Brief Communication

Eleven policy recommendations for harnessing the potential of marine fisheries in India

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Introduction

A high-level policy-oriented workshop was organized under the aegis of the National Institution for Transforming India (NITI Aayog), in collaboration with the Department of Fisheries, Government of Kerala, and the ICAR-Central Marine Fisheries Research Institute (ICAR-CMFRI), on 5th January 2024 at ICAR-CMFRI Headquarters, Kochi, India. The workshop was titled "Harnessing the Potential of Fisheries in the Marine States" and primarily intended to serve as a platform to garner ideas and opinions towards developing strategies and options to optimize the harvest and utilization of marine resources in India's EEZ. The workshop was attended by Shri. Suman Bery, Hon. Vice Chairman, NITI Aayog, and Prof. Ramesh Chand, Hon. Member (Agriculture), NITI Aayog, and senior officials and delegates representing the NITI Aayog, Department of Fisheries, Government of Kerala, Marine Products Exports Development Authority (MPEDA), office bearers of Seafood Exporters Association of India (SEAI), scientists and staff of ICAR-CMFRI, Fishery Survey of India (FSI), ICAR-CIFT and other research and academic institutions, representatives of fishermen associations, civil society of organizations and other stakeholder institutions. The forum enabled experience-sharing between coastal states, facilitated discussion on key challenges, and aided deliberations on a variety of potential solutions. The presentations and discussions also focused on how technology and policy changes can make fishing more efficient, while also encouraging a shift towards mariculture and land-based fish farming. This brief note delves into the eleven key recommendations proposed as part of the workshop deliberations by Dr. A. Gopalakrishnan, Director, ICAR-CMFRI towards harnessing the potential of marine fisheries in India. Implementing these critical policy action points will require careful consideration at the highest levels of the government and a coordinated effort from all stakeholders within the marine fishing industry. These priority areas were chosen by carefully considering the challenges to growth within the sector, the need to ensure the sustainability of marine ecosystems, opportunities to tap into new resources, and our national and global commitments. The prioritization was also guided by recent research findings in the field of marine fisheries and experiences of interacting with various stakeholders associated with fish harvesting, marketing, processing, trade, and other extended value chains.

Recommendations

Introduction of a central legislation (Marine Fishery Act) for regulation of fishing in the Exclusive Economic Zone (EEZ) to address policy and legislative vacuum

According to the Seventh Schedule of the Constitution of India, states possess the jurisdiction to govern fishing and fisheries in territorial waters, while the Union Government retains jurisdiction beyond territorial waters, specifically between 12 nautical miles (nm) and 200 nm. Consequently, marine fisheries within territorial waters (areas up to 12 nm from the coastal baseline) are governed by the Marine Fisheries Regulation Acts (MFRAs) enacted

by the respective state governments. These MFRAs contain numerous provisions to regulate, restrict, or prohibit unsustainable or destructive fishing practices, define access rights, impose spatial and temporal fishing restrictions, and mandate licensing and registration of fishing vessels. They also incorporate clauses to penalize non-compliance and include appellate provisions to ensure fair governance of fishing and related activities.

Nevertheless, fishing and allied activities beyond territorial waters remain unregulated in India due to the absence of a Central Act for the Exclusive Economic Zone (EEZ). Such an act is crucial because fishing activities have progressively shifted from near-shore areas to deeper waters following the introduction of multi-day fishing in the early 2000s. A Central act for the EEZ can effectively address matters such as resource conservation, sustainability of fishing in deeper waters, scientific studies, data collection, and punitive measures for harmful and unscientific fishing activities, as well as address issues like intrusion of foreign fishing vessels.

Institutionalization of periodic stock assessment of major fishery resources

Sustainable management and governance of marine fisheries are critically needed, given the multiple constraints faced by the sector that include issues of inefficient management systems, fishing capacity beyond optimal levels, marine pollution, declining biodiversity, habitat destruction, and climate change. Towards this goal, one of the key interventions is monitoring and assessment of commercially exploited marine fishery resources on a regular basis for assessing the sustainability status. ICAR-CMFRI recently completed the assessment of 135 fish stocks covering 70 species (including 49 finfishes and 21 shellfishes) in one or more regions of their availability for 2022. The results show that of the 135 fish stocks assessed, 91.1% were healthy, with 86.7% being sustainable, 4.4% subject to overfishing, 8.2% overfished, and 0.7% rebuilding. None of the assessed stocks had collapsed during the period of assessment. Sustaining such nationwide stock assessments on a regular basis requires the establishment of an institutional mechanism under the overall supervision of the Government of India. Relevant decisions such as the species and stocks to be assessed, the periodicity of assessment, the assessment protocols and methodology to be followed, etc. may be determined by following due deliberations and keeping in mind the international best practices in the realm.

Setting up AI-mediated automated mechanisms for landing estimation, analytics of sub-stock-level information

With almost the entirety of the fishery resources of the Indian EEZ and the Territorial Waters of maritime states and UTs under monitoring and surveillance by the Central and State Government agencies, the production from capture, and to a minor extent, by mariculture has been the hinge on which the policy pathways are moderated upon. However, the current methods for the estimation of fish landings/production data, while comprehensive, rely heavily on manual data collection, making the process time-consuming and prone to human error. To address these limitations, the logical next step is to leverage the available opportunities to develop artificial intelligence (AI)/ Machine Learning (ML)-powered information collection modules. These modules would handle tasks like resource identification, quantification, vessel location tracking, and monitoring fishing activity. Thus, it is high time that a concerted effort is made toward setting up automated/ unmanned data collection of marine fishery production at the policy, governance, and technical orientation level.

The marine fisheries scenario of India is quite vibrant with innovations and sudden crystallization of unexpected challenges, which makes the chain of information from the sea to fish consumers quite a dynamically self-calibrating one. In this context, a combination of machine learning techniques like computer vision and electronic record-keeping systems should be the immediate short-term priority. An automated and self-evolving data collection system can meet diverse needs such as ensuring crew safety, identifying and assessing new fish populations at finer levels (including sub-stocks and specific variations), and providing valuable market intelligence – all crucial aspects for regulatory decision-making.

Focussed research and exploration projects for assessment and characterization of deep sea and non-conventional fishery resources

The National Marine Fishery Policy, 2017 has underlined that one of the approaches to intensify capture fish production in India is the exploitation of deep ocean resources, which are yet to be tapped fully. The proposed activities of deep ocean survey, exploration as well as technological innovations for exploration and conservation of deep sea

biodiversity under the ongoing Deep Ocean Mission can be utilized to develop a clear understanding of the wealth of fishery resources and other marine flora and fauna in deep ocean regions, besides meeting other stated objectives of the Mission. Previous studies have indicated that India has an estimated harvestable potential of 2.0 million metric tonnes of deep ocean resources in these areas which offer a potential new frontier for commercial fisheries. This includes 0.265 MT of conventional resources (mainly 0.215 MT of oceanic tunas, tuna-like fishes, and deep sea sharks) and 1.85 MT of non-conventional resources. The non-conventional resources predominantly include mesopelagic myctophid fish (potential of 1.0 million tonnes), oceanic squids, jellyfish, and marine microalgae. The potential of purpleback squid (*Sthenoteuthis oualaniensis*) and other cephalopods in the deep waters of the Arabian Sea alone is estimated at 0.63 million tonnes. Mesopelagic fishes including lanternfishes are largely unexploited, as they are not used for direct human consumption owing to their high lipid or wax ester content. These fish are a good source of protein, lipids, and minerals, which can be used to advantage in the fishmeal industry and cosmetic industry through appropriate scientific interventions. A joint research program along these lines by ICAR-CMFRI and ICAR-CIFT is presently under consideration. Considering the above facts, an institutional mechanism is needed to oversee deep sea fishing and related aspects. Deep sea resource exploitation should be based on a clear understanding of economic viability and resource status, and subject to national/state-specific policy guidelines.

Integrated fishery development plans for island ecosystems

India's island territories, Andaman and Nicobar Islands, and Lakshadweep boast rich fishing grounds. However, ensuring their long-term viability necessitates developing and implementing integrated fishery management plans. Some of the essential components of such island-centric integrated management plans include (i) a Precautionary approach towards the expansion of fishing activities and a focus on sustainable fishing practices, (ii) the Incorporation of new technologies to improve fishing efficiency with minimal environmental impact (iii) Promoting suitable mariculture and land-based aquaculture to diversify production and reduce pressure on the wild stock and (iv) live-bait management plan for sustaining traditional mode of sustainable tuna fishing. Management of live bait fishery in the Lakshadweep islands requires special attention, considering some of the prevailing unsustainable fishing practices and the resultant decline in live bait stocks in the island waters. Some of the thrust areas for management of live-bait fishery in Lakshadweep include (i) improving the efficiency of live-bait fishing and minimizing wastage due to mortality (ii) Implementing regular training for fishers and fisheries managers on good live bait fishing practices (iii) adopting measures to minimize the interaction of live bait fishing with Endangered, Threatened and Protected (ETP) species, especially corals (iv) regular monitoring of live bait ecosystems and enhancement of natural stock through breeding and sea ranching (v) Improved data collection and management, particularly on live bait species, area and time of live bait spawning aggregations and other details.

Streamlining and intensification of mariculture

Mariculture is a fast-emerging sub-sector of India's Blue Economy. This promising enterprise received a fillip with the development of seed production and farming technologies for some high-value marine fish species by ICAR-CMFRI during the mid-2000s. Research efforts have so far yielded fully mature technologies for 12 finfish, while technologies for 24 species are in various stages of development. Currently, the available technologies in this segment include (i) sea cage farming of finfishes, (ii) hatchery production of cobia, Silver pompano, Indian pompano, Asian sea bass, Orange-spotted grouper, Pink ear seabream, Banded grunter, John's Snapper, Vermiculate spinefoot, and Picnic seabream (iii) seed production and farming of bivalves–Green mussel, Edible oyster and clam (iv) production and farming of the Swimmer crab, Green tiger prawn and fattening protocols of marine lobsters, (v) seaweed farming, (vi) fish production in Recirculation Aquaculture Systems, (vii) Integrated Multitrophic Aquaculture Systems (IMTA), (viii) live feed production techniques for larviculture, marine aquarium techniques (ix) marine ornamental fish culture and (x) marine pearl production.

Developing brood banks, breeding centers, hatcheries, nurseries, and a reliable supply of quality fish feed are crucial infrastructure needs. Supportive policies and clear regulations addressing site selection, leasing, licensing, environmental impact, health management, certification, credit and insurance, and market access are essential to attract entrepreneurs into the mariculture space. Furthermore, mariculture is a dynamic field, and India should embrace advancements in technology and inputs to optimize production. It is envisioned that by 2050, India

can produce about 4.1 million tonnes per annum of marine fish through cage culture alone if one percent of the total coastline (8118 km) can be utilized for mariculture. For this, the country must develop dedicated mariculture parks as envisaged in the draft NMP which would be managed by local fishermen groups/co-operatives/entrepreneurs. In addition, requirements of seed (about 2460 million) and feed (about 6.15 million tonnes) are to be commensurately ensured to meet the future demand from the sector.

Installation of artificial reefs and establishing mechanisms for their continuous impact assessment monitoring and improvisation.

Improved access to fishery resources can be achieved through revitalizing marine ecosystems through the Ecosystem Approach to Fisheries Management (EAFM). A major initiative in this direction is the establishment of artificial reefs (ARs) which have proven to aid in long-term habitat reconstruction through a build-up of natural reef-like fauna and flora. ARs are submerged structures that mimic natural reefs, providing habitat for fish and other marine life. When managed sustainably, they contribute to an increase in fish populations, promote biodiversity, and support recreational diving and fishing. Currently, in India, ARs have been deployed along four states (132 locations, 26,575 units, with a total area of 37 ha), leading to a 17–30% increase in the local fishery. The Government of India (GoI) is presently giving a major boost to ARs by promoting their installation in identified locations under the ongoing scheme 'Pradhan Mantri Matsya Sampada Yojana'. ARs can indirectly act as Other Effective Conservation Measures (OECMs) in marine fisheries, which form complementary approaches towards marine ecosystem conservation while at the same time sustaining the livelihoods of local traditional fishing communities. Along with establishing new ARs, it is equally important to establish mechanisms for their continuous impact assessment, monitoring, and improvisation, which would act as feedback loops for their efficient management in the long run.

Concerted efforts for a cleaner environment

India must enhance marine environmental governance through stronger regulations and improved implementation of Marine Protected Areas (MPAs), while continuing to follow Integrated Coastal Zone Management (ICZM). Pollution control requires robust waste management in the terrestrial domain so that pollutants will be denied entry to the sea, besides strict industrial effluent controls, plastic reduction initiatives, and improved oil spill response. The increasing incidences of ghost fishing and instances of abandoned, lost, and discarded fishing gears make it imperative to mark the gears with specific tools so that traceability can be achieved for better managing the gear-related discards during fishing operations. Monitoring, evaluation, and surveillance of global marine litter and the efforts coordinated by the Glo-Litter community need a renewed emphasis in Indian waters to achieve the targets proposed. Unprecedented increase in Harmful Algal Blooms (HABs) (almost twice in the Bay of Bengal and thrice in the Arabian Sea) is a major reason for fish kills and acts as an impediment to mariculture activities. An early warning system, for HAB events and other extreme events, can be a boon for otherwise struggling fishers and mariculture farmers. Research and monitoring efforts should focus on pollution levels, ecosystem health indicators, and climate change impacts. Promoting sustainable fishing and aquaculture, raising public awareness, and engaging local communities are essential considering the larger stake in marine fisheries. Key research targets include improving existing baseline data collection, pollution impact studies, habitat restoration, and climate resilience. Collaborative efforts aligning with national priorities, state governments, academia, industry, NGOs, and international bodies are vital for achieving a cleaner and sustainable marine environment.

Development of a national guideline on eco-labeling of marine fishery resources

Ecolabel is a market instrument to ensure that fish is sourced from a sustainable fishery. It is assumed to be anchored on three basic incentives, viz., (i) premium prices for fishers for adhering to sustainable fishing practices, (ii) better-managed fishery with mechanisms in place to monitor the health of fish stocks, and (iii) better market access, reputation and credibility for the food chain fraternity. Ecolabeling is done based on a set of standards that define fisheries sustainability and an assessment protocol. They are commonly promoted and administered by third-party labeling agencies or industry/retail groups, though self-declaration by a country/state is also possible subject to third-party verification and granting of equivalence. After completing the assessment protocols, a certificate is issued to a group of operators in the fishery for a period by charging a fee. Even though ecolabel comes with the

potential benefit of harnessing the collective power of value chain agents to achieve ecosystem sustainability, they are criticized for varying types of negative consequences. Some of the purported drawbacks of ecolabel include (i) concerns of monopoly by a few leading market players causing the threat of ecolabel becoming a condition for market access, and a potential trade barrier (ii) concerns regarding inequitable sharing of benefits, mainly, exclusion of some fishers/fisher groups from deriving legitimate benefits (iii) limited coverage of certification only to a few high-value products, thereby constraining its positive ecosystem-wide impacts, and (iv) other hurdles such as water quality, microbial contamination, etc. acting as trade-limiting factors in a labeled fishery. Under these premises, it is suggested that a national guideline on ecolabel covering all relevant dimensions may be notified and be made binding on concerned stakeholders, before allowing a country-wide introduction of ecolabel schemes in fisheries.

Regulating private investments in the post-harvest fisheries sector to safeguard the livelihoods of small-scale fishers and entrepreneurs.

While private investment holds immense potential to modernize India's post-harvest fisheries sector, attracting it requires a nuanced approach. This approach must strike a delicate balance between fostering healthy competition to drive innovation and efficiency, while simultaneously implementing regulations to safeguard the livelihoods of small-scale fishers and entrepreneurs. Unchecked private investment could lead to unintended consequences, with large corporations squeezing out smaller players through price manipulation and controlling the supply chain. This could leave fishers vulnerable to exploitation and disrupt traditional fishing practices that have sustained coastal communities for generations. Furthermore, unregulated investment might prioritize short-term gains over sustainability, leading to overfishing and ultimately harming the very resource the industry depends on. To ensure equitable growth, regulations should focus on fair competition through licensing and quotas, while encouraging decentralized processing units closer to fishing villages to promote local economic development. Additionally, integrating private investment with existing producer organizations run by small-scale fishers empowers them to collectively bargain for better prices and participate more actively in the value chain. Skill development programs can further enhance their competitiveness in the evolving market. Finally, regulations should incentivize sustainable fishing practices and processing techniques to ensure the long-term viability of the resource and the communities that depend on it.

Strengthening fishermen accident insurance, fishing vessel insurance, and coastal immovable asset insurance through technological and policy interventions.

India's vibrant fishing industry faces inherent risks, from perilous weather conditions at sea to potential damage to vessels and coastal properties. A multi-pronged approach is needed to mitigate such risks through appropriate risk management instruments that are affordable and readily accessible to the fishermen. Strengthening fishermen's accident insurance, fishing vessel insurance, and coastal immovable asset insurance can play an instrumental role in ensuring adequate and timely compensation for the losses incurred by fishermen in extreme weather events and other accidents. There is a general discontent among fishermen about high insurance premiums and the unavailability of custom-made insurance products. Strengthening existing insurance options and offering flexible premiums, compensating for partial damage to fishing vessels, and gear protection can incentivize participation. Empirical studies have shown that ensuring the participation of grassroots-level organizations (fishery cooperatives/ NGOs/boat owner associations) as intermediaries or partners for insurance administration can improve its penetration in coastal areas. Micro-insurance is a promising avenue, particularly to administer coastal asset insurance. Bundling micro-credit with asset/disaster insurance programs is another sensible option to enhance coverage of schemes in areas where self-help groups have an active presence. The government should encourage competition in the sector, consider mandatory insurance, and develop dispute-resolution mechanisms. Additionally, special insurance schemes for new aquaculture practices like cage culture, seaweed farming, and mussel culture can benefit mariculture entrepreneurs.