Managing the Unmanaged Shared Resources:

Policy Options for Managing the Transboundary Stocks in the Bay of Bengal

Working Document

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About the Document

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The document was discussed in the IX Technical Advisory Committee (TAC) held at Chennai on 30 Aug 2024 and the comments were addressed.

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1. Introduction

It is now well known that unchecked pursuance of self-interest over shared and common resources such as fish stocks leads to their over-exploitation and the possibility of possible collapse, a phenomenon known as the 'tragedy of the commons', resulting in collective misery over the long run. There is considerable theoretical and empirical evidence generated on this aspect since Hardin's seminal work of 1968. The Food and Agriculture Organization (FAO) reported in its flagship publication the State of World Fisheries and Aquaculture (2022), that the share of over-harvested fish stock reached a new high of 35.4 percent in 2019, an increase of 1.2 percent compared to 2017 and about four times since 1974 (10%)[1].

The situation is not any better in the Indian Ocean, with 34.7 percent of stocks in the Eastern Indian Ocean (EIO) and 37.5 percent of stocks in the Western Indian Ocean (WIO) estimated to be harvested at an unsustainable level (*op cit*).

The Bay of Bengal Large Marine Ecosystem (BOBLME) (***Figure 1***) is not only one of the largest marine ecosystems globally, but it is also pivotal in sustaining the fisheries economy within the broader Indian Ocean region. The Bay of Bengal's waters, stretching over 6.2 million km^2, are home to diverse fish stocks and critical habitats, which provide both direct sustenance and economic benefits to the millions who live along its coasts. Approximately 80 percent of the catch in the EIO comes from the states bordering the Bay of Bengal, underlining its immense contribution to the region's fisheries.

Fisheries in the Bay of Bengal are integral to food security, economic livelihoods, and export revenues for its bordering countries. The ecosystem supports a wide array of species, from small pelagic fish to larger tuna, making it a vital resource for both local consumption and international markets. This region also features complex migration patterns, with fish stocks moving across the Exclusive Economic Zones (EEZs) of the eight bordering countries—Bangladesh, India, Indonesia, Malaysia, Maldives, Myanmar, Sri Lanka, and Thailand—making shared management a necessity.

The significance of BOBLME's fisheries within the Indian Ocean goes beyond local economies. The region's fisheries form part of a larger Indian Ocean fishery system, crucial for the global seafood supply chain. Tuna and other highly migratory species caught here are not only essential for regional markets but are also exported globally. However, the overexploitation of these shared stocks, combined with unsustainable practices such as illegal trawling and destructive fishing techniques like blast fishing, poses a serious threat to the long-term viability of these resources.

Furthermore, the environmental health of the Bay of Bengal is directly linked to the larger Indian Ocean ecosystem. Coastal pollution from land-based sources, unchecked coastal development, and degradation of critical habitats like coral reefs and mangroves have already caused significant declines in fish populations. These ecological damages weaken the capacity of the region to support sustainable fisheries, which in turn exacerbates the socio-economic vulnerabilities of millions of people relying on these ecosystems.

[1] FAO. 2022. The State of World Fisheries and Aquaculture 2022. Towards Blue Transformation. Rome, FAO. https://doi.org/10.4060/cc0461en

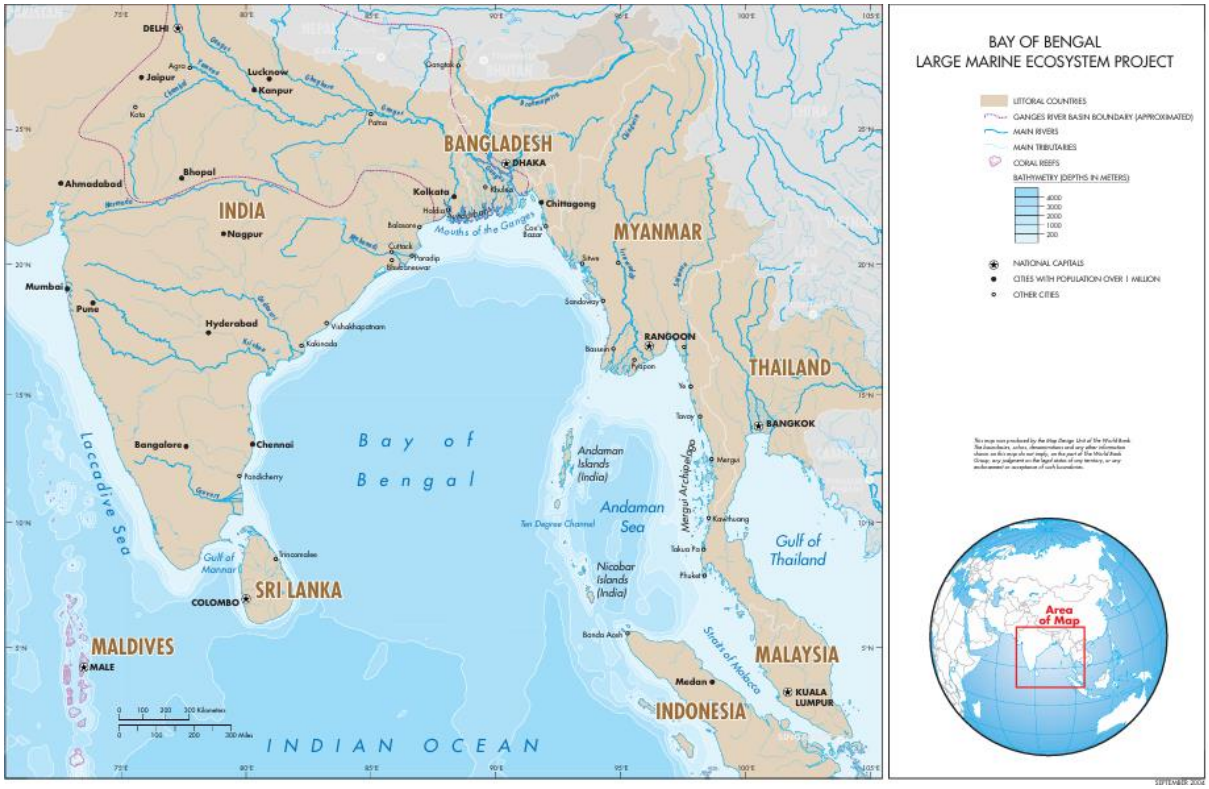

Figure 1. The Bay of Bengal Large Marine Ecosystem[2]

In light of its importance, the BOBLME requires a concerted, transboundary approach to fisheries management. Without collaborative legal frameworks, effective enforcement, and the adoption of an ecosystem-based management model, the pressures of overfishing and environmental degradation could severely compromise the productivity of fisheries in the Bay of Bengal and, by extension, the Indian Ocean. Sustainable management of the BOBLME is therefore not only essential for the livelihoods of coastal communities but also for the stability of the Indian Ocean's fisheries economy.

2. Transboundary Resources

The term "transboundary fish stocks" refers to fish populations that migrate across or straddle the exclusive economic zones (EEZs) of two or more countries. This strict definition of transboundary stocks is in line with the classification of shared stocks provided in the United Nations Convention on Law of the Sea Art 63:

> *(a) "the same stock or stocks of associated species occur[ring] within the exclusive economic zone of two or more coastal States" (Art 63(1));*

It does not include other transboundary species (or straddling and highly migratory fish stocks, defined in the UNCLOS 1982 as: *(b) "the same stock or stocks of associated species occur[ring] within the exclusive economic zone and in an area beyond and adjacent to the zone" (Art 63(2)). These stocks are largely tunas which are under management of the Indian Ocean Tuna Commission (IOTC).*

In case of BOBLME, political boundaries often overlapped natural boundaries, creating many potential transboundary stocks. A study carried out under the BOBLME Project (BOBLME, 2015) highlights the shared nature of the Bay of Bengal, emphasizing the interconnectedness of its marine ecosystems

[2] IOC33629 (unwater.org)

across the littoral states. BOBLME is characterized by a complex network of physical, biological, and ecological processes that transcend national boundaries, making it a true transboundary ecosystem. The study outlines those major drivers such as monsoonal winds, ocean currents, and riverine inflows, including those from the Ganges, Brahmaputra, and Irrawaddy rivers, shape the productivity and biodiversity of the region in ways that affect multiple countries simultaneously.

As mentioned above, this shared nature is particularly evident in the distribution and migration of marine species, which often span across the exclusive economic zones (EEZs) of multiple nations. Species such as Hilsa (*Tenualosailisha*), mackerels, tunas, and shrimps move across national waters during different life stages, making regional cooperation essential for sustainable fisheries management. Additionally, the Bay's diverse habitats, including coral reefs, mangroves, and seagrass beds, support a wide range of species that are critical to the livelihoods of coastal communities throughout the region. The degradation of these ecosystems in one country can, therefore, have direct consequences for biodiversity and fisheries in neighbouring countries.

Vivekanandan (2010) said that each of these sub-regions is a self-sustaining ecosystem but with overlapping residual species. A few species are distributed in large areas: for example, the Indian mackerel *Rastrelliger kanagurta* and the thread fin bream *Nemipterus japonicus* are distributed along the entire rim of the Bay of Bengal. On the other hand, some other species have a restricted distribution: for example, the shad *Tenualosailisha* and the Bombay duck *Harpadonnehereus* have distributional abundance largely restricted to the northeast coast of Bangladesh, India, and Myanmar. These differences in species distribution and abundance, but with overlapping national jurisdictional boundaries, underline the need for considering the sub-regions to manage the resources distributed in two or more countries.

Based on fisheries species complexes, a set of suggested sub-regions, which share the resources, is tabulated below (Table 1):

Table 1: Sub-regional Fisheries Complex in the Bay of Bengal

Code	Sub-regional Fisheries Complex	Concerned states
1	Western BoB Oceanic Complex	India - Maldives - Sri Lanka
2	Gulf of Mannar Complex	India - Sri Lanka
3	Sunderbans Complex	Bangladesh - India – Myanmar
4	Middle East BoB Complex	Bangladesh – Myanmar
5	Malacca Strait Complex	Indonesia - Malaysia - Myanmar - Thailand–
6	Western Andaman Sea Complex	India - Indonesia - Malaysia - Thailand
7	Eastern BoB Oceanic Complex	India – Indonesia - Malaysia - Myanmar - Sri Lanka - Thailand

3. Identification of Transboundary stocks

Alam et al. (2013) characterized transboundary species in the Bay of Bengal as those whose populations cross international borders, encompassing not only the physical migration of adult individuals but also the dispersal of larvae and the impact of fishing activities on migration patterns.

A recent study (Palacios-Abrantes et al., 2020) used two main criteria to identify transboundary stocks, focusing on species shared between neighbouring countries' Exclusive Economic Zones: (1) Geographic Proximity, where they used a shape file from the Sea Around Us project to determine

which species were present in the EEZs of neighbouring countries, ensuring that only species found in adjacent areas were considered transboundary; and (2) Data Agreement, where they cross-referenced their findings with three databases (an occurrence database, the ENM-Nereus model, and the SDM-SAU model) to ensure accuracy, and only classified species identified as present in all three databases as transboundary. Additionally, the authors only considered species that were fished in those EEZs, using catch data from the Sea Around Us database.

Trend in production of transboundary species

From 1990 to 2019, the total catch of all species shows a general upward trend with some fluctuations, indicating an increase in overall fishing activities and possibly improvements in fishing technologies and efforts. The catch of transboundary species follows a similar trend, underscoring their significant contribution to global fisheries. Throughout this period, the percentage contribution of transboundary species to the total catch remains relatively stable, ranging from 58% to 65%. This stability suggests that transboundary species consistently form a major part of the total marine catch (***Figure 2***).

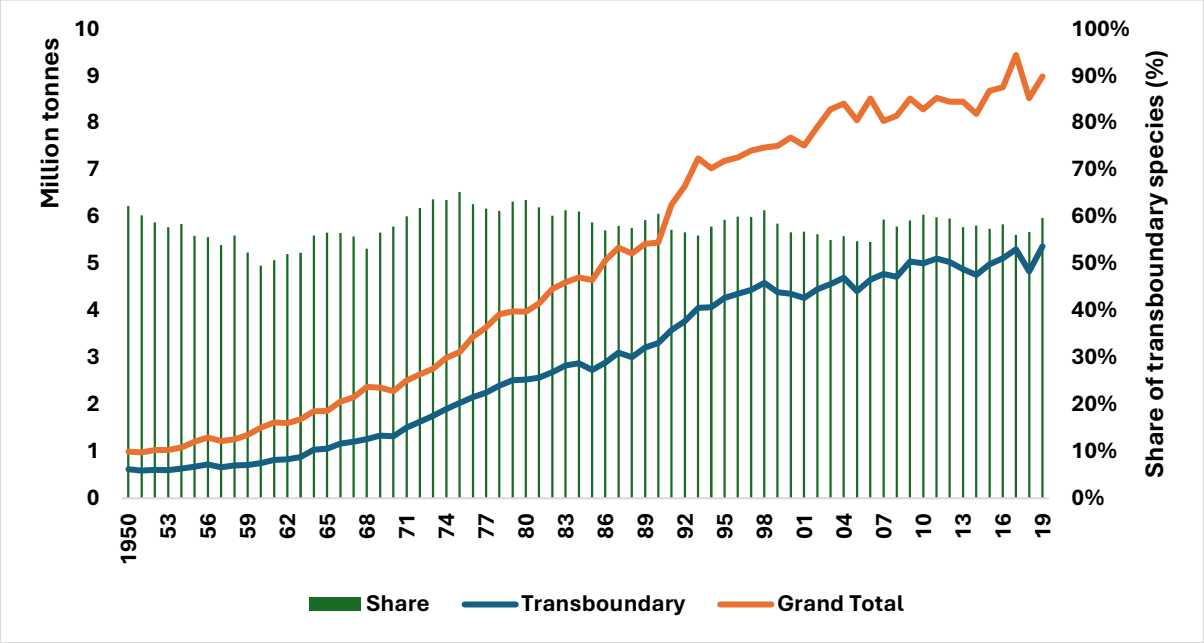

Figure 2. Trend in catch of transboundary species in the Eastern Indian Ocean
(Compiled from Sea Around Us)

The data indicates that transboundary species play a critical role in the fisheries sector. Their significant and stable contribution highlights the importance of international cooperation in the management and conservation of these species. Effective management strategies are necessary to ensure the sustainability of these species, given their shared nature and the pressures from increased fishing activities.

Major Transboundary Species

Commercial Shrimps and Prawns: This species is predominantly produced by countries with contiguous EEZs, including Australia, Bangladesh India, Malaysia, Myanmar, and Thailand. The

contiguous block comprising these countries demonstrates the shared nature of this valuable resource. India, for example, holds a substantial production share (25.71%), while Malaysia contributes significantly (43.15%). Collaborative management strategies are essential to ensure the sustainability of shrimp stocks across these nations.

Drums, Croakers: Drums and croakers are another major transboundary species, primarily produced by Bangladesh, India, and Myanmar. The significant shares from these countries (Bangladesh 6.20%, India 28.85%, Myanmar 35.67%) highlight the need for coordinated efforts in fisheries management. Sri Lanka also contributes to the production of this species (4.96%), further emphasizing the transboundary nature of these fish stocks.

Hilsa Shad: Hilsa shad, with a predominant production share from Bangladesh (87.49%), also involves India (12.51%) in its production. The migratory patterns of Hilsa shad across the Ganges-Brahmaputra-Meghna (GBM) river system necessitate regional cooperation between these countries to manage and conserve this critical species effectively.

Slip mouths and Pony fishes: The production of slip mouths and pony fishes is significant in countries such as Bangladesh, India, Myanmar, and Thailand. This species' production shares highlight the importance of contiguous EEZs in managing shared fish resources. Collaborative measures among these countries can help maintain the sustainability of pony fish populations.

Indian Mackerels: Indian mackerels are predominantly produced by India and Malaysia with minor contributions from other neighbouring countries. Regional cooperation is crucial to address the migratory nature of mackerels and ensure their sustainable harvest.

Herrings, Shads, and Anchovies: Countries like Bangladesh, India, and Myanmar hold significant shares of herrings, shads, and anchovies production. The transboundary distribution of these species highlights the need for joint conservation strategies to manage their populations effectively.

The following figure (***Figure 3***) provide a concise summary of the major transboundary fisheries and countries participated therein.

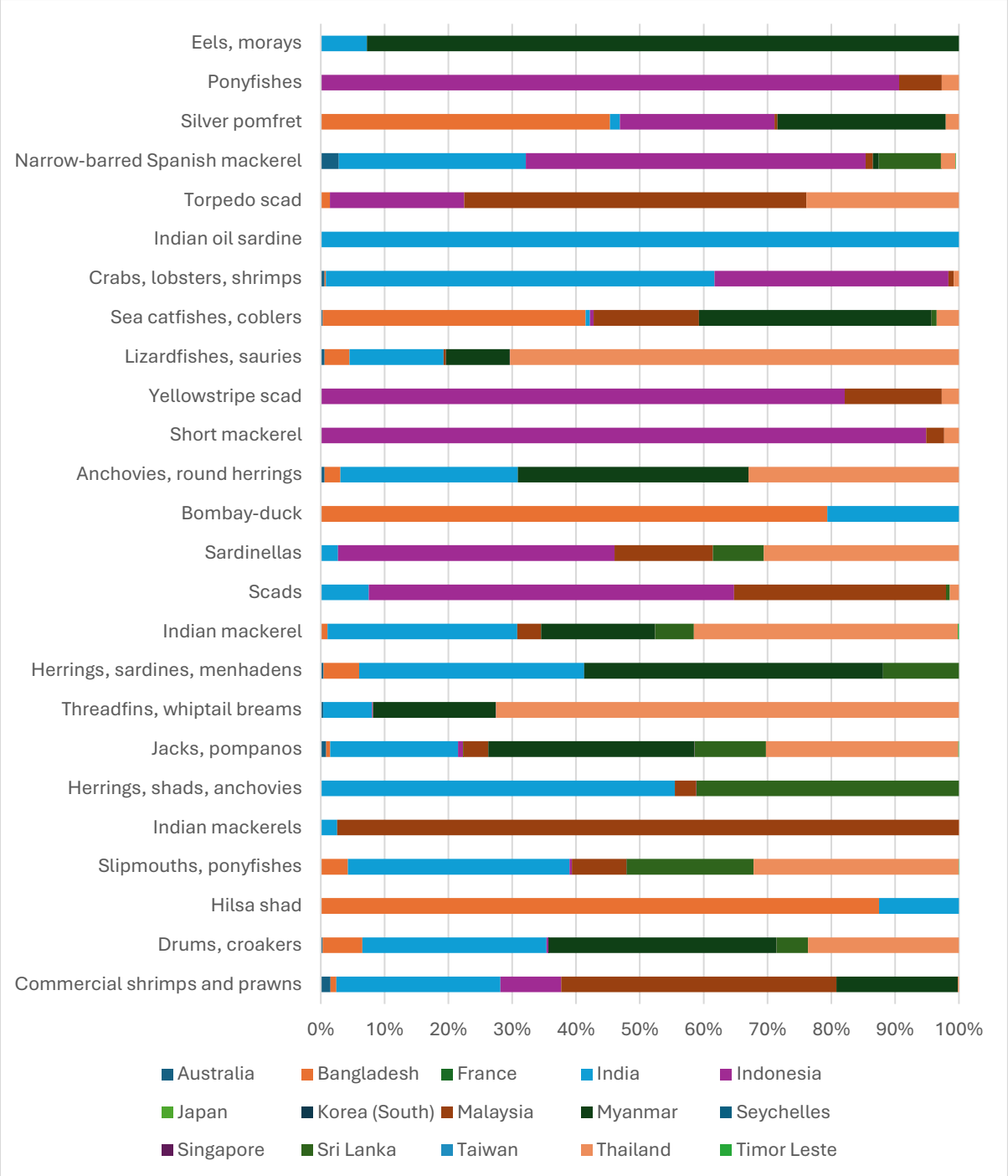

Figure 3. Country-wise share in production of major transboundary species

4. Status of transboundary stock

The analysis of transboundary stock status from 1950 to 2019 reveals significant trends and shifts across four main categories: Developing, Exploited, Over-Exploited, and Collapsed, along with a persistent presence of stocks classified as N/A (Not Applicable) (***Figure 4***).

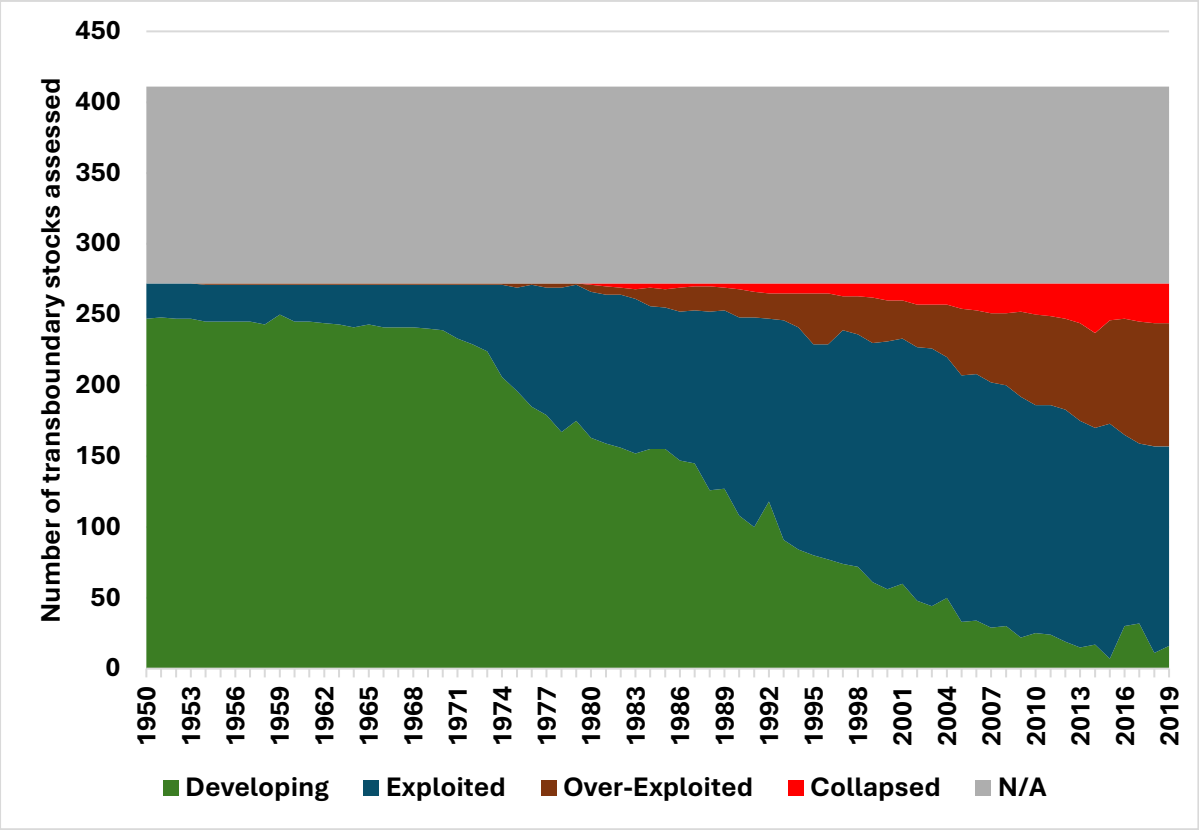

Figure 4. Status of Transboundary Stocks in EIO

Stock status categories were determined using criteria from Pauly et al. (2020), based on maximum catch (peak catch) or post-peak minimum in each series. Stocks were categorized as Developing (catches ≤ 50% of peak and the year is pre-peak, or the year of peak is the final year of the time series), Exploited (catches ≥ 50% of peak catches), Over-Exploited (catches between 50% and 10% of peak and the year is post-peak), Collapsed (catches < 10% of peak and the year is post-peak), and Rebuilding (catches between 10% and 50% of peak and the year is after post-peak minimum). Stocks that did not meet these criteria due to various reasons, including insufficient information, inconsistent data, or non-reporting, were labelled as N/A.

The percentage of developing stocks declined significantly from 60.1% in 1950 to just 1.7% by 2017, with the most rapid drop occurring in the 2000s. Exploited stocks, in contrast, increased steadily from 6.1% in 1950, peaking at 44.3% in 2005 and stabilizing around 39-42% in the 2010s. Over-exploited stocks were negligible until the late 1970s but rose sharply to 20.9% by 2019. Collapsed stocks, grew slowly until the 2000s, reaching 6.8% by 2019. These trends illustrate the increasing pressure on EIO fish stocks over the study period.

Lack of Information and Other Conditions (N/A Stocks)

Throughout the entire period from 1950 to 2019, a constant number of 33.8% of stocks were categorized as N/A. This category includes stocks for which there was insufficient information to accurately classify them, as well as those that did not meet the criteria for classification due to inconsistent data or non-reporting. The persistence of this category suggests ongoing issues in data collection and reporting, as well as potential gaps in monitoring systems that have not been addressed over the decades. This consistency raises concerns about the adequacy of resource allocation for research and data collection in these areas, and the need for improved transparency and data-sharing practices.

Preliminary findings from the BOB show that transboundary species play a crucial role, contributing 14.22% of the total fish catch by quantity (***Figure 5***) and 10.53% by economic value. This indicates their significant ecological and economic importance, though they represent a smaller fraction of the overall fisheries. Countries like Indonesia and Malaysia show substantial total catches and economic returns from BOB fisheries, but a relatively lower reliance on transboundary stocks, whereas Bangladesh exhibits a more balanced contribution from transboundary species. These findings highlight the need for cooperative management of transboundary stocks to ensure sustainable exploitation and equitable economic benefits among BOB countries. In addition, corroborating the findings of the FAO report, detailed studies of the BOBLME show that several over-exploited stocks have quadrupled since the 1980s while the share of developing stocks, stocks where fishing efforts can still be increased steadily declined.

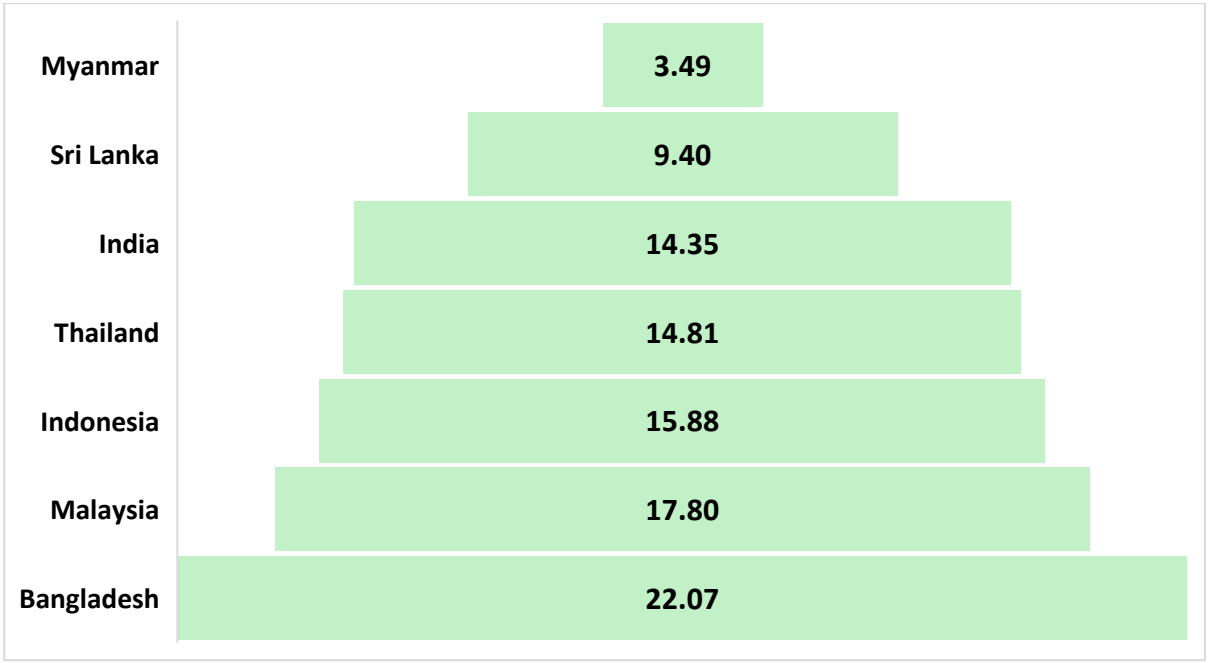

Figure 5. Share of transboundary species in total catch in the BOBLME

(compiled from SeaAroundUs)

5. Key questions in managing transboundary resources

Since the adoption of UNCLOS in 1982, the international legal framework for fisheries management has evolved to address emerging challenges, including the need for more effective conservation and management of shared and transboundary fish stocks. The United Nations Fish Stocks Agreement (UNFSA), adopted in 1995, was a significant milestone in this regard. It built on UNCLOS by specifically addressing the management of highly migratory and straddling fish stocks, strengthening the role of Regional Fisheries Management Organizations (RFMOs), and establishing the principle of precautionary management.

In parallel, other international instruments, such as the Code of Conduct for Responsible Fisheries (1995) by the FAO, introduced voluntary guidelines to promote sustainable fishing practices. These instruments encouraged states to adopt ecosystem-based management and improve enforcement mechanisms against Illegal, Unreported, and Unregulated (IUU) fishing. The Port State Measures Agreement (PSMA), which came into force in 2016, further reinforced the legal framework by providing tools to combat IUU fishing through stringent port inspections and control measures.

Despite these advancements, transboundary fish stocks have continued to pose governance challenges. International agreements have largely focused on straddling and highly migratory stocks, with less attention paid to stocks that migrate across multiple EEZs. This gap reflects ongoing tensions between state sovereignty and the need for cooperative management of shared marine resources.

The limited focus on transboundary fish stocks in the international legal framework, particularly under UNCLOS and the UNFSA, can be largely attributed to concerns around state sovereignty. Sovereignty plays a critical role in explaining why these stocks were kept out of stronger, binding international agreements. Coastal states are reluctant to cede control over the resources within their Exclusive Economic Zones (EEZs), as managing these resources is seen as a sovereign right. Transboundary fish stocks, which straddle or move between EEZs, raise complications because they require cooperative management that could challenge or dilute the control each state has over its own waters.

UNCLOS, while reinforcing the responsibility of coastal states to manage resources within their EEZs, deliberately refrained from imposing rigid rules for transboundary stocks to respect this principle of sovereignty. This is particularly evident in Article 63(1), which encourages states to cooperate on managing shared stocks but does not mandate reaching agreements. The rationale here is to avoid infringing on the sovereign rights of coastal states, ensuring they maintain autonomy over resource management decisions within their jurisdictions.

In view of the above, two critical questions emerge:

- ***The right and obligation to cooperate: How do coastal states and distant-water fishing nations cooperate in managing straddling and highly migratory fish stocks?***
- ***The precautionary approach to fisheries management: To what extent can the application of precautionary principles in the absence of cooperation address the sustainability of transboundary stocks?***

6. Potential Institutional Framework for Transboundary Fisheries Management in the Bay of Bengal

When political will exists and there are no barriers to cooperation, various measures and guidance are available to help states develop cooperative management arrangements and employ effective bargaining strategies (Churchill, 2006). The following are the possible mechanisms that can be adopted by countries for managing the shared fish stocks in the region.

a. Bilateral and Multilateral Fisheries Management Initiatives

Bilateral and multilateral fisheries management initiatives can be more effective for managing transboundary stocks compared to RFMOs, where competing national interests often complicate management. UNCLOS granted the right and responsibility to manage marine resources within 200nm from the baseline. As a result, the management of transboundary fisheries shifted from multilateral organizations to bilateral negotiations between the coastal states (Honneland et al., 2000).

A classic example of this approach is the Canada–US Bilateral Fisheries Management in the Gulf of Maine. In 1984, the International Court of Justice established the international boundary between two countries in the Gulf of Maine.[3], which is a commercial fishing ground for cod, haddock, and yellowtail founder. However, during the late 1980s and early 1990s, an increase in fishing effort and fishing mortality resulted in marked reductions in spawning stock size (Serchuk et al., 1994). Following this, Canada - United States (U.S.) Transboundary Resources Steering Committee was established in 1995 to promote a collaborative approach to fisheries resource management in the Gulf of Maine. Under the Steering Committee, two separate committees were established: Transboundary Resource Assessment Committee (TRAC) in 1998, which reviewed stock assessments and projections necessary to support management activities, which was strengthened by the establishment of the Transboundary Management Guidance Committee (TMGC) in 2000, which provided the non-binding advice management of these resources.[4]

Similarly, there is an Agreement between the United Kingdom, European Union, and Norway to jointly manage North Sea fish stocks like cod, haddock, saithe, whiting, plaice, and herring by establishing a trilateral framework.[5] Discussions are also underway to extend joint management to other stocks, such as hake, anglerfish, and Norway pout. Additionally, there are plans to establish a Joint Working Group for Monitoring, Control, and Surveillance, and the agreement also implements the exchange of electronic vessel position data and fishing activity through the North-East Atlantic Fisheries Commission.[6]

Currently, several bilateral frameworks exist between the countries bordering the BOBLME, including the Indo-Sri Lanka Joint Working Group (JWG) on Fisheries, established in 2016. However, the terms

[3] International Court of Justice. 1984. Case Concerning Delimitation of the Maritime Boundary in the Gulf of Maine Area (Canada v. USA).

[4] Canada-U.S Transboundary Resources Steering Committee. https://www.bio.gc.ca/info/intercol/sc-cd/index-en.php

[5] Agreed Record of Fisheries consultation between the European Union, Norway and the Untied Kingdom for 2021. Available at <https://assets.publishing.service.gov.uk/media/6050ee728fa8f55d38ea3455/fisheries-agreed-record-trilateral-EU-NO-UK-210316.pdf>

[6] Agreed Record of Fisheries consultation between the European Union, Norway and the Untied Kingdom for 2023.<https://oceans-and-fisheries.ec.europa.eu/document/download/b53f2ba4-cf0d-4624-9203-f74230582163_en?filename=2023-eu-no-uk-fisheries-consultations_en.pdf>

of reference of JWG are focused on addressing the fisheries conflicts in the region.[7] Also, in 2015, Bangladesh and India signed a Memorandum of Understanding (MoU) on Blue Economy and maritime cooperation in the Bay of Bengal and the Indian Ocean Region and agreed to set up a Joint Working Group on Blue Economy and Maritime Cooperation.[8] A recent session of the Joint Commission between Maldives and theSri Lanka , established in 1984, explored the possibility of expanding cooperation in the fisheries sector.[9] Additionally, recent talks have considered initiatives such as a MoU for transboundary collaboration in fisheries and aquaculture between India and Thailand, aiming to explore opportunities in the Andaman and Nicobar Islands.[10]

With these existing frameworks in place between the countries in BOBLME, the countries could enhance the regional cooperation in transboundary fisheries management, by developing joint mechanisms for stock assessments, resource-sharing agreements, and monitoring, control, and surveillance measures, like the Canada-US model and the trilateral framework in the North Sea.

b. Expanding the Scope of Existing RFMOs

Presently, three RFMOs exclusively manage the fish stocks in Areas 51 and 57. However, expanding the scope of these RFMOs in terms of species coverage and geographical scope can help ensure the sustainable management of the resources.[11] For instance, IOTC, which currently manages Tuna and Tuna-like species, can broaden its species coverage to include species like Sharks. Even though sharks are not under the IOTC mandate, Contracting Parties, and Cooperating non-contracting Parties are required to report information at the same level of detail for Tuna and Tuna-like species. A recent initiative by ICCAT to include management measures to ensure the conservation of the South Atlantic Blue shark (*Prionace galuca*) in line with ICCAT's mandate by setting up a Total Allowable Catch.[12] IOTC's expansion of its geographical coverage, including oceanic sharks, helps manage these species, which are critical to both oceanic ecosystems and socio-economic development (WWF, 2020).

SIOFA currently covers two-thirds of the Indian Ocean, including parts of Area 51 and 57. Still, it excludes the Arabian Sea, the Gulf, the Bay of Bengal, and the Northeast Indian Ocean (FAO, 2016b). In recent years, the fishing effort of squid fisheries in the Northwest Indian Ocean (Arabian Sea) has significantly increased from 13,000 to 56,000 vessel days from 2017 to 2020 (Seto et al., 2023). Several vessels that are involved in squid fisheries were observed to be fishing on the high seas of the Eastern Indian Ocean (WWF, 2020), an area outside the SIOFA convention area. In the future, SIOFA may extend its area of competence to include species like squids and cover both the Northeast and

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[7] Indo-Sri Lanka Joint Working Group on fisheries. Available at <https://www.mea.gov.in/rajya-sabha.htm?dtl/27680/QUESTION+NO965+INDOSRI+LANKA+JOINT+WORKING+GROUP+ON+FISHERIES?

[8]Memorandum of Understanding Between the Government of the Republic of India and the Government of the People's Republic of Bangladesh in the field of Blue Economy and Maritime Cooperation in the Bay of Bengal and the Indian Ocean Region. Available at <https://mea.gov.in/Portal/LegalTreatiesDoc/BG15B2419.pdf>

[9] Fourth Session of the Sri Lanka – Maldives Joint Commission. Available at < https://mfa.gov.lk/4th-session-sl-maldives-joint-commission/>

[10]https://www.icsf.net/newss/andaman-and-nicobar-islands-india-encourages-thailand-to-tap-into-fisheries/

[11] Report of the resumed Review Conference on the 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, New York, United States of America, 23-27 May 2016 (A/CONF.210/2023/6). Para 93.

[12] Recommendation by ICCAT on Management measures for the conservation of South Atlantic Blue Shark caught In Association With ICCAT Fisheries. Available at <https://www.iccat.int/Documents/Recs/compendiopdf-e/2019-08-e.pdf>

Northwest Indian Ocean. Extending the jurisdiction of the existing RFMOs could improve the management of migratory species and address IUU fishing issues beyond its current scope. Including more species, such as sharks and other pelagic fish, would facilitate a comprehensive ecosystem-based management approach. This would address the full range of species interactions and ecosystem dynamics, leading to more effective and sustainable management of marine resources.

c. Enhanced Cooperation Between RFMOs and regional organizations

Considering the importance of exchanging information among regional fisheries bodies, including RFABs and RFMOs, the Regional Fishery Body Secretariats' Network (RSN) was established.[13]

Pacific Islands Forum Fisheries Agency (FFA), an RFAB in the South Pacific Region, showcases an effective model for collaboration with the Western and Central Pacific Fisheries Commission (WCPFC) by establishing an MoU for the exchange of information and activities related to highly migratory fish stocks, associated and dependent species in the Pacific Islands subregion, to maximize the effectiveness of scientific and compliance activities (Løbach, et al., 2020). In the Indian Ocean Region, possible areas of collaboration were identified between the Southwest Indian Ocean Fisheries Commission (SWIOFC) and SIOFA, which include i) research of demersal fisheries resource, ii) curbing IUU fishing, and iii) projects to promote the application of SIOFA Conservation and Management Measures.[14]

In accordance with Article 15 of the establishment of IOTC and Article 10 of SIOFA, RFMOs can collaborate with RFABs like BOBP-IGO and SEAFDEC and other regional organizations to exchange information and act as extended arms to coordinate efforts in surveillance, monitoring, and enforcement. This collaboration would address regulatory gaps and strengthen the fight against IUU fishing. Also, Joint scientific research and data sharing would lead to better stock assessments and more informed management decisions. Further, RFABs and RFMOs working together on capacity building and technical assistance would ensure that local regulations are effectively implemented, and sustainable practices are promoted.

d. Transforming Regional Fisheries Advisory Bodies (RFABs) into RFMOs

Transformation of RFABs into RFMOs is one viable solution to address the call for establishing new RFMOs, as they already possess a functional structure that requires only minor adjustments to effectively fulfil their responsibilities. A recent example of this process can be seen in the Atlantic Ocean, where discussions are underway to transform existing RFAB into RFMO.[15]

Currently, RFABs in the Bay of Bengal region lack the authority to enforce conservation measures, which limits their effectiveness in managing fishery resources. Three RFABs to which countries bordering BOBLME are members are BOBP-IGO, SEAFDEC, and SWIOFC. However, SWIOFC was explicitly established to promote the sustainable utilization of living marine resources in the Southwest Indian Ocean, not the Bay of Bengal. The region often faces challenges due to east-west polarization, which makes it difficult to find an organization acceptable to all countries within the Bay of Bengal.

[13] Regional Fishery Body Secretariats' Network (RSN). https://www.fao.org/fishery/en/rsn

[14] Report of the ninth session of the Southwest Indian Ocean Fisheries Commission. 9-12 October 2018. SFS/R1258.

[15] Western Central Atlantic Fishery Commission (WECAFC). Summary report of the First preparatory meeting of the Western Central Atlantic Fishery Commission (WECAFC) for the transformation into a Regional Fisheries Management Organization. 4 June 2019. (WECAFC/SAG/X/2019/2).

SEAFDEC, for instance, was established with a mandate to promote and facilitate concerted actions among Southeast Asian countries to ensure the sustainability of fisheries and aquaculture. However, its scope is limited to the Southeast Asian countries bordering the Bay of Bengal, and it lacks the membership of four countries from the eastern part of the Bay. BOBP-IGO, which was established in 2004, has its own limitations, with only four countries bordering the BOBLME as members.

The Transboundary Diagnostic Analysis (TDA) and Strategic Action Programme (SAP) phase of the BOBLME program (BOBLME Project Phase I) identified three priority transboundary concerns and their proximate causes. These include 1) overexploitation of marine living resources, 2) degradation of critical habitats, and 3) pollution and water quality. To address these issues, the participating countries jointly developed the SAP under the BOBLME Phase II titled "Sustainable Management of Fisheries, Marine Living Resources, and Their Habitats in the Bay of Bengal Region for the Benefit of Coastal States and Communities," involves all eight countries bordering the Bay of Bengal.

One of the major components of the Project is to establish EAFM pilot Units to demonstrate its efficacy and pave the way for broader adoption. Implementing EAFM in a country that lacks national examples presents unique challenges and opportunities. (BOBP-IGO, 2024). Although BOBP-IGO and SEAFDEC are actively implementing Phase II of the BOBLME program, BOBLME Phase II lacks the mandate to adopt binding management measures on member states, as it is not a formal intergovernmental organization with an enforceable organizational structure.

Preston (2012) proposed establishing a regional fishery body called the Bay of Bengal Fisheries Management Cooperation Organisation (BOBFMCO) without granting it any definitive decision-making authority over fishery management matters. However, if the participating countries agree over time, the organization could evolve into a full-fledged RFMO. Similarly, Faiyaz and Sidhu (2024) suggest that BOBP-IGO has the potential to become an effective RFMO, given a regional commitment to protecting and managing the coastal and marine environment of the Bay of Bengal.

To tackle the global decline of fishery resources, scientists have proposed the adoption of an EAFM. Given the importance of incorporating EAFM into the management policies of RFMOs[16] Considering that BOBP-IGO is currently implementing BOBLME Phase II, which involves applying EAFM in member countries, BOBP-IGO has the potential to evolve into a Generic RFMO. This organization could facilitate bilateral or multilateral cooperation agreements, as mentioned in section (a), and extend its scope to cover unmanaged areas beyond the 200 nm of the Bay of Bengal. However, to effectively perform the functions of an RFMO, the current organizational structure of BOBP-IGO would need to be restructured. Transforming RFABs into RFMOs would provide the necessary legal framework and enforcement capabilities to implement binding conservation and management measures.

Why an RFMO is the Best Choice for the Bay of Bengal

Of the institutional options available, establishing an RFMO is the most viable and comprehensive solution for the Bay of Bengal. An RFMO would bring together all the countries that share fish stocks in the region under a single, legally binding agreement. This structure would ensure coordinated management, data sharing, and enforcement across national borders. Moreover, an RFMO would

[16] Fifteenth round of Informal Consultations of the States Parties to the 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, New York, 17-19 May 2022. (ICSP15/UNFSA/REP/INF.3).

promote the harmonization of monitoring, control, and surveillance (MCS) efforts, reducing the variability in enforcement seen under the current national frameworks

Furthermore, an RFMO would align well with Ostrom's design principles, particularly in terms of establishing clearly defined boundaries, enabling collective decision-making, and implementing robust monitoring systems. It would also facilitate graduated sanctions and conflict resolution, ensuring that violations are addressed appropriately without undermining regional cooperation. In short, an RFMO would provide the institutional framework needed to manage transboundary fish stocks sustainably, ensuring that these critical resources are preserved for future generations.

Tabular Comparison of Institutional Mechanisms

Design Principle	JFM	Policy & Legal Complementarity	Multi-Country Fisher Committees	RFMO	PPP	Transboundary Resource Councils
Clearly Defined Boundaries	5	5	3	5	3	4
Congruence with Local Conditions	3	3	5	3	3	3
Collective-Choice Arrangements	5	3	5	4	3	4
Monitoring	4	3	5	4	3	4
Graduated Sanctions	3	5	3	5	3	4
Conflict-Resolution Mechanisms	3	3	3	5	3	4
Minimal Recognition of Rights	5	5	5	3	3	4
Nested Enterprises	4	5	3	5	3	4
Total	32	32	32	34	24	31

The above analysis demonstrates that while JFM, legal harmonization, and fisher committees offer viable approaches, only an RFMO fully satisfies the critical design principles necessary for effective regional management. Its comprehensive scope and enforcement capabilities make it the best choice for managing shared fish stocks in the Bay of Bengal.

7. Conclusion

Within the Indian Ocean, a significant portion of the catch comes from the Bay of Bengal region. The case of the Bay of Bengal is presented here as a study template of the Indian Ocean for which enough information is yet to be available to highlight the different facets of the need for regional cooperation. Intensive fisheries in several countries that, knowingly or unknowingly, target the same stock have the potential to cause overfishing and stock decline or collapse. Global experience in fisheries management indicates that cooperation becomes viable when certain conditions are met, i.e., when the resource is shared among different parties and the concerned parties assign comparable values to

the resource's use, ensuring equal user value. Also, the objectives of the parties regarding the use of resources must align with each other. Finally, cooperation is more likely to occur when the cooperative outcome is superior to the non-cooperative outcome.

There are at least two levels of cooperation in fisheries management (Gulland, 1980). The first, or primary level, consists of cooperation in research alone, without reference to coordinated management programs. This is relatively easy to achieve since all parties benefit from improved information and data. The secondary level involves establishing coordinated joint management programs that may include a description of the fishery, management objectives, measures to achieve these objectives, indicators and reference points to measure performance, decision rules for management adjustments when goals are not met, and necessary information and research to support management (FAO, 2002).

Given the complexity of secondary-level cooperation, one of the previously discussed options could be adopted. Global fisheries management often addresses species in isolation, ignoring the broader ecosystem impacts. Therefore, several international and regional agreements advocate for an ecosystem-based approach to fisheries management. Recognizing this, there have been longstanding calls to transform regional fisheries management organizations into regional ecosystem management organizations. Implementing an ecosystem-based approach in the Bay of Bengal could effectively prevent over-exploitation of resources, increase economic benefits, and address IUU fishing. Such an approach would tailor management strategies to the unique needs of the fisheries in the region.

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