO and IOC/UNESCO have established a productive partnership, particularly within the Intergovernmental Panel on Harmful Algal Blooms (IPHAB), founded in 1991 as a global framework to combat HABs. To enhance collaboration, a joint IOC-FAO Secretariat was created for IPHAB, ensuring a more robust and flexible collaborative structure.

d) application of an ecosystem approach and precautionary approach in the face of climate change

The ecosystem approach and precautionary approach provide foundations for an adaptive and dynamic framework to enable responses to climate change. Viewing ecosystems as tightly coupled socio-ecological systems, an ecosystem approach can be seen as a process for achieving a balance between ecological well-being and human

[52] https://www.fao.org/3/cc4794en/cc4794en.pdf

well-being, ensuring that development does not destroy the natural resource base on which it relies, while also avoiding excessive conservation that hinders rational development.[53] In the context of fisheries, the Ecosystem Approach to Fisheries (EAF) is an approach to fisheries management and development that strives to balance diverse societal objectives, by taking into account the knowledge and uncertainties about biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries.[54] The application of the EAF foresees the thorough identification of key issues that affect, or are likely to affect in the future, the ecological well-being of the system under consideration, the well-being of the people it supports and the ability to achieve these well-beings, whether this ability is related to governance, or to external factors such as climate change. Currently, FAO is developing a guidance document on mainstreaming climate change into Ecosystem Approach to Fisheries (EAF) with a compilation of case studies, as requested by the 1st session of the FAO COFI Sub-Committee on Fisheries Management held on 15-18 January 2024.

Precaution to account for uncertainty and unknowns is another foundation of climate-resilient fisheries. The precautionary approach is acknowledged as a key underlying basis for incorporating uncertainty into decision-making. A precautionary approach is recommended for each stage of the fisheries management process, and Table 1 summarizes the examples of precautionary actions that can be taken in the planning and implementation phases to cope with climate change.[55]

e) incorporating economic, social and cultural aspects into sustainable fisheries management in the face of climate change

Attaining sustainability and climate resilience of the fisheries sector encompasses more than just environmental concerns; it should also account for economic, social, and cultural considerations. Special attention needs to be given to vulnerable communities including small-scale fishers. An example of a related activity is the guide on building resilience to climate change and disaster risks for small-scale fisheries communities, which supports the implementation of the Voluntary Guidelines for Securing Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines), with special attention to protecting human rights.[56]

There is also an increasing recognition of the importance of integrating traditional and local knowledge into climate solutions in the fisheries management cycle, and FAO has captured relevant cases from the Pacific and the Amazon in the report "Indigenous Peoples' food systems. Insights on sustainability and resilience from the front line of climate change".[57]

[53] Staples, D., and Funge-Smith, S. 2009. Ecosystem approach to fisheries and aquaculture: Implementing the FAO Code of Conduct for Responsible Fisheries. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand. RAP Publication 2009/11, 48 pp. https://www.fao.org/3/i0964e/i0964e00.htm

[54] FAO. 2003. Fisheries Management. 2. The Ecosystem Approach to Fisheries. FAO Technical Guidelines for Responsible Fisheries. No. 4, Suppl. 2. Rome, FAO. 112 pp. http://www.fao.org/3/Y4470E/y4470e00.htm#Contents

[55] Bahri, T., Vasconcellos, M., Welch, D.J., Johnson, J., Perry, R.I., Ma, X. & Sharma, R., eds. 2021. Adaptive management of fisheries in response to climate change. FAO Fisheries and Aquaculture Technical Paper No. 667. Rome, FAO. https://doi.org/10.4060/cb3095en

[56] Cook, K., Rosenbaum, K. L. and Poulain, F. 2021. Building resilience to climate change and disaster risks for small-scale fisheries communities. A human-rights-based approach to the implementation of Chapter 9 of the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication. Rome, FAO. https://doi.org/10.4060/cb7616en

[57] FAO and Alliance of Biodiversity International and CIAT. 2021. Indigenous Peoples' food systems: Insights on sustainability and resilience from the front line of climate change. Rome. https://doi.org/10.4060/cb5131en