

GOVERNMENT OF INDIA
Ministry of Fisheries, Animal Husbandry & Dairying
Contribution on
Sustainable Fisheries Management in the face of Climate Change

Experience and direction in the implementation of the agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks, (UNFSA)

India stands out as one of the leading fish-producing nations globally, boasting an extensive coastline stretching over 8000 kilometers and abundant inland water bodies. In the fiscal year 2022-23, its total fish production reached 17.5 million metric tons, contributing approximately 9% to the global production figures (DoF, 2023). The marine and freshwater fisheries sector plays a crucial role in India's food security, serving as a primary source of protein and essential nutrients for millions of its citizens. Additionally, the fishing industry significantly contributes to job creation, income generation, export earnings, and overall economic development, particularly in rural regions.

However, this vital sector faces significant challenges due to the impacts of climate change. Rising global temperatures and unpredictable weather patterns may also impact to the fisheries sector of India. The challenges due to climate change would also affect Indian fishermen, who are among the most vulnerable communities. Given that the Indian fishing industry is largely composed of small-scale enterprises, fishermen are confronted with increased uncertainty regarding the sustained availability of fishery resources due to climate change. This, in turn, may also result in a decline in employment opportunities in fisheries sector.

The following is India's inputs to the Seventeenth round of Informal Consultations of States Parties to the Agreement (ICSP-17), focusing on "Sustainable fisheries management in the face of climate change."

(i) Experience in sustainable fisheries management in the face of climate change, including:

1) Assessing the impact of climate change on fisheries:

Various factors, including increasing seawater temperatures, ocean acidification, rising sea levels, changes in current patterns, more intense cyclones, fluctuations in oxygen and nitrate levels in the ocean, and the movement of fish populations are creating significant challenges to Indian fishery. These challenges could potentially lead to an estimated cost of 1-2% of India's current GDP by 2050 (BOBP, 2023). To understand how climate change is affecting fisheries, India has been implementing extensive research and monitoring programs, including:

Scientific Studies: India has a robust system in place to assess and monitor fish populations, particularly in the marine sector. This involves using research vessels and systematically monitoring landings at harbours. Researchers gather data, use modeling techniques, and analyze information to understand changes in ocean conditions, fish populations, and overall ecosystem health. The Potential Yield (PY)

of marine fishery resources of Indian EEZ is estimated at 5.31 million tones indicating scope for further developing the fisheries (FSI, 2018).

The stock status of 70 Indian marine species, comprising 49 finfishes and 21 shellfishes, was assessed by the ICAR-CMFRI in 2023. Among the 135 fish stocks evaluated, 91.1% were found to be healthy, with 86.7% considered sustainable. Notably, none of the assessed stocks were in a collapsed status (CMFRI, 2023).

The National Innovation for Climate Resilience in Agriculture (NICRA) initiative by ICAR played a significant role in developing a national strategy for climate-resilient agriculture, which also includes fisheries. Under this project, the vulnerability of Indian marine fishes to climate change was evaluated. The vulnerability indices calculated for 68 species across different zones along the Indian coast revealed that three species were highly vulnerable in three coastal zones, and 14 species were highly vulnerable in two zones. Additionally, 13 species were identified as highly vulnerable solely along the east coast. The findings and recommended mitigation measures serve as valuable tools for understanding which species need priority attention zone-wise and the extent of management required.

Monitoring and management of critical habitats such as coral reefs, mangroves, and sea grass beds are carried out by various agencies, notably the Ministry of Environment, Forest and Climate Change of the Government of India and the Forest Departments of its States and Union Territories.

India takes pride in its advanced early warning systems for natural disasters and enhanced monitoring systems for Harmful Algal Blooms under the Ministry of Earth Sciences (MoES) and the Department of Space. Furthermore, oceanographic parameters are monitored by national institutes including CSIR-NIO and NIOT.

Collaborative Efforts: Collaboration between Government agencies, research institutions, and local communities facilitates data sharing, knowledge exchange, and interdisciplinary research on climate change impacts.

Traditional Knowledge: Indigenous knowledge systems held by coastal and freshwater fishing communities provide valuable insights into climate change impacts on fisheries and ecosystem dynamics, complementing scientific research efforts towards climate-resilient fisheries.

2) Addressing the impacts of climate change on fisheries

Adaptation and Mitigation (A&M) Management: India employs adaptation and mitigation (A&M) approaches to tackle climate impacts on fisheries, adapting practices and regulations to changing conditions. Notably, India implements a large-scale initiative, installing artificial reefs and promoting seaweed farming all along the Indian coasts under the *Pradhan Mantri Matsya Sampada Yojana* (PMMSY) programme of the DoF. These measures will help to mitigate climate effects by sequestering carbon, reducing ocean acidity, and restoring marine habitats, offering sustainable alternatives to land-based agriculture and fossil fuels thereby contributing to climate resilient fisheries. India had established more than 125 MPAs,

several sanctuaries and national parks which support climate change A&M in addition to providing other ecosystem services.

Integrated resources Management: India balances ecosystem and socio-economic factors in fisheries management, promoting sustainable fishing practices, habitat protection and biodiversity conservation to ensure long-term resilience and sustainability in its fisheries sector.

Capacity Building: Through various Government Institutes and non-profit organizations, various capacity-building programmes are arranged, empowering fishers, communities, and fisheries managers to adapt to climate change through sustainable practices, alternative livelihoods, and disaster preparedness, enhancing resilience and adaptive capacity.

Policy Support: India's fisheries policies integrate climate change considerations, promoting sustainable practices and conservation measures such as sustainable aquaculture and marine protected areas. The National Policy on Marine Fisheries, 2017 emphasizes targeted research, timely implementation of adaptation measures, and promoting green fisheries to reduce greenhouse gas emissions from fishing activities. This policy advocates a participatory, adaptive, and precautionary fisheries management system.

International Collaboration: India collaborates with RFMOs (e.g., IOTC, SIOFA, CCAMLR) intergovernmental organisations (BOBP-IGO), international organisations, research institutions, and neighboring countries to address trans-boundary issues including climate-resilient fisheries management, fostering knowledge exchange and joint efforts to mitigate climate change impacts etc.

3) Accounting for cumulative impacts

a. Understanding Cumulative Impacts:

Comprehensive Assessments: India conducts comprehensive assessments to understand the cumulative impacts of climate change and other stressors on fisheries. These assessments blend scientific research, stakeholder input, and traditional knowledge to measure the combined effects on fish stocks and marine ecosystems. Under the NICRA project, climate change impact on marine and freshwater fishes were studied and catch prediction for the period 2020-2100 were undertaken under different Representative Concentration Pathways (RCP) scenarios (CMFRI, 2019).

Interdisciplinary Research: Interdisciplinary research programs combine natural and social sciences to explore the interactions between climate change, habitat degradation, pollution, and fishing pressure. By analyzing these interactions, India gains insights into the cumulative impacts on fisheries and develops targeted management strategies.

b. Addressing Cumulative Impacts:

Adaptive Management Strategies: India employs adaptive management to address cumulative impacts by monitoring, evaluating, and adjusting measures based on changing conditions. This emphasizes habitat conservation, biodiversity restoration, and ecosystem service preservation to enhance resilience and sustainability amidst multiple stressors. The concept of climate smart villages had been implemented in the coastal as well as landlocked areas of Indian States and Union Territories. Installations of automatic weather stations and similar facilities along with awareness to enable better weather forecasting and climate change adaptations are planned in these villages.

Policy Integration: India incorporates cumulative impacts into fisheries policies, prioritizing precaution, resilience, and sustainability. This framework aims to minimize cumulative effects and ensure the long-term health of fish stocks and ecosystems.

4) Application of an ecosystem approach and the precautionary approach in the face of climate change

India recognizes the importance of considering broader ecosystem dynamics in fisheries management, including the interconnection of fish populations, habitats, biodiversity, and human activities.

Conservation of Ecosystem Services: India places a high priority on the conservation of critical habitats such as mangroves, coral reefs, estuaries, ponds, rivers, and lakes. These habitats not only sustain fish populations but also offer crucial ecosystem services, including coastal protection, carbon sequestration, and serving as nursery grounds for fish species. As one of the Contracting Parties to the Ramsar Convention, India actively manages wetlands through both *in situ* and satellite monitoring, facilitating the inventory, monitoring, and management of these ecosystems. This ongoing surveillance of wetlands and critical habitats is instrumental in studying the effects of climate change and implementing necessary mitigation measures.

Ecosystem Based Fisheries Management: India emphasizes ecosystem-based approaches to fisheries management, recognizing the interconnectedness of marine ecosystems. Ecosystem-based fisheries management models are developed for various regions within the Indian Exclusive Economic Zone (EEZ). The ICAR-CMFRI had developed ecosystem-based fisheries management strategies for marine waters, whereas the ICAR-CIFRI develops similar strategies for reservoirs and other freshwater bodies.

Risk Assessment and Management: India adopts a precautionary approach to fisheries management, acknowledging uncertainties and climate change risks. Risk assessments identify threats to fish stocks and ecosystems, informing proactive management strategies to prevent over-exploitation and ecosystem degradation. These preventive measures help to minimize irreversible harm to fisheries and ecosystems due to climatic variability and various anthropogenic causes. Examples include a 61-day annual fishing ban for entire Indian coasts, gear restrictions, demarcation of fishing areas for mechanised and artisanal sectors, gear-mesh size regulations, minimum legal sizes (MLS) for capture of exploited resources, and

establishing protected areas and no take zones. These measures aim to conserve fish stocks and preserve vital habitats.

5) Socio-economic and cultural participation in sustainable fisheries management in the context of climate change risk

Socio-economic Participation:

Livelihood Support: In response to climate change, India recognizes the vital socio-economic role of fisheries for coastal communities and fishermen. Sustainable management efforts prioritize supporting livelihoods, creating alternative income opportunities, and establishing social safety nets to lessen the impact of climate change on vulnerable communities. Offering compensatory packages to fishermen during annual fishing bans is a crucial step in this direction. Fishermen Welfare Boards and similar institutions in various State Governments are tasked with compensating fishermen for income loss due to these management measures.

Another notable example of such initiatives is the "*Punargeham*" program, implemented by the State Government of Kerala, which addresses climate change-induced displacement of fishing communities in coastal areas. Similarly, the State Government of Odisha provides livelihood support to marine fishermen during fishing bans for olive Ridley turtle conservation (in addition to 61 days annual fishing ban), furthering efforts in this direction. These programs highlight India's commitment to supporting coastal communities and fishermen amidst the challenges posed by climate change.

Capacity Building: Capacity-building programs empower fishers, local communities, and fisheries managers to adapt to climate change impacts by providing training in sustainable fishing practices, climate resilience, and entrepreneurship. These initiatives enhance socio-economic resilience and adaptive capacity. Government training and research Institutes conduct regular and need-based training programmes and workshops at major fishing villages and landing centres to impart training on various aspects of fishing including mitigating the effects of imminent climate change.

Inclusive Decision-making: India promotes inclusive decision-making processes in fisheries management, engaging fishers, local communities, managers, financial institutions, and other stakeholders. Participatory approaches encourage dialogue, collaboration, and co-management, ensuring that measures align with the socio-economic needs and cultural values of coastal communities. Fisheries Management Councils are constituted at State and district levels to achieve this goal. Fisheries Management Council established by Government of Kerala in 1997 advises the Government in formulating fisheries policies.

Cultural Participation:

Traditional Knowledge: India recognizes the value of traditional knowledge systems held by coastal communities in understanding aquatic ecosystems and climate change impacts (Ravikumar et al., 2014). Indigenous knowledge informs adaptive management strategies, enhances ecosystem resilience, and fosters cultural pride and identity among fisherfolk.

Cultural Practices: India recognizes the importance of integrating cultural practices into sustainable fisheries management. Rituals, customs, and community-based institutions foster stewardship and collective action among fishing communities, enhancing social cohesion and resilience to climate change. Many communities voluntarily observe fishing bans and abstain from fish eating during cultural or religious occasions. In some regions, fishermen protect areas designated as sacred groves or fish sanctuaries, demonstrating the profound link between cultural beliefs and environmental conservation.

(ii) Lessons learned, best practices, and challenges in sustainable fisheries management in the face of climate change

Lessons Learned:

Interconnectedness of Ecosystems: India has learned that fisheries management cannot be viewed in isolation but must consider the broader ecosystem dynamics. Climate change impacts on aquatic ecosystems affect fish stocks, habitats, and biodiversity, highlighting the need for an integrated approach to management.

Community Engagement: Engaging local communities, fisherfolk, and stakeholders in decision-making processes is critical for successful fisheries management. India has learned that participatory approaches empower communities, enhance compliance, and foster ownership of management measures.

Adaptive Management: Flexibility and adaptability are essential in responding to climate change impacts. India has learned the importance of adaptive management strategies that allow for iterative decision-making based on evolving environmental conditions and scientific knowledge.

Best Practices:

Ecosystem-Based Management: India promotes ecosystem-based approaches to fisheries management, recognizing the interconnectedness of marine ecosystems.

Precautionary Approach: India adopts a precautionary approach to fisheries management, acknowledging the uncertainties and risks associated with climate change. Implementing preventive measures, adopting green fishing, and monitoring fish populations help mitigate risks and prevent over-exploitation.

Stakeholder Engagement: Involving diverse stakeholders, including fishers, local communities, scientists, financial institutions, and policymakers, fosters collaboration, transparency, and accountability. Regular feedback loops with all stakeholders enhance the effectiveness and legitimacy of management measures.

Challenges:

Limitations in Data collection: Although India have a well established system for fisheries data collection, there are challenges in real-time scientific monitoring and frequent data collection due to a very long coastline of the country, remotely located

fish landing sites and limitations of trained manpower required for effective assessment and response to climate change impacts. Implementing real-time data reporting mechanisms, equipping fishing crafts with electronic logbooks, capacity building and fostering collaboration among national and international bodies may further enhance the comprehensive stock status monitoring.

Capacity Building: Building technical and institutional capacity is essential for implementing sustainable fisheries management practices. India faces challenges related to training, resources, and institutional coordination, particularly at the local level.

Monitoring, Control, and Surveillance (MCS) system: India's MCS system is esteemed as one of the most advanced; nevertheless, facing challenges like the vast coastline, remote landing sites, and limited resources and manpower allocated to MCS efforts indicates a need for further enhancement, which will be pivotal for ensuring sustainable fisheries management amidst climate change.

Gender mainstreaming: India is taking effective steps to address gender disparities in fisheries participation and management. Empowering women in decision-making is also essential for enhancing socio-economic and cultural involvement and fostering resilience in fishing communities.

Community Engagement: Enhancing community engagement in fisheries management necessitates effective communication, capacity-building, and institutional support. Investing in social capital and collaborative governance boosts the legitimacy and effectiveness of management measures. Best examples of fisheries management councils in some of the Indian States need to be extended to other States and Union Territories.

Surging natural calamities: Addressing the recent surge in natural calamities along Indian coasts, partly due to climate change, requires additional resources for compensation, rehabilitation, infrastructure rebuilding, and alternative income generation.

(iii) Actions needed to further strengthen sustainable fisheries management in the face of climate change, including addressing particular challenges faced by developing countries through capacity-building under Part VI of the Agreement.

Equitable Responsibility Sharing: Given that industrialized developed States are largely responsible for climate change, there is a need for equitable responsibility sharing in supporting developing countries' efforts to strengthen sustainable fisheries management in the face of climate change. This includes providing financial aid, technology transfer, and capacity-building initiatives to help them adapt to and mitigate climate impacts on fisheries, especially the small-scale fishers. By contributing to international funds, facilitating technology transfer, and sharing expertise, industrialized nations need to ensure a fair distribution of the burden, considering historical emissions and differing capacities to address climate challenges.

Enhanced Data Collection and Monitoring: Developing countries struggle with fisheries and oceanographic data collection due to resource and infrastructure

limitations. Capacity-building and technology transfer efforts should focus on improving data systems and monitoring technologies to grasp climate change impacts on fish stocks and aquatic ecosystems. This may include training fisheries managers and scientists in data techniques.

Climate Resilience Training: Developing countries require capacity-building support to adapt to climate change in fisheries. Training should equip fishers, communities, and managers with skills for climate-resilient practices and technologies.

International Collaboration and Knowledge Sharing: Developing nations stand to benefit from international collaboration in adopting energy-efficient propulsion, sustainable fishing practices, green climate-proofed fisheries infrastructure, and the use of alternative fuels and green energy. Sharing of information and technology on early warning systems, fishing safety innovations etc., and protecting the coasts from swell surges due to sea level rise, extreme weather conditions etc. will also benefit developing states. Capacity-building efforts should facilitate partnerships between developed and developing countries, regional fishery groups, and international organizations. This collaboration fosters the exchange of best practices and technical expertise, promoting climate-resilient fisheries management.

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