Mainstreaming Biodiversity into Coastal and Marine Fisheries Sector

Centre for Biodiversity Policy and Law
National Biodiversity Authority
Taramani, Chennai - 600 113
Tamil Nadu, India

Mainstreaming Biodiversity into Coastal and Marine Fisheries Sector

August, 2018

Centre for Biodiversity Policy and Law
National Biodiversity Authority
Taramani, Chennai - 600 113
Tamil Nadu, INDIA

Prepared by:

Dr. C. Thomson Jacob, Consultant (Biodiversity Policy)
Centre for Biodiversity Policy and Law (CEBPOL), National Biodiversity Authority (NBA)

Dr. Yugraj Singh Yadava, Director, Bay of Bengal Programme Inter-Governmental Organisation

Dr. B. Meenakumari, Chairperson, NBA

Shri T. Rabikumar, Secretary, NBA

Layout, design and graphics:

S. Jayaraj

M. Krishna Mohan

This document should be cited as:

CEBPOL, NBA, 2018. Mainstreaming Biodiversity into Coastal and Marine Fisheries Sector. Centre for Biodiversity Policy and Law, National Biodiversity Authority, 52p.

Copies of the report can be requested from:

The Secretary
National Biodiversity Authority
TICEL Biopark, 5th Floor
CSIR Road
Taramani, Chennai - 600 113
Tamil Nadu, India

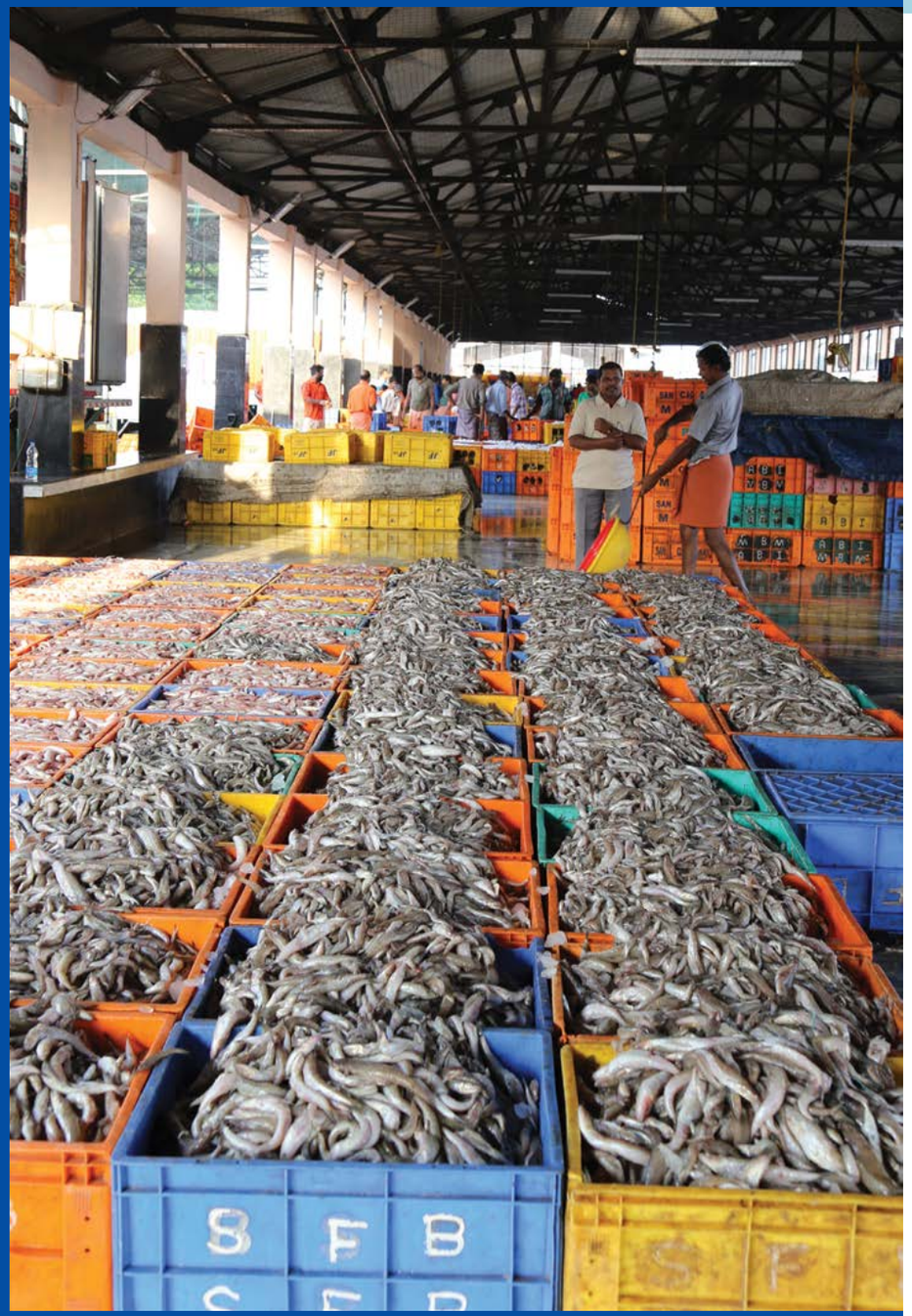
ISBN: 978-81-932753-7-5

About NBA

The National Biodiversity Authority (NBA) is an autonomous body established by the Government of India for implementation of the provisions of the Biological Diversity Act, 2002. As a statutory body, the NBA regulates the activities of access to biological resources and associated traditional knowledge and sharing of benefits arising from their use. Besides, the Authority performs an advisory role on matters related to conservation, sustainable use and access to biological resources and benefit sharing.

About CEBPOL

The Centre for Biodiversity Policy and Law (CEBPOL), set up within the NBA, is a bilateral collaborative programme established between India and Norway in 2013 to develop professional expertise in biodiversity policies and laws and to develop capacity of stakeholders at various levels. This Centre is focusing on biodiversity policies and laws that cater to the needs of national and international rule-making and their implementation on matters concerning biodiversity. Some of the thematic areas identified under this collaborative initiative include: Mainstreaming Biodiversity, Nature Index, Access and Benefit Sharing, Multilateral Environment Agreements, Invasive Alien Species and Capacity Building.



List of Abbreviations

ABS	Access and Benefit Sharing
BD	Biological Diversity
BOBP-IGO	Bay of Bengal Programme Inter-Governmental Organisation
BHS	Biodiversity Heritage Site
BMC	Biodiversity Management Committee
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CBD	Convention on Biological Diversity
CCRF	Code of Conduct for Responsible Fisheries
CEBPOL	Centre for Biodiversity Policy and Law
CIBA	Central Institute of Brackish Water Aquaculture
CIFT	Central Institute of Fisheries Technology
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMFRI	Central Marine Fisheries Research Institute
C&M	Coastal and Marine
CMS	Convention on Conservation of Migratory Species of Wild Animals
CoPs	Conference of the Parties
CSIR	Council of Scientific and Industrial Research
CRZ	Coastal Regulation Zone
CVCA	Critically Vulnerable Coastal Area
DAHD&F	Department of Animal Husbandry, Dairying and Fisheries
DoF	Department of Fisheries
EAFM	Ecosystem Approach to Fisheries Management
EBSA	Ecologically or Biologically Significant Marine Area
EEZ	Exclusive Economic Zone
ENVIS	Environmental Information System
ESA	Ecological Sensitive Area
EU	European Union
FAO-UN	Food and Agriculture Organization of the United Nations
FSI	Fishery Survey of India
ICG	Indian Coast Guard
ICMBA	Important Coastal and Marine Biodiversity Area
IOTC	Indian Ocean Tuna Commission
IUCN	International Union for Conservation of Nature
IUU	Illegal, Unreported and Unregulated fishing
MFRA	Marine Fishing Regulation Act
MLS	Minimum Legal Size
MLW	Minimum Legal Weight
MoA&FW	Ministry of Agriculture and Farmers' Welfare

MoEF&CC	Ministry of Environment, Forest and Climate Change
MPA	Marine Protected Area
MPEDA	Marine Products Exports Development Authority
MSC	Marine Stewardship Council
MSY	Minimum Sustainable Yield
MZI	Maritime Zones of India
NBAP	National Biodiversity Action Plan
NBA	National Biodiversity Authority
NBFGR	National Bureau of Fish Genetic Resources
NBT	National Biodiversity Target
NPMF	National Policy on Marine Fisheries
NCAOR	National Centre for Antarctic and Ocean Research
NCSCM	National Centre for Sustainable Coastal Management
NFDB	National Fisheries Development Board
NGC	National Green Corps
NIO	National Institute of Oceanography
NIOT	National Institute of Ocean Technology
NTC	Normally Traded as Commodities
PA	Protected Area
PBR	People's Biodiversity Register
PCB	Pollution Control Board
SACON	Salim Ali Centre for Ornithology and Natural History
SBB	State Biodiversity Board
SBSTTA	Subsidiary Body on Scientific, Technical and Technological Advice
SDG	Sustainable Development Goal
SFB	Seasonal Fishing Ban
SICOM	Society of Integrated Coastal Management
SPCB	State Pollution Control Board
TEEB	The Economics of Ecosystems and Biodiversity
TK	Traditional Knowledge
TPAP	Transboundary Protected Area Programme
TURF	Territorial Use Rights for Fishing
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	United Nations Environment Programme
UT	Union Territory
VME	Vulnerable Marine Ecosystem
WII	Wildlife Institute of India
WLPA	Wildlife Protection Act
ZSI	Zoological Survey of India

Acknowledgements

I am grateful to Dr. S. K. Khanduri, former Inspector General of Forest (Wildlife), Ministry of Environment, Forest & Climate Change, Ms. Maja Stade Aaronaes and Ms. Eva Degre from the Norwegian Environment Agency, Norway and Dr. K. Sivakumar, Head, Department of Endangered Species Management, Wildlife Institute of India for reviewing the document and providing valuable comments.

I express my sincere thanks to the Directors of the Central Marine Fisheries Research Institute, Kochi; Central Institute of Fisheries Technology, Kochi; and Secretary, Marine Products Export Development Authority, Kochi for the interactions and providing the required information. I also thank Dr. P. Krishnan, former Principal Scientist, National Centre for Sustainable Coastal Management, Chennai for sharing data related to important coastal and marine biodiversity areas in India.

C. Thomson Jacob
Consultant (Biodiversity Policy)
Centre for Biodiversity Policy and Law

Foreword

Biodiversity mainstreaming is the process of embedding biodiversity considerations into policies, strategies and practices of key public and private actors that impact or rely on plant and animal resources so that biodiversity is conserved and sustainably used, both locally and globally. The concept of mainstreaming was included in Article 6(b) of the Convention on Biological Diversity (CBD), which calls on the parties to "integrate the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programs and policies". The Goal A of the Strategic Plan for Biodiversity 2011-2020 of CBD addresses the underlying causes of biodiversity loss and emphasises on mainstreaming biodiversity across government and society.

India has an Exclusive Economic Zone (EEZ) of 2.02 million sq. km and a long coastline of 8118 km. This vast resource provides habitat for a variety of aquatic flora and fauna and offers range of livelihoods as also ecosystem services for human well-being.

Some of the major concerns related to marine fisheries in the Indian EEZ include excess fleet capacity, overexploitation, bycatch and discards, oil spills, marine debris and plastics, industrial and domestic waste, introduction of invasive alien species through ballast water, underwater noise, etc. Besides these man-made problems, climate change is also impacting the biodiversity and threatening the existence of many plant and animal species.

In this regard, the coastal States/Union Territories (UTs) are expected to play an important role in addressing the above-mentioned concerns and initiate action for effective implementation of the Biological Diversity Act, 2002. Further, the coastal States/UTs must also take a lead in regulating 'Access and Benefit Sharing' mechanism in the EEZ, conservation and recovery plans for depleted species, help the National Biodiversity Authority (NBA) in notifying coastal and marine biological resources under the 'Normally Traded as Commodities', constitution of Coastal Biodiversity Management Committees and documentation of marine biological resources in People's Biodiversity Register.

Dr. Yugraj Singh Yadava, Director, Bay of Bengal Programme Inter-Governmental Organisation and Dr. C. Thomson Jacob, Consultant (Biodiversity Policy), Centre for Biodiversity Policy and Law (CEBPOL), NBA have done a commendable work in bringing out a comprehensive set of recommendations for mainstreaming biodiversity concerns into the marine sector. I must also compliment Dr. B. Meenakumari, Chairperson, NBA and Shri T. Rabikumar, Secretary, NBA for their support to this work. I hope this document will facilitate better understanding of the concept of biodiversity mainstreaming and help India in achieving its national targets and ultimately help in conserving the precious marine biological resources.

Prof. M. S. Swaminathan
Founder Chairman-MSSRF
Ex-Member of Parliament (Rajya Sabha)

Contents

1.0 Introduction

The coastal and marine (C&M) ecosystems *viz.,* estuaries, mudflats, backwaters and lagoons and other sensitive ecosystems such as mangroves, coral reefs and seagrass beds are amongst the most biologically and economically productive ecosystems in India. These ecosystems are a source of livelihood and play a significant role in providing food, nutritional and health security and in reducing poverty, besides providing a range of ecological services that are critical for human well-being. Fin and shell fishes constitute one of the main components of C&M biodiversity and hence mainstreaming biodiversity conservation into fisheries policies, programmes and plans and *vice versa* is a key to sustaining the habitats that serve as feeding, spawning and nursing sites[1] for the fisheries wealth of the country.

The significant growth in fish consumption has enhanced people's diets around the world through diversified and nutritious food. Fish accounts for about 17 percent of the global population's[2] intake of animal protein and 6.7 percent of all protein consumed. It is the source of three different types of animal protein that includes structural proteins (actin, myosin, tropormyosin), sarcoplasmic proteins (myoalbumin, globulin, enzymes) and connective tissue proteins vital for human health[2]. In addition to being a rich source of easily digestible and high quality protein, it also contains amino acids, fats, vitamins and minerals that are essential for human well-being.

1.1 Fisheries - global scenario

The global fish production was estimated at 171 million metric tonnes (mmt) in 2016, which includes production from aquaculture (80.0 mmt) and capture fisheries (91.0 mmt). The capture fishery production has been relatively static since the eighties, while production from aquaculture has been registering a steady growth and meeting the increasing supplies of fish for human consumption. China remains the major producer of marine fisheries followed by Indonesia, the United States of America, the Russian Federation, Peru and India. The share of world fish production utilized for direct human consumption has increased significantly from 67 percent in the 1960s to 88 percent in 2016. Table 1 and Figure 1 (see page 14) provide statistics on some key attributes of global fisheries and aquaculture production and related aspects.

It is predicted that the total world fish production will reach 201 mmt in 2030 and the major contribution (109 mmt) is expected to come from aquaculture, registering a growth of 37 percent over 2016 production. In 2016, nearly 59.6 million people were engaged in capture fisheries and aquaculture, with 19.3 million people engaged in aquaculture and 40.3 million people engaged in fisheries. Asia accounts for nearly 85 percent of the global population engaged in fisheries and aquaculture, followed by Africa (10 %) and Latin America

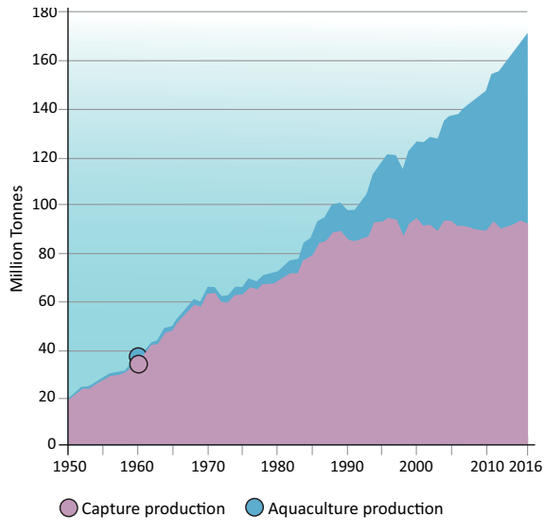
1. Conference of the Parties-13, Cancun Declaration, 2016. United Nations Biodiversity Conference, Mexico: Cancun Declaration on Mainstreaming the Conservation and Sustainable use of Biodiversity for Well-being.
2. FAO. 2018. The State of World Fisheries and Aquaculture. Meeting the sustainable development goals, Rome, ISBN 978-92-5-130562-1.

Table 1: World fisheries and aquaculture production and utilization (Million metric tonnes)

Category/ Year	2011	2012	2013	2014	2015	2016
Production						
Capture						
Inland	10.7	11.2	11.2	11.3	11.4	11.6
Marine	81.5	78.4	79.4	79.9	81.2	79.3
Total capture	92.2	89.5	90.6	91.2	92.7	90.9
Aquaculture						
Inland	38.6	42.0	44.8	46.9	48.6	51.4
Marine	23.2	24.4	25.4	26.8	27.5	28.7
Total aquaculture	61.8	66.4	70.2	73.7	76.1	80.0
Total world fisheries and aquaculture	154.0	156.0	160.7	164.9	168.7	170.9
Utilization						
Human consumption	130.0	136.4	140.1	144.8	148.4	151.2
Non-food uses	24.0	19.6	20.6	20.0	20.3	19.7
Population (billions)	7.0	7.1	7.2	7.3	7.3	7.4
Per capita apparent consumption (kg)	18.5	19.2	19.5	19.9	20.2	20.3

a) Excludes aquatic mammals, crocodiles, alligators and caimans, seaweeds and other aquatic plants.
b) Utilization data for 2014-2016 are provisional estimates.
c) Source of population figures: UN 2015e.

Fig. 1: World capture fisheries and aquaculture production



and the Caribbean (4 %). Europe, North America and Oceania each has less than 1 percent of the global population engaged in fisheries and aquaculture[3]. According to the Food and Agriculture Organization (FAO) of the United Nations, around 61 percent of the fish stocks are fully exploited and 28.8 percent fished at a biologically unsustainable level[4].

1.2 Fisheries in India

The Indian coastal ecosystems comprising mudflats, estuaries, creeks, mangroves, coral reefs, marshes, lagoons, seagrass beds, sandy and rocky beaches, have an estimated area of 42, 808 sq.km[5] and provide habitat for a variety of aquatic flora and fauna. The country has an Exclusive Economic Zone (EEZ) of 2.02 million sq.km[6] and a long coastline of 8118 km. These C&M ecosystems provide a range of ecosystem services contributing to economic stability of the country. The marine fisheries wealth in the Indian EEZ is estimated at 4.412 mmt (Maximum Sustainable Yield). The resources are distributed in the entire EEZ and Table 2[7] provides an overview of the depth/area-wise distribution of the resources.

Table 2: Area-wise distribution of marine resources in the Indian EEZ

Sl. No.	Depth/area	Resources	Potential (mmt)
1	Pelagic	Indian oil sardine, Indian mackerel, ribbon fish.	2.128 (48.2%)
2	Demersal	Penaeid and non-penaeid prawns, cephalopods, perches, croakers.	2.067(46.9%)
3	Oceanic	Yellowfin tuna, skipjack tuna, big eye tuna, billfishes, pelagic sharks, barracuda, dolphin fish and wahoo.	0.217 (4.9 %)

Source: National Policy on Marine Fisheries, 2017

The species-wise marine fish landings in India during 2014-15 show that oil sardine (*Sardinella longiceps*) tops the list with a contribution of 15 percent to the total fish landing, followed by Indian mackerel (*Rastrelliger kanagurta*) with a share of 6.6 percent. Carangids (5.8%), ribbonfishes (5.8%), lesser sardines (5.7%), penaeid prawns (5.7%) and non-penaeid prawns (5.1%) constitute the other important fin and shellfish species[8].

3. Ibid
4. Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA), 2015. Biodiversity and Fisheries, Strategic scientific and technical issues related to the implementation of the strategic plan for biodiversity 2011-2020, UNEP/CBD/SBSTTA/19/INF/6.
5. The Economics of Ecosystems and Biodiversity, India Initiative – Interim Report Working Document, 92p. Published by MoEF&CC & GIZ, 2014.
6. Ibid
7. National Policy on Marine Fisheries (NPMF), 2017. Ministry of Agriculture and Farmers' Welfare (MoA&FW), Department of Animal Husbandry, Dairying and Fisheries (DAHD&F), Government of India (GoI).
8. Central Marine Fisheries Research Institute, Annual Report 2014-15 (url: www.cmfri.org.in).

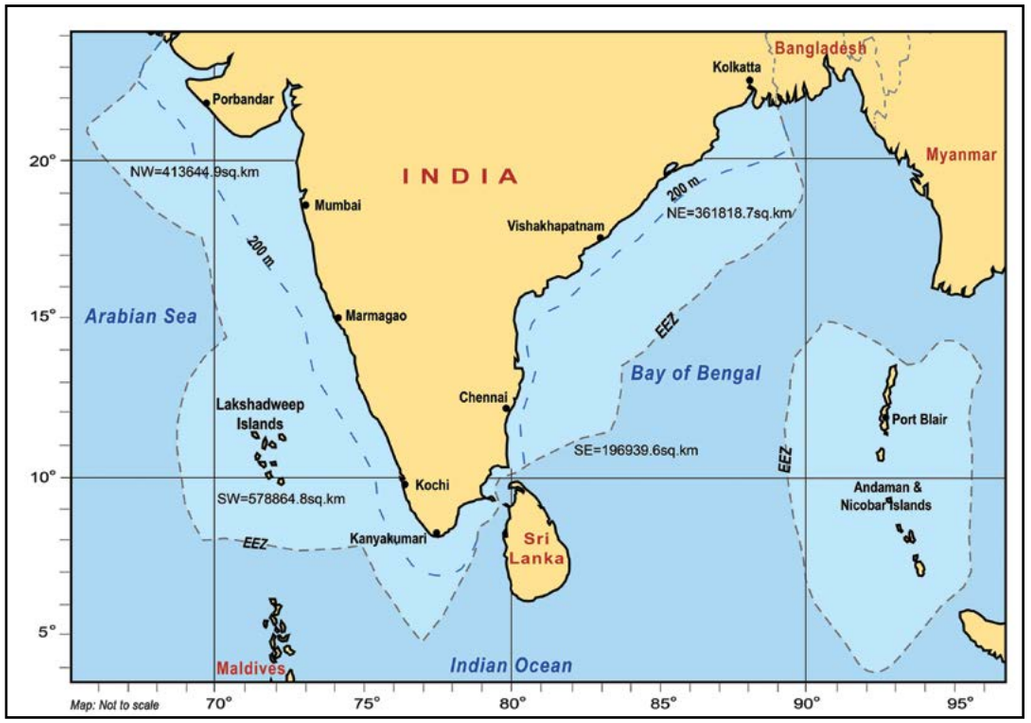


Fig 2: Map of India showing the Exclusive Economic Zone

It is estimated that around 4.0 million fishers depend on the C&M fishery resources, of which about 1.0 million fishers are active. Among the active fishermen, 33 percent are employed in the mechanised sector, 62 percent in the motorised sector and 5 percent in the artisanal sector. Of the total marine fish production, 75 percent comes from the mechanised sector, 23 percent from the motorised sector and 2 percent from the artisanal sector. The mechanised trawls constitute the most dominant fishing method, contributing to about 55 percent of the total marine fish production in the country[9]. Around 25 percent of India's population is living within 100 kms of the coast and around 5 -10 million people are employed in fishing and fish value chain. Fisheries sector contributed around 0.91 percent to the national Gross Domestic Product (GDP) and 5.23 percent to the agriculture GDP during 2014-15 constituting about 6.30 percent of the global fish production and 5 percent of the global trade[10].

1.3 Fisheries management measures

India is signatory to several International Agreements and Arrangements (including Conventions and Protocols) such as the United Nations Convention on the Law of the Sea (UNCLOS), 1982; Ramsar Convention on Wetlands, 1971; Convention on International Trade of Endangered Species of Wild Fauna and Flora (CITES), 1973; Bonn Convention on the Conservation of Migratory Species of Wild Animals (CMS), 1979; Convention on Biological Diversity (CBD), 1992; United Nations Framework Convention on Climate Change (UNFCCC), 1992; FAO Code of Conduct for Responsible Fisheries (CCRF), 1995; and Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization, 2010. India is committed to the UN Sustainable Development Goals (SDG) and SDG-14 (Life Below Water) relates to conservation and sustainable use of the oceans, seas and marine resources. Besides, India is also member of several Regional Fisheries Bodies and projects such as the Indian Ocean Tuna Commission (IOTC), the Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO) and the Bay of Bengal Large Ecosystem Project[11] that deal with both biodiversity and C&M fisheries issues.

At the national level, India has enacted several legislations and policies that support conservation of biodiversity as well as sustainable use of marine fisheries resources. These include, The Wildlife (Protection) Act, 1972 (WLPA, 1972); Marine Products Export Development Authority Act, 1972; Marine Fishing Regulation Act (MFRA) promulgated by each coastal State/UT based on a model bill circulated by the Union Ministry of Agriculture in 1978; Maritime Zones of India (MZI) Act, 1981; Environment (Protection) Act, 1986; Coastal Regulation Zone Notification, 1991 and 2011;

9. NPMF, 2017. Published by the DAHD&F, MoA&FW.
10. Guidelines on Central Sector Scheme on Blue Revolution: Integrated Development and Management of Fisheries, 2015. Published by the DAHD&F, MoA&FW, GoI.
11. Neiland, Sampath A. V. and R. Srinivasan, 2011. Integrated Fisheries Policy Analysis Toolbox. A Report prepared for the Fisheries Management for Sustainable Livelihood Project (FIMSUL), 2011. Report No. FIMSUL/R7. FAO/UTF/IND/180/IND.

Coastal Aquaculture Authority Act, 2005; Biological Diversity Act, 2002 (BD Act, 2002); the National Environmental Policy, 2006 and the National Policy on Marine Fisheries (NPMF), 2017.

The NPMF notified in May 2017 provides an overarching goal towards ensuring the health and ecological integrity of the marine living resources in the Indian EEZ through sustainable harvest for the benefit of the present and future generations. The NPMF is based on seven pillars, namely sustainable development, socio-economic upliftment of fishers, principle of subsidiarity, partnership, inter-generational equity, gender justice and precautionary approach. These seven pillars will guide the actions of various stakeholders in meeting the vision and mission set for the marine fisheries sector of the country[12].

Keeping in view the high potential in marine fisheries, the country has initiated a 'National Mission on Blue Revolution' for creating an enabling environment for integrated development of the fisheries sector, along with improvements in the economic status of fishers and fish farmers[13]. The 'Blue Revolution' while bearing in mind the sustainability, bio-security and environmental concerns, encompasses elements of 'Blue Growth Initiative' as also the targets set under the SDGs, to which India is committed.

1.4 Coastal & marine biodiversity wealth of India

India's C&M areas are repositories of biological treasures, having dense mangrove forests in the States of West Bengal (Sunderbans), Odisha (Bhitrakanika), Andhra Pradesh (Coringa), Tamil Nadu (Pichavaram), Andaman & Nicobar Islands, Gujarat and Maharashtra. The world's largest congregation of nesting turtles in Odisha, seagrass beds and dugongs in the Palk Bay, dolphins and corals in the Gulf of Mannar and Andaman and Nicobar Islands, and whale sharks in the Gulf of Kachchh are a few examples of the treasures of India's C&M biodiversity.

The C&M biodiversity of the country is remarkable with over 200 diatom species, 90 dinoflagellates, 936 seaweed, 500 fungi, 1042 species of corals, 14 species of seagrasses and 69 species of mangroves. The C&M faunal diversity includes 3,400 species of molluscs, 187 species of birds, 2,629 species of fishes, 37 species of reptiles and 24 species of marine mammals and the total number of species is estimated to be more than 17,795[14]. The data reveal that India contributes 6.75 percent to the global marine biodiversity. Table 3 (on page 19) provides a snap shot of the C&M biodiversity wealth of India.

12. NPMF, 2017. DAHD&F, MoA&FW, GoI.
13. Guidelines on Central Sector Scheme on Blue Revolution: Integrated Development and Management of Fisheries, 2015. DADH&F, MoA&FW, GoI.
14. Sivakumar, K. 2013. Coastal and Marine Protected Areas in India: Challenges and Way Forward. ENVIS Bulletin: Wildlife & Protected Areas. Vo.15, Wildlife Institute of India, Dehradun – 248 001, India. 368pp.

Table 3: C&M biodiversity wealth of India

Sl. No.	Parameters	Spatial area/species
1	Length of the coast*	8118 km
2	Total land area	3,287,263 sq.km
3	Exclusive Economic Zone*	2.02 million sq.km
4	Area of continental shelf	372,424 sq.km
5	Annual harvestable potential*	4, 412 mmt
6	Coastal population	4.0 million
7	Marine fishing villages	3300
8	Marine biodiversity**	>17, 795 species
9	Marine fish species identified	>2568
10	Coastal ecosystem areas***	42, 808 sq.km
11	Marine Protected Areas i) Peninsular India ii) Andaman & Nicobar and Lakshadweep Islands	 24 106
12	Marine protected area covered****	8214 sq.km
13	Number of coastal States/UTs	9 States and 4 UTs
14	Marine fish production*****	3,83,45,474 tonnes

Source: *NPMF, 2017, **5th National Report to CBD, 2014; *** TEEB Report, 2014; WII, ****ENVIS Report 2014; ***** CMFRI Report, 2018.

1.5 Marine Protected Areas

There are 24 Marine Protected Areas (MPAs) in peninsular India and 106 in Island Territories (Andaman& Nicobar Islands and Lakshadweep). These MPAs have unique marine biodiversity and provide a range of ecological services to the local communities. The country has 885 protected marine faunal species and they are placed under Schedules I-IV of the WLPA, 1972. These include, 10 species of sponges, 619 species of corals, 24 species of mollusca, 163 species of echinodermata, 34 species of fishes, 6 species of reptiles and 26 species of marine mammals. Table 4 (on page 20) provides details on the protected species.

India has also identified 12 protected areas as transboundary protected areas under the framework of the Transboundary Protected Area Programme (TPAP) of the International Union for Conservation of Nature (IUCN). Gulf of Mannar Marine Biosphere Reserve and Sundarbans National Park are part of the TPAP. India has also designated seven sites under the United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage Natural sites category and the Sundarbans Marine National Park is one among them[15]. The highly threatened marine species of India are conserved on priority basis using special 'Species Recovery Plans'. Under this Plan, seven threatened marine taxa have been selected for preparation of recovery plans. The selected species are dugong, whale shark,

15. Ibid.

Table 4: Protected marine faunal species in India

Faunal group	Number of protected species	Schedule under WLPA, 1972
Porifera		
Calcareous sponges (all species)	10	Schedule III
Coelenterata		
Reef-building corals (all Scleractnians)	519	Schedule I
Black corals (all Antipatharians)	08	Schedule I
Organ pipe coral (*Tubipora musica*)	01	Schedule I
Fire corals (all Millepora species)	05	Schedule I
Sea fans (all Gorgonians)	86	Schedule I
Arthropoda		
Robber crab (Crustacea)	01	Schedule I
Horseshoe crabs (Merostomata)	02	Schedule IV
Mollusca		
Gastropoda	20	Schedules I,IV
Bivalvia	04	Schedule I, IV
Echinodermata		
Sea cucumber (all Holothuria)	163	Schedule I
Fishes		
Elasmobranchs (sharks and rays)	10	Schedule I
Sea horses (all Syngnathidians)	23	Schedule I
Giant grouper	01	Schedule I
Reptiles		
Marine turtles	05	Schedule I
Saltwater crocodile	01	Schedule I
Mammals		
Marine mammals	26	Schedules I, II
Total	**885**	

Source: ENVIS Bulletin: Coastal & Marine Protected Areas in India, 2014

marine turtles (two species), giant clams, holothurians (sea cucumbers), horseshoe crabs and sea horses. The Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India has chosen the threatened dugong, marine turtles, coral reefs and mangroves under its 'Integrated Development of Wildlife Habitats' (IDWH) programme on a priority basis. Species Recovery Plan for dugongs and their habitats has already been implemented by the Wildlife Institute of India (WII).

1.6 Marine biotechnology

Marine biotechnology is an emerging sector of blue economy. Some of the marine animals (*e.g.,* sponges, macro algae, jellyfish, red algae, and seaweeds) are sources of potential health products, beneficial in treating life-threatening illnesses. The bioactive compounds extracted from these marine animals are used as antioxidants, antiviral, anticoagulant, anti-diabetic, anti-allergic, anti-hypertensive, anti-bacterial and also used as protective agents against radioactive substances. It has been reported that nearly 10-15 percent of the marine natural products are under clinical trial for cancerous ailments and for producing pills, tablets, syrups, medicated oils, fermented liquids, powders, enzymes, decoctions, etc[16]. The biopolymers produced from marine animals are used for producing biodegradable plastics, food additives, medical polymers, wound dressing, bio-adhesives, biosensors, bioactive compounds, dental biomaterials, tissue regenerations and 3D tissue culture scaffolds[17]. The drugs and metabolites produced from marine bacteria and invertebrates have facilitated formulation of several pharmaceutical products *viz.,* anti-inflammatory agents such as pseudopterosins, topsentins, scytonemin, manoalide and anti-cancer agents like bryostatins, discodermolide, eleutherobin and sarcodictyin.

1.7 Marine patents

The potential of marine bioresources derived pharmaceutical products is valued at multi-billion dollars through patents. Presently, around 55 percent of the genes extracted from the marine organisms are patented. The Indian Patent Office reveals that marine organisms such as seaweeds, snails, corals, sponges and algae are extensively used for research purposes and claiming patents. It is reported that out of the total 677 international claims between 1991 and 2009 of marine gene patents, 90 percent are by 10 countries, of which 3 countries (USA, Germany and Japan) hold 70 percent share. Norway is placed at the 10th position with 9 marine patent claims and India stands at 11th place with eight claims[18] (Table 5, see page 22).

16. Prospects of Blue Economy in the Indian Ocean, 2015. Published by Research and Information System for Developing Countries. New Delhi.
17. Sharma, Rahul, 2015. Environmental issues of deep-sea mining, Procedia Earth and Planetary Science, Vol. 11, pp. 204-11.
18. Saravanan A., Deepak Debnath, 2013. Patenting trends in marine biodiversity: Issues and challenges. Pharma Utility 7, No.4.

Table 5: Top 11 International claims of marine gene patents during 1991-2009

Sl. No.	Countries	Patent Claims
1	USA	199
2	Germany	149
3	Japan	128
4	France	34
5	United Kingdom	33
6	Denmark	24
7	Belgium	17
8	Netherland	13
9	Switzerland	11
10	Norway	09
11	India	08

Source: Procedia Earth and Planetary Science, 2015

2.0 Mainstreaming biodiversity and its linkages with International agenda

Mainstreaming biodiversity is the process of embedding biodiversity considerations into cross-sectoral plans such as sustainable development, poverty reduction, climate change adaptation/mitigation, trade and international cooperation, and in sector-specific plans such as agriculture, fisheries, forestry, mining, energy, tourism, transport and others[19]. The concept of mainstreaming is advocated in Article 6(b) of the CBD[20] and it is also integrated into Section 36 of the BD Act, 2002 of India[21]. Article 10(a) of the CBD stipulates that each party shall integrate as far as possible and as appropriate, the conservation and sustainable use of biological resources into relevant sectoral or cross-sectoral plans, programmes and policies. The global Aichi Biodiversity Target 6 states that by 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and by applying ecosystem-based approaches. Table 6 (see page 23) lists only those Aichi targets that are relevant to the present study.

In pursuance of the decision of the Tenth Conference of the Parties (CoP) of CBD, India has developed 12 national targets using the Global Strategic Plan for Biodiversity 2011-2020 and its 20 Aichi Biodiversity Targets through a consultative process[22]. In this context,

19. Updating National Biodiversity Strategies and Action Plans in line with the Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets. Module 3: Mainstreaming Biodiversity into National Sectoral and Cross-sectoral Strategies, Policies, Plans and Programs. Published by CBD.
20. Article 6, Convention on Biological Diversity, 2011. Text and Annexures, The Secretariat of the CBD, Montreal, Quebec, Canada.
21. Section 36, The Biological Diversity Act (BD Act), 2002 and BD Rules, 2004 Published by National Biodiversity Authority (NBA).
22. National Biodiversity Action Plan (NBAP) Addendum 2014 to NBAP 2008. Published by the MoEF&CC, GoI.

Table 6: Aichi biodiversity targets relevant to C&M resources

Target #	Targets
3	Abolishing subsidies harmful to biodiversity.
7	Area under aquaculture is managed sustainably.
8	Pollution level needs to be brought to levels that are not detrimental to ecosystem function and biodiversity.
9	Emphasis to control invasive alien species.
10	Pressure on coral reefs and other vulnerable ecosystems impacted by climate change or ocean acidification are minimised.
11	10 percent of C&M areas, especially areas of particular importance for biodiversity and ecosystem services are conserved.

Source: CBD resource (cbd.int/sp). The text above is an abridged version of the original text.

national targets 5 & 6 pertain to the coastal and marine resources, especially with respect to sustainable management of the fishery resources and coverage of area for conservation of biodiversity. With regard to coverage of area, the national targets indicate a coverage of 20 percent of the geographic area of the country by 2020, which includes terrestrial and inland waters and also C & M zones[23].

The SDG-14 advocates conservation and sustainable use of oceans, seas and marine resources for sustainable development. It recommends parties to address the impact of ocean acidification through enhanced scientific cooperation (Target 14.3); regulate harvesting and overfishing; eliminate illegal, unreported and unregulated (IUU) fishing and destructive fishing practices (Target 14.4); enhance the conservation and sustainable use of oceans and their resources by implementing UNCLOS (Target 14 c); and conserve at least 10 percent of the C&M areas (Target 14.5)[24]. Besides, Aichi targets and SDGs, parties to the CITES and CMS are also increasingly responding to the depletion of aquatic species and have listed 20 and 28 commercially exploited fish species respectively. Some of these listed species have binding regulation on their trade and enforcement of such regulatory mechanisms require action from the parties, Regional Fishery Bodies (RFBs) and others concerned[25].

3.0 Emerging issues

The objective of mainstreaming biodiversity into C&M fisheries is to promote integrated and sustainable management of the fisheries resources in the Indian EEZ. Such integration would mean effective implementation of the national laws and policies concerning the

23. Aichi Biodiversity targets, Source: CBD website: https://www.cbd.int/sp/targets.
24. Linking Sustainable Development Goals to National Biodiversity Targets, Published by Biodiversity Finance Initiative, India.
25. FAO, 2018. The State of World Fisheries and Aquaculture. Meeting the sustainable development goals. ISBN 978-92-5-130562-1, Rome.

sector and/or strengthening the existing laws and policies to ensure that the purpose of mainstreaming is adequately reflected in such regulatory documents. To achieve the objective, a "Policy Dialogue on Mainstreaming Biodiversity into the Fisheries Sector" was organized by CEBPOL, NBA[26] and the following concerns were noted:

3.1 Overexploitation of the C&M fishery resources

Marine fisheries in India are set in an open access regime, with regulations governing only registration and licensing of fishing vessels. Presently, there are no controls on effort or on formulation of management plans. Resultantly, the resources in the coastal waters up to 12 nautical miles (nm) and also extending up to 200 m depth are exploited to the MSY levels. In the absence of a dedicated law on regulation of fisheries within 12 to 200 nm, the harvesting of the resources are also unmanaged and unregulated. With overlapping jurisdiction of functions between the Centre and the coastal States, the multiplicity of resource users and the fact that the fishing community considers the C&M waters as a common property resource, the management of fish stocks is largely unattended resulting in depletion of many key fisheries in the Indian EEZ.

There has been a significant increase in the number and sizes of the fishing boats, including the use of high power marine engines. Trawling and energy intensive fishing methods continue to increase in both numbers and their hours of operation. Similarly, some of the other fishing gear and practices (ring and pure seines, use of lights, etc.) are also causing immense damage to the resources. This impact is also visible in the reduced stocks of commercial varieties and higher volumes of small pelagic, indicating a shift towards 'fishing down the food chain'. The problem is further compounded by the spread of fishmeal plants in some parts of the country and their overwhelming demand for small pelagic fish which is contributing to overfishing[27]. The over exploitation of the C&M resources has also resulted in increased numbers of inter-sectoral conflicts for sharing the renewable but finite resources.

3.2 Impact of developmental activities on C&M biodiversity

Developmental activities such as construction of ports and harbors has led to erosion and accretion of soil, thus changing the configuration of the coastal habitat. Such changes are known to have negative effect on fishery resources, including their population density and movement patterns. It is also a well-known fact that many fin and shellfish species are dependent on tail-end ecosystems (*e.g.,* estuaries, lakes, lagoons, backwaters) for closing their life cycles. Once these ecosystems are subjected to anthropogenic impacts resulting in degradation of their environmental quality, the recruitment of several important marine fish resources are also affected. Reduction in inflow of freshwater into the tail end ecosystems also impacts the water quality, resulting in loss of biodiversity. A study carried out by the Central Marine Fisheries Research Institute (CMFRI) reveals that increase in population growth/tourism resulted in decline of mangrove fringed coastline and coral reefs[28].

3.3 Marine debris, industrial and domestic waste and microplastic

The disposal of untreated sewage and industrial effluents into the C&M waters causes pollution and leads to the reduction of fish stocks. It is reported that around 80 percent of such pollutants enter into the marine environment from land-based sources (domestic sewage, industrial effluent, shipping activities and agricultural runoff)[29]. Marine debris is recognized as a globally significant stressor on the C&M environment. The majority of marine debris is made up of various forms of plastics that are highly persistent and toxic[30]. The United Nations Environment Programme (UNEP) has reported that each year, more than 8 million tonnes of plastics ends up in the oceans, wreaking havoc on marine wildlife, fisheries and tourism, and costing $ 8 billion damage to marine ecosystems[31]. The CMFRI has reported that microplastics have been observed in benthos (ranging from 15kg /10 ha to 5kg /10 ha in the Cochin back-waters) and also in the Dugong habitat in the Gulf of Mannar[32]. Further, microplastics have also been recorded in the gut of planktivorous fishes like sardines and anchovies and plastic strands in carnivores like *Trichurus* species.

3.4 Climate change

Climate change has overarching and long-term impacts on the C&M ecosystems. These impacts include extreme weather events, rise in sea level, flooding from high waves, increase in sea water surface temperature and ocean acidification[33]. Various documents indicate that the most vulnerable coastal States would be Maharashtra, Gujarat and Goa[34]. In India, the impact of climate change on marine fisheries is showing an increasing trend in distribution in area and also in depth in species such as the Indian oil sardine and mackerel. Such changes in the distribution of commercial species has also led to shifts in fishing gears and their operations in many areas along the Indian coastline.

3.5 Oil spills and oil exploration

Oil pollution occurs through ship accidents, rupture of seabed and onshore pipelines and offshore oil production and exploration platforms. Such oil spills severely affect the C&M habitats, which include seagrass beds, mangroves and coral reef ecosystems causing irreversible damage to biodiversity. When the oil eventually sinks, it affects benthic

26. Policy Dialogue on 'Mainstreaming Biodiversity into the Fisheries Sector, 25 November 2016, at NBA Chennai, Tamil Nadu, India.
27. NPMF, 2017. DAHD&F, GoI.
28. CMFRI Annual Report, 2014-15 (web source: www.cmfri.org.in).
29. Viikas, M. and Bwarakish G.S. 2015. Coastal Pollution: A review, Aquatic Procedia 4: 381-388.
30. SBSTTA, 2015. Addressing Impacts of Marine Debris and Anthropogenic Underwater Noise on Marine and Coastal Biodiversity. Brief for the Indian Delegation to the Twenty Second Meeting of the SBSTTA-22. Ref. UNEP/CBD/SBSTTA/20/5.
31. UN declares war on ocean plastic (Web Source: https://www.unenvironment.org/news-and-stories/press-release/un-declares-war-ocean-plastic).
32. ibid
33. Report of the IPCC 2004, web source: ipcc.gov.hk/doc/en/report/2004report_e.pdf.
34. Ministry of Statistics and Programme Implementation, 2015. Statistics related to climate change-India, 2015, GoI.

organisms such as clams and muscles, as tar particles get deposited in the mantles of these organisms. In 2010, collision between MSC Chitra and MV Khalijia off the coast of Mumbai led to the spread of oil along the beaches at Uran and Mandwa, resulting in the death of about 150 sting rays and dolphins[35]. During 2017 in Chennai, LPG tanker (BW Maple) rammed a petrol tanker, resulted in spilling of 20 tonnes of oil into the sea and causing mortalities of turtles, fishes, prawns and other biota[36].

3.6 Invasive alien species and their introduction through ballast water

Discharge of ballast water from the hulls of ships has been one of the main sources of introduction of invasive marine species into the environment posing threat to the world's oceans. Ballast water released from a single ship may contain hundreds of species of microbes, phytoplankton, zooplankton, larval fish and invertebrates, introducing non-native organisms into the point of discharge. These introduced species are considered as exotic, nuisance and alien or non-indigenous species. Ballast water discharges are also known to cause toxic algal blooms. In India, during the period 1998-2010, nearly 80 algal blooms have been reported, of which 31 blooms were formed by dinoflagellates, 27 by cyanobacteria and 18 by diatoms[37].

In India, eighteen species of alien animals and plants have been documented along the coast, which may have been possibly introduced through ballast water and may be potentially invasive[38]. Some of the invasive species such as *Caulerpa, Cladophora*, etc. are causing extensive damage to the ecosystem and affecting aquatic biodiversity adversely. The invasive *Carijoa riisei* (snowflake coral) is found in the Andaman and Nicobar Islands, the Gulf of Mannar and the Gulf of Kachchh and the spider crab *Acanthonyx euryseroches* is now found along the central west coast of India and is considered as a threat to the native marine biodiversity.

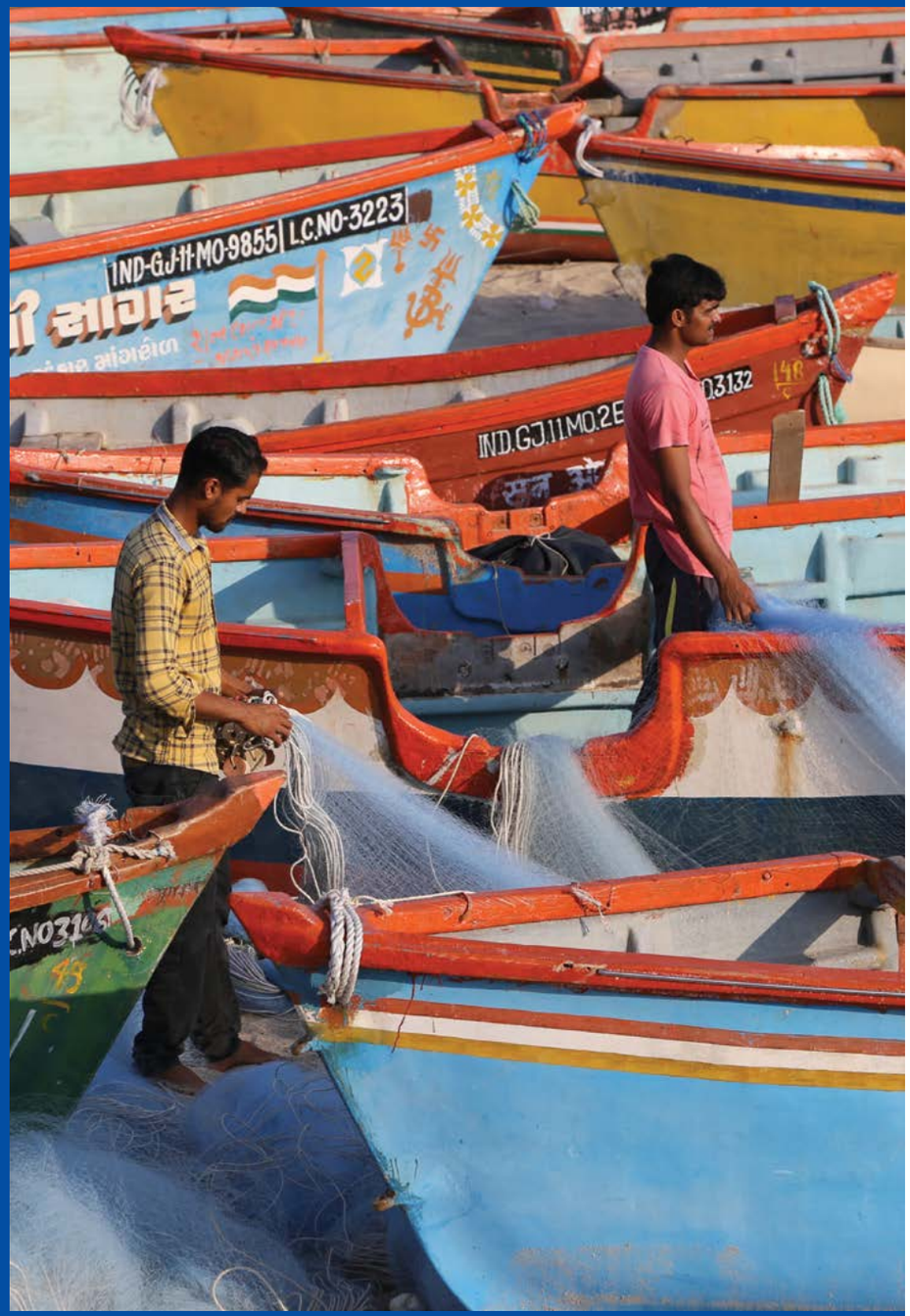
3.7 Trade

The increasing demand for marine ornamental fishes, especially species caught from the wild has resulted in overexploitation of the wild population impacting on the species composition and their distribution in the natural habitat. Besides finfishes, there are various other marine species such as sea horses, sea cucumbers, corals, mollusks and horse-shoe crabs that are illegally traded for medicinal and aesthetic purposes. International trade of wild fauna and flora is covered under CITES and the WLPA, 1972 (as amended in 2002). Trade regulations such as the Foreign Trade (Development Regulation) Act, 1992, the Foreign Trade Policy of the Government of India and the Customs Act, 1962 also place restrictions on the trade of prohibited species[39]. Some of the threatened marine species, including some fish species, are placed under different schedules of the WLPA, 1972 that prohibit trade of these species (Refer Table 4).

3.8 Underwater noise

The impact of underwater noise on C&M biodiversity and its habitats has gained recognition as an important stressor for marine life and is now acknowledged as a global issue that need to be addressed. The CBD encourages parties to take appropriate measures within the framework of national and international laws to avoid, minimize and mitigate the potential significant adverse impact of anthropogenic underwater noise on C&M biodiversity by providing specific guidance. The Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) of CBD has reported that 55 marine species have been affected globally due to anthropogenic noise. These species belong to cetaceans, teleost fishes, marine turtles and invertebrates[40].

35. Sukhdhane, K.S., Priya, E.R., Raut, S.M. and Jayakumar, T. 2013. Status of oil pollution in Indian coastal waters. Fishing Chimes, Vol. 33(5) 53-54.
36. Press Release, Chennai Oil Spill. The Hindu, 28th January, 2017.
37. United Nations University - Institute for Water, Environment and Health, 2012. Land based pollution sources- Synopsis report.
38. Anil, A.C., Venkat, K., Sawant, S.S., Dileepkumar, M., Dhargalkar, V.K., Ramaiah, N., Harkantra, S.N., & Ansari, Z.A. 2002. Marine bio-invasion: Concern for ecology and shipping. Current Science, 83(3), 214-218.
39. Draft State of Environment Report, 2015, MoEF&CC, GoI.
40. SBSTTA, 2015. Addressing Impacts of Marine Debris and Anthropogenic Underwater Noise on Marine and Coastal Biodiversity. UNEP/CBD/SBSTTA/20/5.



4.0 Mechanisms to address emerging issues

4.1 Protection of biodiversity rich C&M areas

India has several policies, legal and programmatic measures under implementation for conservation and management of C&M areas, emanating from MoEF&CC and DAHD&F. The measures administered by the MoEF&CC include *inter-alia* the notification of Coastal Regulation Zone (CRZ), 2011; and setting up of C&M protected areas (PAs) under the WLPA, 1972. The country has so far 130 C&M PAs, of which 24 marine PAs are in peninsular India and 106 marine PAs in the Island Territories. The 24 MPAs of the mainland have a total area of about 8214 km^2, which is about 5 percent of the total area under the entire PA network of India and less than 0.3 percent of the total land area of India[41].

The CBD is also requesting parties to identify 'Ecologically' or 'Biologically Significant Marine Areas (EBSAs)' by using identified criteria such as uniqueness or rarity, special importance for life history stages of species, importance for threatened, endangered or declining species and/or habitats, vulnerability, fragility, sensitivity, or slow recovery, biological productivity, biological diversity, naturalness, etc[42]. The objective of identifying EBSAs is to achieve sustainable fisheries and to protect at least 10 percent of the World's C&M areas by 2020. The Aichi Target-11 and SDG-14 also emphasize that at least 10 percent of the C&M areas of particular importance for biodiversity and ecosystem services should be conserved through effective and equitable manner through connected systems of protected areas and other area-based conservation measures.

Keeping in view the above requirements, the WII has identified 'Important C&M Biodiversity Areas (ICMBAs)' based on (i) ecosystem resilience; (ii) ecosystem functions; (iii) biodiversity uniqueness; (iv) cultural-religious and aesthetic significance; (v) socio-economic potential; and (iv) land tenure. Nearly 350 potential sites have been surveyed along the entire coastline of the country, of which 106 sites have been identified and prioritised as ICMBAs. This identification of ICMBAs aims at strengthening of the MPA network in the country[43]. Further, these sites would act as breeding and nursing grounds for a large number of fin and shellfish species that would further augment the fisheries resources in the C&M waters.

Similarly, the National Centre for Sustainable Coastal Management (NCSCM), Chennai has mapped all ecologically sensitive areas (ESA) in the coastal regions of the country following the CRZ Notification, 2011. The Centre has also developed a framework for assessment of 'ecological sensitivity' of four coastal ecosystems *viz.,* mangroves, coral reefs, seagrasses and salt marshes and for demarcation of highly sensitive areas using a set of criteria as specified

41. Sivakumar, K., Mathur V. B. and Anant Pande, 2014. Coastal and Marine Protected Areas in India: Challenges and way forward. Published by WII, Dehradun, India, 368pp.
42. Ecologically or Biologically Significant Marine Areas (EBSA); web resource: https://www.cbd.int/ebsa/about.
43. Saravanan, K. R., Sivakumar, K & Choudhury, B. C. 2013. Important Coastal and Marine Biodiversity Areas of India. In: Sivakumar, K (Ed.) Coastal and Mariine Protected Areas in India: Challenges and Way Forward, ENVIS Bulletin: Wildlife & Protected Areas. Vol. 15, Wildlife Institute of India, Dehradun-248 001, India, 368pp.

in EBSA. The NCSCM has further developed a framework for identification of critically vulnerable coastal areas (CVCA)[44]. IUCN in consultation with CBD has also been identifying 'Important Marine Mammals Areas (IMMA)' to promote the conservation of marine mammals and sustainable fisheries in the region.

4.2 By-catch reduction

By-catch comprises incidental catches or discards. While by-catch predominantly includes species of low value, it also consist of large numbers of juveniles of commercially important fin and shellfish species. Therefore, harvesting of such species amounts to loss of C&M biodiversity. The FAO has estimated that globally 7.3 million tonnes of by-catch are discarded annually. In India, large quantities of juvenile fishes, non-edible biota and marine mammals (25 to 54 %) are being caught by the mechanized fishing vessels to cater exclusively to fishmeal plants. The expansion of fishmeal plants and their overwhelming demand for small pelagic biota has driven the oil sardine stocks to low levels in some parts of the country.

In India, by-catch is a more complex issue due to the multi-species and multi-gear nature of fisheries and it is reported by CMFRI that more than 250 fish species are sieved as by-catch[45]. CMFRI has further reported that the majority of the threatened fishes (under the endangered and vulnerable categories of IUCN) are also caught in the drift gillnet, hooks and lines. These species include *Carcharhinus longimanus* (White tip shark),

44. Brochure, Unpublished data, NCSCM, Chennai.
45. Santhosh N. K., Naveen Sathyan., Afsal V. V and Joice V. Thomas, 2015. Efficacy of square mesh cod end in trawlers in reducing the by-catch of juvenile fishes and fuel consumption: An experiment conducted off Munambam coast (Kerala). MPEDA Newsletter.

Manta birostris (Manta ray), *Cheilinus undulates* (Humphead wrasse), *Sphyrna lewini* (Scalloped hammerhead shark) *and Sphyma Zygaena* (Smooth hammerhead shark) and are listed under Appendix II of CITES[46]. To reduce by-catch, CMFRI has defined minimum legal size (MLS) of 58 species and has provided advisory support to the Government of Kerala for implementation and sustainable management of these species.

4.3 Seasonal fishing ban

Marine fisheries in India though regulated through registration and licensing of fishing boats, are still in an open access regime as there is no control on the number of fishing boats and other inputs such as gears, etc. This situation has led to overfishing and decline in several fish stocks, making the fishery of such stocks unsustainable. To add to the overfishing problems, conflicts between different categories of marine fishers (mechanized, motorized, traditional) are also on the increase.

One of the significant measures to reduce fishing pressure has been the implementation of 'Seasonal Fishing Ban (SFB)', which is practiced uniformly by all the coastal States/UTs. The SFB was introduced in the late nineties for a period of 45 days coinciding with the monsoon in the east and west coasts of the country. In view of the success of the SFB, recently the Government of India has increased the ban period to 60 days, again coinciding with the monsoon period. The coastal States/UTs enforce this ban in the territorial waters using the provisions of the Marine Fisheries Regulation Act. In the extra-territorial waters of the EEZ, the Union Government enforces the ban through an executive order[47].

A recent study on the 'Economic Evaluation of Seasonal Fishing Ban' by CMFRI under a GIZ/MoEF&CC Project on 'Economics of Ecosystems and Biodiversity (TEEB)' indicated that the SFB improved the ecosystem services in the form of increased fish catch, fisher income, biodiversity and respite to the C&M ecosystem. The findings reveal that the economic value of the incremental growth/positive trend of fish attained due to SFB totaled to Rs. 1,07 billion (US$ 0.76m) in the five States (Gujarat, Karnataka, Kerala, Tamil Nadu and Andhra Pradesh) studied under the project and the net social benefit was estimated at Rs. 1.09 million (US$ 18, 167).

4.4 Protection of access and user rights of traditional fishers

Tenure refers to the legal or customary regime under which land or natural resources like forests and fisheries are owned or 'held' by an individual. Tenure is a set of rules - sometimes formal, sometimes informal – developed by the society to govern behaviour and use of land and other resources. The rules of tenure determine who can use what resources of the land for how long, and under what conditions[48].

46. CMFRI Annual Report, 2014-15. Web Resource (www.cmfri.org.in).
47. R. Narayana Kumar, J. Jayasankar, Shyam S. Salim and U. Ganga, 2016. The Economics of Ecosystems and Biodiversity – India Initiative Factsheets, Published by MoEF&CC and GIZ.
48. SBSTTA, 2015. Biodiversity and Fisheries, Strategic Scientific and Technical Issues related to the implementation of the Strategic Plan for Biodiversity 2011-2020. UNEP/CBD/SBSTTA/19/INF/6.

Fishing communities need to secure use rights to fishery resources and to land in coastal, lakeshore or waterfront areas for ensuring and facilitating access to the fishery, for accessory activities (including processing and marketing), and for housing and other livelihood support. It is emphasized that tenure rights are (i) administered in a fair and equitable way; (ii) respect human rights and reflect societal objectives; and (iii) recognize the potential of small-scale fisheries sector to contribute to food and nutritional security, poverty eradication, equitable development and sustainable resource utilization[49].

Fishers' rights need to be protected to make them secure, equitable, socially and culturally appropriate, and should take into account the rights of women as well. Presently, coastal States/UTs have specific areas earmarked (based on depth or distance from shore) as reserved for traditional fishers. Such 'Territorial Use Rights for Fishing (TURFs)' have also proved to be a useful tool in sustaining the livelihoods of artisanal fishers in many countries (*e.g.,* Mexico, the Philippines, Spain, Brazil, Belize, Japan, Chile, Fiji, Samoa, Vanuatu)[50].

User/tenure rights recognize the potential of the small-scale fisheries sector to contribute to food security, nutrition, poverty eradication, equitable development and sustainable resource utilization. The UNCLOS, 1982; FAO CCRF, 1995; Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security, 2012; and the Voluntary Guidelines for Securing Sustainable Small-scale Fisheries in the Context of Food Security and Poverty Alleviation, 2014 are important international instruments related to fisheries tenure rights over sea and costal land.

4.5 Co-management of fishery resources

Co-management in fisheries is globally recognised as one of the successful management systems for fisheries at the local level. Co-management involves all the stakeholders in a given setting and decisions are taken following a participatory approach. Through the adoption of co-management practices, many issues prevailing in the fisheries sector can be minimised. Some of the examples of co-management practices adopted in India[51] are alternate-day fishing regulation and self-regulation by women seaweed collectors in the Gulf of Mannar and Palk Bay areas of Tamil Nadu (TN); Maharashtra fishing communities initiatives on conserving coastal and marine resources; community-based fisheries management in Nagapattinam District, TN; and community conservation initiatives in Orissa. In India, a few co-management initiatives carried out under the GEF-UNDP Project on 'Mainstreaming biodiversity conservation in production sectors' in Sindhudurg (Maharashtra) and East Godavari Estuary (Andhra Pradesh) are elaborated in the boxes (refer page 33).

49. ibid
50. Allison, E. H., Ratner, B. D., Åsgård, B., Willmann, R., Pomeroy, R., & Kurien, J. 2012. Rights-based fisheries governance: from fishing rights to human rights. Fish and Fisheries, 13(1), 14-29.
51 Fisheries and Fishing commuities in India, Web resource: indianfisheries.icsf.net

In Sindhudurg (Maharashtra), fishing communities were involved in the preparation of biodiversity inclusive fisheries plan, joint patrolling, usage of square mesh net at the cod end, crab farming, mangrove plantation and conservation practices. Nearly 40 BMCs were constituted and 8 PBRs have been prepared for documenting the C&M resources. Mussel and oyster farming units were set up with the help of women SHG groups and the biodiversity of the degraded coral sites have been enhanced through the deployment of 250 artificial reefs building blocks.

In East Godavari (Andhra Pradesh), micro-plans for 41 villages were prepared for strengthening SHGs/Community-Based Organizations (CBOs) in natural resource use and sustainable livelihoods. Sectoral plans were prepared for oil and gas, tourism, aquaculture and fisheries and key recommendations concerning fisheries have been incorporated in the Andhra Pradesh State Fisheries Action Plan and in the Smart City Proposal of Kakinada. Some of the co-management initiatives carried out involving fishing community are: nesting habitats of olive ridley turtle protected and communit-based eco-tourism centers established with the help of Tourism & Forest Departments. These initiative have helped fishing communities in conserving the C&M biodiversity resources.

4.6 Trade

Certification, eco-labelling and traceability in fisheries sector are rapidly moving to the centre stage and have important bearings on international fish trade. Eco-labelling provides the consumers an opportunity to make informed choices about the source of sea food and creates a market-based incentive to encourage products that can demonstrate that they have been sourced through an ecologically sustainable manner[52]. Since January 2010, traceability of seafood is an important requirement for all seafood exported to EU markets. The short-neck clam fishery in Ashtamudi lake in Kerala has received India's first Marine Stewardship Council (MSC) certification, which will help boost sustainable fisheries and also protect the ecosystem. It is the first MSC certification in India and third in Asia[53].

4.7 Policy and institutional strengthening

To strengthen the policy and institutional framework, it is essential that biodiversity considerations are effectively integrated into the coastal and marine policies and programmes implemented by the Government. Further, effective implementation of the BD Act, 2002; the National Biodiversity Targets (NBTs); and the associated action plans would also require integration with the Marine Fisheries Policies[54] of the Union Government and the State/UT Governments. In this regard, the following need to be considered:

52. Eco-labelling and Certification in Capture Fisheries and Aquaculture. Policy Paper 53, National Academy of Agricultural Sciences, New Delhi.
53. CMFRI Annual Report, 2014-15
54. The NPMF, 2017 has included the suggestions made by the NBA, which *inter-alia* relate to Ecosystem-based Approach to Fisheries Management.

4.7.1 Access and benefit sharing

India's marine and biological resources are commercially exploited for the preparation of drugs, medicines, industrial applications, biotechnology, food processing, pharmacy, medicines, cosmetic products, dentistry and dietary supplements. Some of the products extracted/derived from the coastal/marine biological resources include carrageenan, green algal extract, green mussel extract, ornamental fish feed, chitosan, calcium capsules, pet food, fish oil, chitosan, glucosamine hydrochloride, squalene, gelatin, Isinglass, liver oil, etc. In this regard, CMFRI, Kochi has carried out several bio-prospecting projects resulting in extraction of anti-diabetic nutraceutical products, anti-inflammatory concentrates, anti-oxidative bio-actives, concentration of n-3 polyunsaturated fatty acids from sardine oil and their stabilization, etc[55].

The National Institute of Ocean Technology (NIOT), Chennai, has reported around 200 deep-sea microorganisms/microalgae isolated from water and sediment samples collected from 1000-2000 m depth of the Arabian Sea, Bay of Bengal and the Andaman Sea. These microorganisms/microalgae are rich sources of bioactive compounds (antifungal and anti-cancer characteristics) used in food, nutritional, cosmetic, pharmaceutical and bio-fuel industries[56].

India exercises sovereign rights over its EEZ that extends up to 200 nautical miles (nm) from the baseline[57]. In this context, the BD Act, 2002 stipulates that any person[58] (a) accessing biological resources and associated knowledge; (b) transfer of research results; (c) obtaining intellectual property rights over invention using the obtained biological resources; and (d) transfer of biological resources/associated traditional knowledge (TK)[59] needs to get approval from the National Biodiversity Authority (NBA). Similarly, a person who is a citizen of India or a body corporate, association or organization which is registered in India is required to intimate to the concerned State Biodiversity Board (SBB).

Following the jurisdiction of the BD Act, 2002, the NBA and the SBBs are mandated to regulate the biological resources available in the EEZ. The Act encourages bio- prospecting of the resources and stipulates that research institutions/companies who are accessing the country's biological resources for research/commercial utilization/bio-survey/bio-utilization purposes/applications should seek prior approval of the NBA/SBB.

55. Fact sheet on 'Marine Microbial Biotechnology', The Marine Biotechnology Division, Ocean Science and Technology for Island Group, National Institute of Ocean Technology, Chennai.
56. ibid
57. UN doc A/RES/65/37, of 7 December 2010, Preambular para4, at www.un.org. UNCLOS states that countries can exercise sovereignty over the living and non-living natural resources in its contiguous zone, the EEZ as well as continental shelf up to 200 nm from the baseline. The rights includes exploitation, conservation and management of living and non-living resources found in the water column, the seabed, and the subsoil thereof. Such rights also exercise jurisdiction over marine scientific research and for the protection of marine environment.
58. The BD Act, 2002, states that person who shall require approval of NBA namely: (a) A person who is not a citizen of India; (b) A citizen of India, who is a non-resident; (c) A body corporate, association or organization (i) not incorporated in India; (ii) Incorporated or registered in India under any law for the time being in force which has any non-Indian participation in its share capital or management.
59. Sections 4, 5 and 6 of the BD Act, 2002 and BD Rules, 2004, NBA, India.

4.7.2 Conservation and recovery plans for depleted species

The BD Act, 2002 stipulates that the coastal States/UTs shall notify the biological resources that are on the verge of extinction[60]. In this regard, necessary action needs to be taken to prohibit or regulate collection thereof for any purpose and take appropriate steps to rehabilitate and preserve those species. Further, the BD Act, 2002 also stipulates that necessary action needs to be taken for conserving species that are listed under the WLP Act, 1972 and as recommended by the CITES. Moreover, stock enhancement of depleting but commercially important species (lobsters, crabs, etc) inside the Protected Areas is also required, which would help to enhance the livelihoods of fishermen who fish in the surroundings of such PAs. The 'Species Recovery Plans' could consider both *in-situ* (*e.g.,* artificial propagation/sea ranching) and *ex-situ* conservation measures (*e.g.,* gene banking, egg/sperm cryopreservation, tissue banking, etc.).

4.7.3 Notification of C&M biological resources under Normally Traded as Commodities

The BD Act, 2002 stipulates listing of the biological resources that are 'Normally Traded as Commodities (NTCs)'[61]. In this regard, the NBA has so far notified 385 biological resources, which fall under agriculture, horticulture crops, medicinal plants, spices and plantation crops[62]. Such commodities are exempted from the purview of the BD Act, 2002 and can be traded without any restrictions. Similarly, it is essential that C&M animals, plants and products are also notified under the BD Act, 2002.

4.7.4 Preparation of People's Biodiversity Registers for C&M Bioresources

The People's Biodiversity Registers (PBRs)[63] are guide to assess the diversity of the bioresources and to develop strategies for sustainable management of the resources with active involvement of the community. The PBRs play an important role in generating awareness on conservation and sustainable utilization of the natural resources. In the context of C&M bioresources, the PBRs will help the coastal States/UTs to document the available biodiversity and the associated TK available with the fishing community and others who are associated with the resources. The local and regional marine checklists are in demand for conservation and fisheries management, ecological surveys and training in marine ecology

60. Section 38, The BD Act, 2002 and BD Rules, 2004, Publiched by NBA, India.
61. Section 40 of the BD Act, 2002, Published by NBA, India.
62. The Gazette of India: Extra ordinary (Part II-SEC.3ii) published by MoEF&CC on 7th April, 2016, Under Section 40 of the BD Act, 2002.
63. NBA/PBR/02, People's Biodiversity Register, Revised PBR Guidelines, 2013. Prepared by NBA based on the Guidelines issued in 2009.

and environmental management. For documenting the global marine biological resources, an open-access inventory of all marine species to be included in the 'World Register of Marine Species (WoRMS)' is under preparation[64].

The coastal SBBs/UTs can document the local/regional fishery resources and associated TK covering (a) coastal (mudflats, estuaries, creeks, mangroves, coral reefs, marshes, lagoons, seagrass beds, sandy and rocky beaches); and (b) marine (up to 200 nm). Hence, a sector specific PBR for fishery resources (at block/district level) is recommended. The preparation of sector-specific PBR will help to strengthen the national database and world register.

4.7.5 Regulation of invasive alien species and their management

The spread of marine invasive alien species is considered as a major threat to the C&M biodiversity. Over 90 percent of the world cargo is mobilized spanning different oceans and nearly 10 billion tonnes of ballast water is collected in one part of the ocean and discharged at the other, which includes a wide range of living organisms. Such discharges are believed to be a major source of invasive species in marine waters, thus posing public health and environmental risks, as well as significant economic loss to native biodiversity[65]. Available information reports significant negative economic consequences in different parts of the world, posing threat to human health and biodiversity. Norway has recorded 1180 species (both terrestrial and C&M) considered as alien and has also identified 203 alien 'door knockers' that have the potential to establish and reproduce in nature[66]. In India from 8 September 2017, all ships of 400 gross tonnage and above will be required to have an (a) approved ballast water management plan; (b) ballast water record book; (c) treatment system; and (d) international ballast water management certificate or statement of compliance[67]. Further, CSIR-NIO is helping the Ministry of Shipping, Government of India, in addressing the ballast water issue.

Problematic species need to be further researched by carrying out risk assessment studies and understanding the potential threat to the Indian marine environment. India signed the 'International Convention for the Control and Management of Ships Ballast Water and Sediments, 2004 (Ballast Water Management Convention)', towards protecting the marine environment from transfer of harmful aquatic organisms contained in ballast water. India now also needs to ratify the said convention.

64. Mark J. Costello, Philippe Bouchet, *et al.*, 2013. Global Coordination and Standardization in Marine Biodiversity through the World Register of Marine Biodiversity World Register of Marine Species and related databases, PLOS ONE, Vol: 8, issue 1, e51629.
65. Alaa Mohamed Ibrahim and Manal M. A. El-naggar, 2012. Ballast Water Review: Impacts, Treatments and Management, Middle-East Journal of Scientific Research 12(7):976-984, ISBN 1990-9233.
66. Alien Species in Norway - with the Norwegian Black list, 2012. Published by Norwegian Biodiversity Information Centre, Trondheim (www.biodiversity.no).
67. Ballast Water Management Convention to enter into force in 2017, Published by the Ministry of Shipping, Directorate General Shipping (http://www.dgshipping.gov.in).

4.7.6 Management of marine debris and under water noise pollution

Marine debris is becoming a key environmental issue at the global level and posing threat to C&M biodiversity[68]. India is no exception in this regard. Marine debris is usually defined as any persistent manufactured or processed solid material discarded, disposed of, lost or abandoned in the marine and coastal environment[69]. In recent times, plastic has become a major constituents of marine debris. Globally, it is reported that more than 800 C&M species are affected by marine debris.

Human activities such as shipping, recreational boating, mineral exploitation and fisheries in the costal and marine waters in the last 4-5 decades. Noise from these activities are leading to increases and changes in ocean noise levels, which can negatively impact ocean animals and ecosystems. Scientific evidences indicate that these higher noise levels can reduce the ability of animals to communicate with potential mates, other group members, their offspring, or feeding partners and can also impact their maneuvering to escape from predators, etc. The CBD Secretariat has also produced scientific syntheses on the impacts of underwater noise on marine and coastal biodiversity and habitats, and a background document addressing the development of practical guidance and toolkits to minimize and mitigate the significant adverse impacts of anthropogenic underwater noise on marine and coastal biodiversity[70].

4.7.7 Capacity building and awareness

Capacity building and awareness raising of stakeholders at different levels will be the key to successful implementation of the provisions of the BD Act, 2002. To ensure that capacity building and awareness is effective and contributes to the mainstreaming of C&M biodiversity aspects into the fisheries sector, it is essential that the capacity building and awareness programmes are customized to the needs of the stakeholders. WII has already developed customized courses for forest and fisheries sectors to promote the integrated and sustainable management of MPAs and fisheries after conducting a comprehensive need and gap analysis with the help of various biodiversity and fisheries institutions. However, this needs to be re-visited, up-scaled and implemented by fisheries institutions.

68. IOC/UNESCO, IMO, FAO, UNDP., 2011. Present disturbing facts relating to coastal megacities in the world and the challenges it throws for blue economy.
69. SBSTTA, 2016. Addressing Impacts of Marine Debris and Anthropogenic Underwater Noise on Marine and Coastal Biodiversity, UNEP/CBD/SBSTTA/20/5.
70. CBD, 2014. Expert Workshop on Underwater Noise and its impact on Marine and Coastal Biodiversity; 25-27 February 2014.

4.7.8 Ecosystem approach to fisheries management

The mainstreaming of biodiversity in the C&M fisheries sector of India is largely based on 'Ecosystem Approach to Fisheries Management (EAFM)' and it is widely advocated for implementation in the fisheries sector. It recognizes the interdependence between human well-being, ecosystem health and ecosystem productivity for present and posterity (*e.g.,* conserving critical habitats, reducing pollution and degradation, minimizing waste, protecting endangered species, etc.)[71]. The EAFM principle follows an integrated approach[72] and It helps to plan, develop and manage fisheries and to get benefits from a full range of goods and services provided by the C&M ecosystems[73]. Some of the recommendations highlighted by SBSTTA under EAFM include: (i) area-based management measures (*e.g.,* marine protected areas); (ii) disincentives for discarding by-catch; (iii) new and improved fishing gear and fishing practices (*e.g.,* rotational harvest, closed areas and seasons); and (iv) rehabilitation plans for depleting stocks and the targeted species. These approaches address issues related to overfishing, reversibility, rebuilding, minimizing fishery impact, improving human well-being and equity, allocation of user rights, promoting sectoral integration, broadening stakeholder participation and maintaining ecosystem integrity[74].

71. Ward, T., Tarte, D., Hegerl, E. & Short, K., 2002. Ecosystem-based management of marine capture fisheries. World Wide Fund for Nature Australia, 80 pp.
72. Ecosystem Approach to Fisheries Management, Integrated Fisheries Policy Analysis Toolbox, (Web Source: FAO (http://www.fao.org/fishery/topic/13261/en).
73. FAO 2003. The ecosystem approach to marine capture fisheries. FAO Technical Guidelines for Responsible Fisheries, No. 4(Suppl.2): 112 pp.
74. Reference Fisheries Management 2, The Ecosystem Approach to Fisheries, 2003. ISSN 1020-5292; ISBN 92-5-104897-5, Published by FAO Corporate document repository.

5.0 Recommendations

The marine fisheries sector is dealt by a range of institutions that fall within the purview of the coastal States/UT Governments, Central Government [Department of Animal Husbandry, Dairying & Fisheries (DAHD&F), Ministry of Agriculture and Farmers' Welfare (MoA&FW); Ministry of Commerce & Industry, Indian Coast Guard (ICG), etc.] and scientific bodies. Fishing operations in the 12 - 200 nm zone of the Indian EEZ are carried out as per the guidelines issued by the DAHD&F from time to time. For mainstreaming biodiversity into the marine fisheries sector, a Policy Dialogue was organized on 25 November, 2016 at the NBA, Chennai involving stakeholders representing expert institutions such as the BOBP-IGO, Marine Products Exports Development Authority (MPEDA), Fishery Survey of India (FSI), Central Institute of Brackish Water Aquaculture (CIBA), Central Institute of Fisheries Technology (CIFT), NCSCM, State Biodiversity Boards (SBBs), National Bureau of Fish Genetic Resources (NBFGRs), NIOT, National Fisheries Development Board (NFDB), Department of Fisheries of the coastal States/ UTs, experts and Non-Governmental Organizations (NGOs). A List of Participants at the 'Policy Dialogue' is placed as ***Annexure 1***. Recommendations accrued from the 'Policy Dialogue' are given below:

5.1 Ecologically sensitive areas such as mangroves, corals, seagrass beds, sand dunes and mudflats should be conserved on priority basis as they are important for turtle nesting, habitat for biodiversity, feeding and nesting grounds for birds and various other ecological services vital for sustaining biodiversity in the C&M waters. Further, areas inhabited by marine mammals should also be considered for conservation though appropriate regulatory mechanisms. In this regard, the areas identified by WII[75] (as important coastal and marine biodiversity areas) and NCSCM[76] (as ecologically sensitive areas) could be initially considered for conservation. As our knowledge on such areas increases, more areas could be considered for conservation in the future.

5.2 The BD Act, 2002[77] stipulates that the State Governments in consultation with the local bodies can notify C&M areas of biodiversity importance (*e.g.,* key fish breeding sites, migratory routes, etc.) as Biodiversity Heritage Sites (BHSs). Further, the State Governments in consultation with the Central Government may also frame rules for the management and conservation of all identified heritage sites.

5.3 The coastal States/UTs may consider restricting, regulating or prohibiting the use of fishing crafts and gear, which are deemed as destructive so as to conserve the biodiversity/ sea floor ecosystem and the non-targeted species in general and the endangered/threatened species in particular. In this regard, the following are recommended:

75. Sivakumar, K., Mathur, V. B., and Anant Pande, 2014. Coastal & marine protected areas in India: Challenges and way forward. Published by WII, Dehradun, India.
76. Fact sheet 04, India@Cop 22. Conservation of Coastal Ecologically Sensitive areas. NCSCM, Anna University, Chennai for MoEF&CC.
77. Guidelines for selection and management of the Biodiversity Heritage Sites, Published under Section 37 of the BD Act, 2002.

5.3.1 Replacement of existing mesh design with square mesh in the cod ends[78].

5.3.2 Mandatory use of fish excluder-cum-shrimp sorting device[79] and turtle excluder device (TED)[80].

5.3.3 Use of cutaway top belly trawl and semi and pelagic trawl system to allow escapement of juveniles[81].

5.3.4 Avoid ghost fishing and minimize marine debris in the coastal/marine waters. In this regard the use of bio-degradable nets is suggested.

5.3.5 Coastal States/UTs to consider specifying Minimum Legal Size (MLS) and/or Minimul Legal Weight (MLW) for commercial species following the example of Kerala. Further, the Marine Fishing Regulation Act (MFRA) may be amended for regulating the harvest of juveniles and by-catch and setting up of fish meal plants that use low-value/juvenile fish.

5.3.6 Incentives may be considered for fishermen who adopt responsible fishing practices that contribute to reduction of by-catch and juveniles.

5.3.7 Government may consider phasing out subsidies on inputs such as gear, craft, fuel, etc. to optimize fishing efforts in the C&M waters.

5.3.8 Coastal States/UTs to strictly enforce the non-use of banned gears such as bull trawling. Further, the coastal States/UTs may also consider prohibiting bottom trawling in Territorial Waters (up to 12 nm) to allow for restoration of the habitat and conserve breeding and feeding grounds of large number of fin and shell fish species.

To reduce the biodiversity losses, fishing methods and gear should be selective and designed to minimize waste, promote high survival rates for escaping fish and minimize the capture of non-target/by-catch of endangered species.

5.4 The implementation of Seasonal Fishing Ban (SFB) and the whole-hearted participation of fishers in this programme is one of the success stories of fisheries sector in India in the recent decades. While fishers utilize this period largely for repair of their crafts and nets, this is also a good time when the Government can consider implementation of capacity building programmes such as training in sustainable fishing practices, use of by-catch reduction devices, maintenance of hygiene and sanitation on-board fishing vessels and at fish landing sites and in value addition to get better remuneration.

5.5 The Government may consider providing necessary policy, legal and organizational support for recognising and protecting the territorial use rights of traditional and small-scale fishing communities in the country. In this regard it is reiterated that the entire stretch of the Territorial Waters may be considered for reservation for fishing by traditional and motorised fishing crafts [see action point 5.3.8].

5.6 Following the example of the Government of Kerala wherein the setting up of co-management units has been included in the MFRA, the other coastal States/UTS may also consider setting up of co-management units to manage their marine fisheries sustainably. Further, it is also recommended that these co-management units may build organic linkages with the Biodiversity Management Committees (BMCs) constituted under the BD Act, 2002.

5.7 Besides fisheries, the C&M resources are being utilized by many sectors such as tourism, shipping, oil and gas exploration, industries, etc. Therefore, it is essential that all these economic activities are carried out in a coordinated manner. In this regard, it is recommended that the Government may consider carrying out Marine Spatial Planning (MSP) to accommodate the legitimate interests of the economic sectors and in the process reduce/eliminate possible conflicts.

5.8 To protect trade interests, it is necessary that the stakeholders are fully aware of the standards, labelling, traceability and certification requirements that are stipulated by the seafood importing countries. In this regard, the Government may consider creating awareness amongst the stakeholders on the above mentioned aspects.

5.9 Following provisions contained in the BD Act, 2002, research institutions/companies who are accessing country's biological resources from the EEZ for research/commercial utilization/bio-survey/bio-utilization purposes should seek prior approval of the NBA/SBB.

5.10 The Central Government in consultation with the concerned State/UT Governments may from time to time notify such biological resources in the EEZ that are either vulnerable or threatened. Such species should be considered for recovery.

5.11 All bioresources harvested from the EEZ and traded as commodities should be notified under the BD Act, 2002 as NTCs after due process of verification from sustainability angle. Further, the Government may also consider preparing comprehensive guidelines to assist concerned agencies in preparing a list of the NTCs.

5.12 The NBA may prepare a set of comprehensive guidelines for preparation of C&M Biodiversity Registers.

5.13 The Government may consider preparing national-level strategies for mapping and creating a database on 'Invasive Alien Species' in the C&M waters. Such strategies may also include a national-level policy on 'Prevention and Management of Invasive Alien Species' in the Indian EEZ.

78. Kunjipalu, K. K., Varghese, M. D. and Kesavan Nair, A. K., 1994. Studies on square mesh codend in trawls Studies with 20 mm mesh size. Fishery Technology 31:112-117.

79. Boopendranath, M. R., Pravin, P., Gibinkumar, T. R., Sabu, S., Madhu, V. R., 2013. Investigations on juvenile fish excluder-cum-shrimp sorting device (JFE-SSD). Springerplus 2: 271-282.

80. Raghu Prakash, R., Boopendranath, M.R. and Vinod, M., 2016. Performance Evaluation of Turtle Excluder Device off Dhamra in Bay of Bengal. Fishery Technology 53(3): 183-189.

81. Central Institute of Fisheries Technology (CIFT) 2011. Semi Pelagic Trawl System: An Eco-friendly Alternative to Bottom Trawling for Small-scale Mechanized Sector. CIFT Technology Advisory Series; Central Institute of Fisheries Technology, Cochin: p.16.

5.14 The Government may consider formulating a national strategy for prevention and mitigation of the impact of marine debris on C&M biodiversity and its habitats. Such a strategy may also include a time-bound action plan. In this regard, utilizing the assistance available under the *Swachh Bharat Abhiyan* (Clean India Movement) Scheme of the Government of India, a collaborative platform for adoption of good practices for keeping the beaches and coastal environment clean may be adopted.

5.15 A comprehensive need and gap analysis may be carried out to ascertain the requirements of the stakeholders for capacity building and awareness creation. Subsequent capacity building and awareness programmes may be carried out based on such an analysis. To reach the younger generation, it would be useful to organize specific capacity building and awareness programmes for the eco-clubs under the National Green Corps (NGC) programme supported by the MoEF&CC.

6.0 Conclusion

The C&M ecosystems of India are providing enormous ecosystem services for human well-being. The NPMF, 2017 highlights the marine fish wealth of India in the EEZ, which is estimated around 4,412 mmt comprising pelagic, demersal and oceanic resources. The marine fisheries sector in India supports the livelihoods of more than 4.0 million fishers, provides food and nutritional security to growing population and also supports balance of trade through foreign exchange earnings.

Global conventions on biodiversity such as CBD, CITES and CMS are increasingly emphasizing parties to take action for conservation of threatened species and vulnerable habitats in the C&M areas. The Aichi Biodiversity Targets recommend that all fish and invertebrate stocks should be managed by applying ecosystem approaches. It also guides parties to avoid overfishing, develop recovery plans for the depleted species and to keep stocks, species and ecosystems within safe ecological limits. The Aichi Targets further specify that 10 percent of the C&M areas of particular importance for biodiversity and ecosystem services are conserved through effective area-based conservation measures and the integration of landscape and seascapes. India's national biodiversity targets also emphasize on sustainable fishing practices and the need to conserve the C&M areas important for species, biodiversity and ecosystem services. The SDG (14.5) outlines fisheries accountability and to facilitate mainstreaming biodiversity in policies and management measures. In the same vein, CITES and CMS also call upon the countries to regulate the trade of commercially exploited species and to conserve the migratory species.

Unfortunately, the major concerns leading to the loss of C&M bio-resources are the increasing levels of marine debris, including micro-plastics, release of industrial and domestic waste, over exploitation, oil spill, introduction of invasive alien species though ballast water, under water noise, etc. In addition, the changes being brought in by climate change are exacerbating the situation.

The present study include a comprehensive review of the various national and international policy documents and instruments such as NPMF, NBTs, Aichi targets, SDGs and also schemes and programmes implemented by the fisheries sector. Summing up, the study *inter alia* recommends that coastal States/UTS should (a) notify areas of biodiversity importance as biodiversity heritage sites in consultation with the local bodies; (b) consider restricting, regulating or prohibiting the use of crafts and gears which promote bycatch; (c) facilitate co-management practices by involving BMCs; (d) use MSP tools for better utilization of C&M areas; (e) promote sustainable fishing practices and facilitate standards for labelling and traceability; (f) prepare coastal and marine PBRs; (g) notify the list of threatened species and list the NTCs for the C&M species; (h) formulate strategies to prevent the introduction of invasive alien species though ballast waters; and (i) develop time-bound action plans for the prevention of marine debris entering into the C&M areas.

A matrix detailing the key recommendations, action points and the agencies responsible for implementation is given in ***Annexure 2.***

Participants at the Policy Dialogue Meeting - 25 November 2016, Chennai, Tamil Nadu

Annexure 1

Policy Dialogue on Mainstreaming Biodiversity in Fisheries Sector

25 November 2016

List of Participants

Sl.No	Name	Designation & Organization
1	**B Meenakumari**	*Chairperson* National Biodiversity Authority TICEL Biopark, Taramani Chennai – 600 113, Tamil Nadu
2	**T Rabikumar**	*Secretary* National Biodiversity Authority TICEL Biopark, Taramani Chennai – 600 113, Tamil Nadu
3	**Yugraj Singh Yadava**	*Director* Bay of Bengal Programme Inter-Governmental Organisation Chennai – 600 018, Tamil Nadu
4	**R Ramesh**	*Director* National Centre for Sustainable Coastal Management Chennai – 600 025, Tamil Nadu
5	**A K Srivastava**	*Chairman* Gujarat Biodiversity Board Gandhi Nagar – 382 010, Gujarat
6	**K P Laladhas**	*Former Member Secretary* Kerala State Biodiversity Board Thiruvanathapuram – 695 011, Kerala
7	**Virender Singh**	*Member Secretary* Karnataka Biodiversity Board Bangalore – 560 003, Karnataka
8	**Pradip Sarmokadam**	*Member Secretary* Goa State Biodiversity Board Porvorim, Bardez, Goa – 403 521
9	**Binod Kumar Sinha**	*Member Secretary* Gujarat Biodiversity Board Gandhi Nagar – 382 010, Gujarat

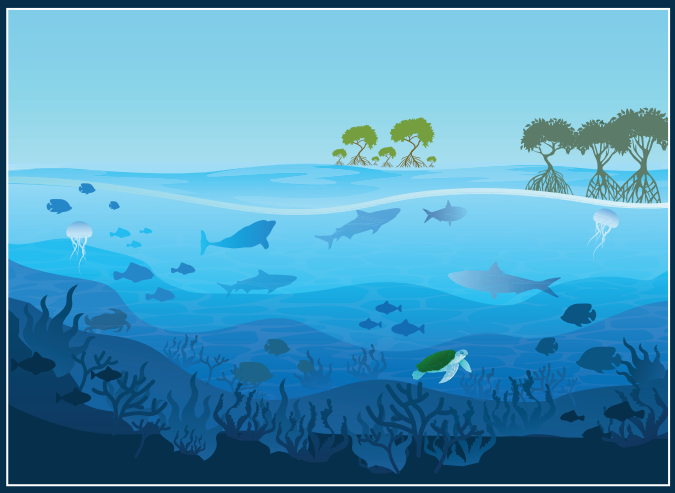
Sl.No	Name	Designation & Organization
10	**H S Upadhayay**	*Member Secretary* Odisha Biodiversity Board Bhubaneswar – 751 015, Odisha
11	**Subrat Mohapatra**	*Member Secretary, (I/C)* Tamil Nadu Biodiversity Board Chennai – 600 009, Tamil Nadu
12	**P N Munde**	*Member Secretary* Maharashtra State Biodiversity Board Wanwadi, Pune – 411 022, Maharashtra
13	**Kuldeep Kumar Lal**	*Director* National Bureau of Fish Genetic Resources Lucknow – 226 002, Uttar Pradesh
14	**V Sampath**	*Former Advisor* Ministry of Earth Sciences, and Consultant FAO/UNDP/UNEP/World Bank, Chennai Tamil Nadu
15	**V Selvam**	*Director* M. S. Swaminathan Research Foundation Taramani, Chennai – 600 113, Tamil Nadu
16	**P Krishnan**	*Principal Scientist* National Academy of Agricultural Research Management Rajendranagar, Hyderabad – 500 030, Telangana
17	**V V Sugunan**	*Senior Consultant* National Fisheries Development Board PVNR Expressway, SVPNPA Post Hyderabad – 500 052, Telangana
18	**C M Muralidharan**	*Consultant* FAO Consultant to BOBLME and REBYC II CTI Project, Chennai, Tamil Nadu
19	**K Phani Prakash**	*Assistant Director* Department of Fisheries Vijayawada – 521 137, Andhra Pradesh
20	**N Venugopalan**	*Programme Manager* International Collective in Support of Fish Workers Venkatrathinam Nagar, Adyar Chennai – 600 020, Tamil Nadu
21	**J E Prabhakar Raj**	*Scientist* Fisheries Survey of India Mumbai, Maharashtra

Sl.No	Name	Designation & Organization
22	**Shine Kumar**	*Deputy Director* Marine Product Export Development Authority MPEDA House, Panampilly Nagar Kochi – 682 036, Kerala
23	**Ajith Kumar T T**	*Senior Scientist* National Bureau of Fish Genetic Resources Lucknow – 226 002, Uttar Pradesh
24	**C P Balasubramanian**	*Principal Scientist* Central Institute of Brackish water Aquaculture # 75, Santhome High Road, Chennai – 600 028 Tamil Nadu
25	**V R Madhu**	*Scientist* Central Institute of Fisheries Technology Willington Island, Kochi – 682 029, Kerala
26	**V V Hari Prasad**	*Biodiversity Coordinator* Hyderabad – 500 004 Andhra Pradesh
27	**Rupam Mandal**	*State Project Coordinator* UNEF-GEF-MoEFCC ABS Project West Bengal Salt Lake City, Kolkata – 700 106 West Bengal
28	**N Prakash**	*ABS – Fellow* Centre for Biodiversity Policy and Law National Biodiversity Authority Chennai – 600 113, Tamil Nadu
29	**Sangita Mitra**	*Consultant* National Biodiversity Authority Chennai – 600 113, Tamil Nadu
30	**S Sandilyan**	*Fellow (Invasive Alien Species)* Centre for Biodiversity Policy and Law National Biodiversity Authority Chennai – 600 113, Tamil Nadu
31	**Karthi Srinivasan**	*Administrative Executive* Centre for Biodiversity Policy and Law National Biodiversity Authority Chennai – 600 113, Tamil Nadu
32	**C Thomson Jacob**	*Consultant (Biodiversity Policy)* Centre for Biodiversity Policy and Law National Biodiversity Authority Chennai – 600 113, Tamil Nadu

Matrix - Key Recommendations, Initiatives and Responsible Agencies

Sl. No.	Recommendations	Proposed Initiatives/action points	Responsible agencies
Ecosystem Approach to Fisheries Management			
5.1	Protection of biodiversity rich C&M areas.	10 percent of ICMBAs and ESAs can be brought under the spatial conservation measures through appropriate legal provisions.	MoEF&CC, WII, NCSCM, NBA, Coastal States/UTs, State Forest and Fisheries Departments.
5.2	Biodiversity Heritage sites.	Coastal States/UTs in consultation with the local bodies can notify C&M areas of biodiversity importance as BHSs.	Coastal States/UTs, NBA, coastal SBBs and BMCs, WII and NCSCM.
5.3	By-catch reduction.	5.3.1 Replacement of existing mesh design with square mesh in the cod ends. 5.3.2 Mandatory use of fish excluder-cum-shrimp sorting device and TED. 5.3.3 Use of cutaway top belly trawl and semi and pelagic trawl system to allow escapement of juveniles. 5.3.4 Use of bio-degradable nets to be explored to avoid ghost fishing and to minimize marine debris. 5.3.5 To notify MLS and/or MLW for commercial species. 5.3.6 Regulation of fish meal plants that use low-value/juvenile fish. 5.3.7 Phasing of subsidies on inputs such as gear, craft, fuel, etc. 5.3.8 Enforcing the ban on use of gears such as bull trawling and prohibiting bottom trawling, etc.	Coastal States/UTs, CIFT, CMFRI, Department of Animal Husbandry, Dairying and Fisheries (DAHD&F) and State Fisheries Department.
5.4	Seasonal Fishing Ban	Training fishers in sustainable fishing practices, use of by-catch reduction device, maintenance of hygiene and sanitation and value addition.	DAHD&F, Department of Fisheries of coastal States/ UTs, CMFRI and BOBP-IGO.

Protection of access and user rights of traditional fishers			
5.5	Protect Tenure Rights.	Policy, legal and organizational support.	NITI Aayog, Department of Fisheries of coastal States/UTs, BOBP-IGO and ICSF.
Co-management of fishery resources			
5.6	Improving management of fisheries resources.	Setting up of co-management regime in the coastal States/UTs with inclusion of representative of the BMCs in the co-management committees and *vice versa*.	Department of Fisheries of coastal States/UTs, ICSF, Coastal SBBs/UTs, BOBP-IGO and BMCs.
Marine spatial planning (MSP)			
5.7	Wise-use of C&M resources.	Government may consider carrying out MSP to accommodate the legitimate interests of the economic sectors and to reduce possible conflicts.	Department of Fisheries of coastal States/UTs, NCSCM and DAHD&F.
Trade			
5.8	Improving trade practices.	Awareness and capacity building of stakeholders in areas sush as sustainable fishing practices, standards and norms for registration and licensing of fishing vessels, food safety, etc.	Departments of Fisheries and Forest of coastal States/UTs, CMFRI and MPEDA.
Policy and institutional strengthening			
5.9	Access and Benefit Sharing.	Regulating the use of biological resources available in the EEZ.	NBA, coastal SBBs/UTs and BMCs.
5.10	Conservation and recovery plans for depleted species.	Notify C&M species that are threatened or vulnerable. The 'Species Recovery Plans' could consider both *in-situ* and *ex-situ* conservation measures.	MoEF&CC, NITI Aayog, WII, State Governments, NBA, coastal SBBs/UTs and BMCs, FSI, CMFRI, WII, NBFGRs, Corporates and NGOs.
5.11	Notification of C&M biological resources under NTC.	Notification of list of C&M biological resources under NTCs. Preparation of a set of comprehensive guidelines to assist the concerned agencies in the preparation of such a list.	MoEF&CC, MPEDA, NBA and coastal SBBs,
5.12	Preparation of PBR for C&M biological resources.	To prepare a set of comprehensive guidelines for preparation of the PBRs covering C&M bioresources.	NBA, coastal SBBs and BMCs.
5.13	Regulation for Invasive Alien Species and their management.	A national-level strategy for mapping and creating a database on Invasive Alien Species from the C&M resources. To study the problematic species and their potential threat to the Indian marine environment examined. To ratify the Ballast Water Management Convention.	MoEF&CC, MoA&FW, NITI Aayog, Department of Fisheries of coastal States/UTs, CMFRI, WII, Wetland International, SACON, CMLRE, CEBPOL, NIOT, NIO, NBA, SBBs, CSIR and Ministry of Shipping.
5.14	Management of marine debris and under water noise pollution.	To prepare a national strategy with a time-bound plan of action for prevention and mitigation of the impact of marine debris on C&M biodiversity and habitats. Utilizing the *Swachh Bharat Abhiyan* (Clean India Movement) Scheme of the Government of India, a collaborative platform for adoption of good practices for keeping the beaches and coastal environment clean may be created.	MoEF&CC, Central Pollution Control Board, State Pollution Control Boards from the coastal States/UTs.
5.15	Capacity building and awareness.	To carry out a comprehensive need and gap analysis to ascertain the requirements of the stakeholders for capacity building and awareness creation. Involvement of the eco-clubs under the NGC programme supported by MoEF&CC would be useful.	MoEF&CC, MoA&FW Department of Fisheries of coastal States/UTs, CMFRI, CIFT, NBA, BOBP-IGO, WII, NCSCM, coastal SBBs & BMCs, FSI, MPEDA, DAHD&F, NFDB, ZSI, NIOT, MPEDA, NCAOR, NBFGR, Fisheries Colleges, NGOs, etc.



Centre for Biodiversity Policy and Law
National Biodiversity Authority
Taramani, Chennai - 600 113
Tamil Nadu, India